Advances in Cognitive Presence: Introduction to OLJ Special Issue

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In the past decade, the Community of Inquiry (CoI) framework has gained attention from scholars for its capability of capturing the collaborative construction of shared knowledge in the online community of learners (Jan et al. 2019; Park & Shea, 2020; Stenbom 2018). CoI assumes that learning occurs at the intersection of the three presences–social presence, teaching presence, and cognitive presence (Garrison et al., 2000). Cognitive presence represents the means to support and maintain a purposeful learning community (Garrison, 2017). Although scholarly evidence indicates the importance of cognitive presence to generate high-level learning in online environments, researchers suggest that it is the least researched of the three presences and little progress has been made in understanding the development of cognitive presence and higher-order thinking (Garrison, 2017; Sadaf et al., 2021). According to Garrison (2017), "much research is needed to fully appreciate the inquiry process (cognitive presence) that occurs in a shared learning environment." Therefore, this special issue meets the need for more conceptual and empirical research to explore processes and strategies that create and sustain conditions necessary to facilitate cognitive presence and higher-order learning in online environments. This special issue includes seven papers that advance new perspectives on conceptualizations and processes related to cognitive presence.

The first paper in this issue is "Shared Metacognition in a Community of Inquiry" by Randy Garrison. While much is known about the CoI framework across contexts, shared metacognition and its essential function in a community of inquiry is a new area of research that has shown considerable insight in understanding the dynamics and ultimate goals of collaborative inquiry. Garrison explored pragmatic challenges through an analysis of recent research and discussed implementation issues of the shared metacognition construct. Garrison stated that metacognitively the educational challenge is how best to develop the dynamic of the awareness and regulatory strategies to monitor and manage inquiry in a collaborative learning environment. To examine the practical implications of shared metacognition, the focus should be at the intersection of cognitive (problem defining, exploration, integration and resolution) and teaching presence (planning, facilitation, and direct instruction). It is important to plan the true collaborative inquiry discourse by the cognitive presence construct (Practical Inquiry Model). This helps students become aware of their roles in the progression of learning tasks (setting goals, questioning ideas, considering alternative hypotheses, and ensuring progression) when they contribute from the perspectives of the phases of inquiry towards intended learning outcomes. Finally, metacognitive reflection and discourse with self and co-regulation can inform students how they can improve their approach to learning. Since this is a theoretical analysis, it advances the analytical vocabulary underlying the Community of Inquiry framework, identifying a useful area of focus for practitioners and researchers to expand.

The second paper "Manifestations of Cognitive Presence in Blended Learning Classes of the Philippine K-12 System" by Juliet Aleta Rivera Villanueva, Petrea Redmond and Linda Galligan examined cognitive presence at the intersection with teaching and social presences in blended learning in K-12 setting. The study was completed in the Philippines. Students ranked high their perceived learning at integration and resolution levels of cognitive presence in reflective community building collaborative activities. Group work impacted students' self-regulation and co-regulation strategies due to their shared metacognition, the construct that signifies "an awareness of one's learning in the process of constructing meaning and creating understanding associated with self and others" (Garrison, 2017, p.60). They become more accountable to learning time management and own responsibilities. This study provided evidence of learning community building and the applicability of the CoI in the K-12 setting.

In the third paper "Student Perceptions and Actuals of Cognitive Presence: A Case Study of an Intentionally Designed Asynchronous Online Course," Gamze Ozogul, Meina Zhu, and Tanner Phillips. The authors explored the design of an online graduate course to foster cognitive presence. The authors used Community of Inquiry (CoI) survey (for self-report) and Linguistic Inquiry and Word Count (LIWC) software (for actual behaviors) to measure cognitive presence. Additionally, they explored the relationship of cognitive presence with other presences. Findings showed that students perceived high levels of cognitive presence and actually showed high cognitive presence in their discussion board acts. In addition, findings showed that teacher and social presence are strong predictors of perceived cognitive presence. They found strategies that helped students to stay cognitively present in this asynchronous online course were, instructor being responsive in discussion posts and creating dialogue, creating course assignments as online hands-on project, interviewing guest speakers on specific course topics, weekly recap and orientation videos, feedback, case-based discussions, and overall teacher being present in the course.

The fourth paper is "Predicting Cognitive Presence in At-Scale Online Learning: MOOC and For-Credit Online Course Environments" by Jeonghyun Lee, Farahnaz Soleimani, India Irish, John Hosmer, IV, Meryem Yilmaz, Soylu, Roy Finkelberg and Saurabh Chatterjee. This study examined applications of machine learning and learning analytics techniques to identify students' levels of cognitive presence in their discussion posts by running a machine learning model. The authors used a transformer-based deep learning model referred to as Bidirectional Encoder Representations from Transformers (BERT), which pre-trains and fine-tunes relevant text data. Authors were inspired by existing machine learning models that automatically classify the level of cognitive presence (Chi & Wylie, 2014; Hayati, Idrissi, & Bennani, 2020; Kovanović et al., 2016; Neto et al., 2021). The results revealed that students' cognitive presence may differ by the course type and design. The type of discussions where students were asked to discuss assignments received higher levels of cognitive presence. The findings of this study are consistent with Sadaf et al.'s (2021) findings that higher levels of cognitive presence are closely associated with their actual final course grades.

The fifth paper in this issue is "The Impact of Designing an Online Discussion Strategy with Learning Analytic Feedback on the Level of Cognitive Presence and Students' Interaction in an Online Learning Community" by Enas Alwafi. This experimental study examined how learning analytics-based elaboration feedback can impact students' cognitive presence and interactions when they participate in asynchronous online discussions. While the first online discussion results were not different between two groups, the second online discussion revealed that the experimental group did better in terms of increasing both levels of cognitive presence and density of the network, i.e., interaction. Students who received learning analytics-based elaboration feedback perceived their motivation and participation engagement were increased because they were aware of the quality of their participation and their classmates' connections. The sixth paper "Evaluating Impact and Perception of a Structured Online Peer Evaluation System Among Graduate Communication Capstone Students Through Action Research" by Karen L Wilkinson. This action research examined the impact of a structured online peer evaluation system for Graduate Communication Capstone students, including an interactive educational technology peer review tool kit innovation. The most frequently coded levels of cognitive presence were exploration and triggering events followed by integration and resolution. The authors mentioned that students actively shared outside resources, offering referrals back to prior instructor guidance, and citing and referencing valid sources to justify their claims during the structured peer review process. This study proved that computer-based cognitive tools can create, facilitate and extend learning and collaboration in alignment with the principles of cognitive apprenticeship, i.e., modeling, coaching, scaffolding, articulation, reflection, and exploration.

The final paper in this issue is "Exploring Cognitive Presence in Online Courses: A Systematic Review (2008-2020)" by Robert Moore and Courtney Miller. Authors examined 24 articles published between 2008-2020 that empirically analyzed cognitive presence in online courses. They synthesized the literature focusing on ways instructors can use to develop their learner's cognitive presence. Results revealed that although reaching the higher levels of cognitive presence– integration and resolution–are optimal, it is not common to reach final phases, particularly the resolution stage. The authors recommend instructors to align their learning objectives with the learning outcomes at appropriate levels of cognitive presence. This study shows the importance of providing clear participation requirements, identifying multiple ways to integrate technology, and designing structured discussion forums in fostering the development of cognitive presence.

The studies in this special issue examined different approaches to facilitate and promote cognitive presence in different learning environments. The findings are varied across the contexts, population and the type of treatment. However, there is consistency in findings that higher levels of cognitive presence can be achieved in the environments where cognitive presence phases based on the Practical Inquiry Model are intentionally incorporated into a learning task or the course design. The task design is part of teaching presence (planning, facilitation and direct instruction). When the collaborative inquiry task is intentionally pre-designed based on the phases of cognitive presence (triggering events, exploration, integration, and resolution), the course instructors can provide thoughtfully designed cognitive and metacognitive processes for their students. In other words, according to Garrison in this issue, to advance cognitive presence in inquiry-based collaborative environments, we need to consider shared metacognition to intentionally regulate the process of cognitive learning.

Future research on cognitive presence is entering a new phase where a more thoughtful investigation of how cognitive presence and shared metacognition can be designed, developed, and evaluated in a community of inquiry to enhance the inquiry process. Instead of reporting the final outcomes in terms of the frequency of posts per cognitive presence phase, studies should pay attention to the type of the inquiry task and how it impacts the process of cognitive presence and shared metacognition. For example, researchers can investigate how different aspects of course design, facilitation techniques, and instructional strategies impact students' progression through the levels of cognitive presence and shared metacognition in a purposeful collaborative inquiry to achieve intended learning outcomes. Furthermore, studies can examine how intentionally designed collaborative inquiry learning environments allow learners to regulate cognitive processes and how shared metacognitive processes can be pre-designed to go beyond self-regulation and co-regulation.

References

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219-243. https://doi.org/10.1080/00461520.2014.965823

Garrison, D. R. (2017). *E-learning in the 21st century: A community of inquiry framework for research and practice* (3rd ed.). Routledge/Taylor and Francis.

Hayati H., Idrissi M. K., & Bennani S. (2020) Automatic classification for cognitive engagement in online discussion forums: Text mining and machine learning approach. In Bittencourt, I., Cukurova, M., Muldner, K., Luckin, R., & Millán, E. (Eds.), Artificial Intelligence in Education. AIED 2020. Lecture Notes in Computer Science, vol 12164 (pp. 114-118). Springer, Cham. https://doi.org/10.1007/978-3-030-52240-7_21

Jan, S., Vlachopoulos, P., & Parsell, M. (2019). Social network analysis and online learning in communities in higher education: A systematic literature review. *Online Learning, 2*3(1), 249–265.

Kovanović, V., Joksimović, S., Waters, Z., Gašević, D., Kitto, K., Hatala, M., & Siemens, G. (2016, April). Towards automated content analysis of discussion transcripts: A cognitive presence case. In Proceedings of the Sixth International Conference on Learning Analytics & Knowledge (pp. 15-24). https://doi.org/10.1145/2883851.2883950

Neto, V., Rolim, V., Cavalcanti, A. P., Lins, R. D., Gasevic, D., & Ferreiramello, R. (2021). Automatic Content Analysis of Online Discussions for Cognitive Presence: A Study of the Generalizability across Educational Contexts. IEEE Transactions on Learning Technologies, 14(3), 299-312. https://doi.org/10.1109/TLT.2021.3083178

Park, H., & Shea, P. (2020). A review of ten-year research through co-citation analysis: Online learning, distance learning and blended learning. *Online Learning*, *24*(2), 225-244.

Sadaf, A., Kim, S. Y., & Wang, Y. (2021). A comparison of cognitive presence, learning, satisfaction, and academic performance in case-based and non-case-based online discussions. *American Journal of Distance Education, 35*(3), 214-227. https://doi.org/10.1080/08923647.2021.1888667

Sadaf, A., Wu, T., & Martin, F. (2021). Cognitive presence in online learning: A systematic review of empiricial research from 2000 to 2019. *Computers and Education Open*, *2*, Advance online publication. https://doi.org/10.1016/j.caeo.2021.100050

Stenbom, S. (2018). A systematic review of the Community of Inquiry survey. *The Internet and Higher Education*, *39*, 22-32. https://doi.org/10.1016/j.iheduc.2018.06.001

Shared Metacognition in a Community of Inquiry

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Abstract
The article begins with a review of the shared metacognition construct and its function within the Community of Inquiry theoretical framework. The primary focus of the shared metacognition construct is the role of learners to take responsibility and control for monitoring and managing learning in a community of inquiry. Pragmatic challenges are explored through an analysis of recent research and a discussion of implementation issues. It is emphasized that shared metacognition is shaped by the teaching presence construct (planning, facilitation, and direction instruction) and its overlap with cognitive presence operationalized by the phases of the Practical Inquiry model (problem defining, exploration, integration, and resolution). The manuscript concludes with a discussion of the potential for future research associated with shared metacognition and the use of a quantitative shared metacognition questionnaire.

Keywords: shared metacognition, community of inquiry framework, self-regulation, co-regulation, cognitive presence, teaching presence, practical inquiry, shared metacognition questionnaire

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There is considerable research to date that supports the validity and pragmatic value of the Community of Inquiry (CoI) framework (Garrison, 2017). This includes confirmation of its constructs (social, cognitive, and teaching presences) along with the nature of the interaction among the presences. In addition, we have gained insight into how the presences evolve over time in a variety of contexts. While much is known about the CoI framework across contexts, there is one new area of research that has shown considerable insight in providing greater depth of understanding regarding the dynamics and ultimate goals of collaborative inquiry. This is the research associated with s*hared metacognition* and its essential function in a community of inquiry.

The core dynamic of a CoI is critical thinking focused on constructing personal meaning and shared understanding. The cognitive presence construct operationalized through the Practical Inquiry model reflects this dynamic, and that of an effective educational experience. However, what has not been emphasized sufficiently until recently is the role of metacognition in developing the necessary awareness and regulation for responsible thinking and learning in a collaborative learning environment. Specific to a CoI, metacognition is central to cognitive presence and effective collaborative inquiry. That is, deep and meaningful learning experiences in a learning community are dependent upon the ability to monitor and manage the inquiry process.

Defining Shared Metacognition

Historically, metacognition has been strongly associated with self-regulation. However, the focus on "self" creates difficulties in a socially shared and collaborative learning environment. In this regard, there has been a recent move away from the exclusive focus on self-regulation. Instead, there is an increasing acknowledgement of metacognition as socially situated and shared (Dindar et. al., 2020). From the perspective of CoI, metacognition must be seen as arising from reflection and discourse among individuals within a shared learning environment. Clearly this dynamic is not an individual process nor is any worthwhile educational experience intended to be such. Therefore, development of metacognitive awareness and regulation in a learning community is both a personally reflective and shared collaboration.

Shared metacognition is a construct that emerged from the CoI framework. Metacognition is shared during CoI where thinking and learning is a collaborative experience. Shared metacognition demonstrates the greatest potential for understanding and developing thinking and learning in a collaborative setting. The primary reason for this is that deep and meaningful learning is best achieved through discourse and an inherent need for the ability to monitor and manage the collaborative inquiry process. From an educational and practical perspective, knowledge of shared metacognition can guide the implementation of effective facilitation techniques in the collaborative inquiry environment and realizing deep and meaningful learning outcomes. Longer term, shared metacognition is key to learning how to learn in a collaborative inquiry environment.

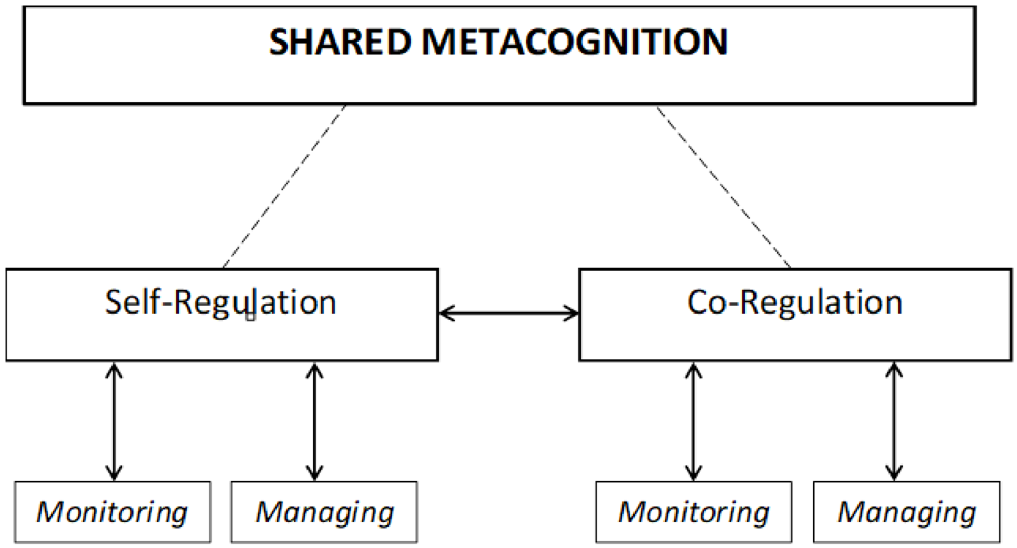
From a theoretical perspective, shared metacognition has considerable potential to develop a deeper understanding of the CoI framework. The essence of the CoI framework is the connectedness of the participants that stimulate insight and innovative thinking through critical discourse. The CoI framework sets the conditions for thinking and learning collaboratively. As such it shapes the learning dynamic but not in an entirely predictable or immutable manner. Inquiry provides the process for exploration and discovery in ways unanticipated in traditional information transmission contexts. Inquiry necessitates that the participants take responsibility and control for the learning transaction. To take responsibility and control for collaborative inquiry requires an awareness and responsibility for monitoring and managing a complex shared learning dynamic. Providing insight into this shared metacognitive dynamic is the goal of shared metacognition.

The challenge in developing and understanding the benefits of the CoI framework is to search for the essential elements and dynamic constants in a collaborative learning environment. For example, we need to explore the constants of the interplay between personal reflection and shared discourse. This is the essence of collaborative inquiry that thrives in a climate of trust and curiosity and represents the interplay between cognitive and teaching presence. For shared metacognition to apply to an educational setting, it must go beyond self-direction or self-regulation. The need to go beyond the individual is what precipitated our work in developing the shared metacognition construct that is consistent with the collaborative constructivist foundational assumptions of a community of inquiry. The important premise here is that developing metacognitive awareness and ability is core to becoming an effective inquirer and essential to collaborative inquiry.

Metacognition is central to any form of learning but is essential to inquiry. A community of inquiry, however, adds an important dimension to metacognition in that monitoring and managing learning collaboratively is both a personal and shared experience. For this reason, shared metacognition is a crucial line of research in the psychology of thinking and learning in collaborative environments. The power and essence of a CoI is the connectedness of the participants, who have an enormous advantage to think critically and creatively. Innovation has the greatest opportunity to emerge from collaborative thinking experiences. We describe shared metacognition as an awareness of one’s learning in the process of constructing meaning and creating understanding associated with self and others. From the perspective of the CoI framework, shared metacognition exists at the intersection of the cognitive and teaching presence constructs and goes to the heart of an educational learning experience. As such the shared metacognition construct has enormous potential to refine and expand our understanding of the core dynamic of a CoI (collaborative inquiry) and to inform both the theoretical and practical implications of learning in a collaborative environment.

Metacognition has been generally accepted as consisting of two components—awareness of the inquiry process and implementation strategies (regulation). Awareness allows the learner to monitor and actively manage or regulate the inquiry process. In short, metacognition awareness and implementation abilities provide the knowledge and strategies to monitor and manage effective inquiry. Most importantly, in a collaborative learning environment, awareness and implementation strategies are developed through critical discourse and the requirement of participants to explain and justify one’s thinking to self and others. The approach to developing a viable metacognition construct for collaborative learning environments is to subsume self and shared awareness and regulatory functions within a single construct. We have defined the shared metacognition construct as reflecting the interdependent dimensions of self and co-regulation, each exhibiting a monitoring (awareness) and a managing (strategic action) function (see Figure 1).

Figure 1
Shared Metacognition Model



(Garrison & Akyol, 2015a, p. 68)

It is important to reiterate that self-regulation in isolation does not recognize the collaborative essence of a community of inquiry (Kilis & Yildirim, 2018a). Similarly, focusing exclusively on learning or learner presence violates the fundamental collaborative-constructivist principle of the CoI framework. Regulation of inquiry is both a personal and social responsibility. Self-regulated learning in a community of inquiry must be fused with a co-regulative function if there is to be effective monitoring and management of collaborative inquiry. Therefore, it is important to advocate for further research that focuses on both self and co-regulation in a community of inquiry. This research must be conducted in a truly collaborative learning environment and with a construct that reflects shared metacognition. We cannot expect to find shared metacognition in a context where learners at best engage in optional discussion forums and are judged on surface outcomes.

Metacognition means increasing awareness of the learning process and taking responsibility to manage the learning process. In the context of a community of inquiry this is a shared experience that considers the transactional environment. To explore the practical implications of shared metacognition we must focus on the intersection of cognitive and teaching presence. This begins with the crucial appreciation that teaching presence is a responsibility of all participants in a learning community. The shared metacognition construct reflects the collaborative premise and nature of a community of inquiry. As such it highlights the collaborative essence of teaching presence. While we have made progress in defining and measuring the construct of shared metacognition, we are in the infancy of describing specific and effective implementation and support for the dynamic of metacognitive awareness and regulation in a collaborative learning environment.

Implementing Shared Metacognition

As defined, shared metacognition exists primarily at the intersection of teaching and cognitive presence. More specifically, the teaching presence categories of planning, facilitation, and direct instruction overlap with the cognitive presence construct operationalized by the phases of the Practical Inquiry model (problem defining, exploration, integration, and resolution). This provides the context in which to explore pragmatic challenges concerning the monitoring and managing of the inquiry process. Zepeda et. al (2019) provided us with clues as to where we might begin focusing our implementation efforts regarding metacognitive support and conceptual development. The first insight was that "teachers are more effective when engaged in metacognitive talk than teachers in low conceptual growth classrooms" (Zepeda et al., 2019, p. 534). The idea is that cognitive talk (discourse) gets students to think about their understanding and become open to sharing their thinking. This, of course, resonates very much with the essence of CoI. The study also suggests that the process of questioning encourages learners to metacognitively think about how they are approaching the learning process.

Planning

At the outset it is crucial to appreciate that planning is a key metacognitive skill. The focus on planning brings to the fore the importance of design and organization and associated principles (Garrison, 2017; Vaughan et al., 2013):

(1) Plan for the creation of open communication and trust.
(2) Plan for critical reflection and discourse.
(3) Establish community and cohesion.
(4) Establish inquiry dynamics (purposeful inquiry).
(5) Sustain respect and responsibility.
(6) Sustain inquiry that moves to resolution.
(7) Ensure assessment is congruent with intended processes and outcomes.

The second, fourth, and sixth principles reflect the need to plan for collaborative inquiry. The first, third, and fifth principles reflect social presence issues that are essential for shared metacognition engagement. That said, our focus here is on teaching presence as it relates to teaching presence responsibilities as it relates to cognitive presence (the essence of the shared metacognition construct). Regarding planning for critical reflection and discourse, it is extremely important to provide a metacognitive map of the inquiry process as defined by the cognitive presence construct (Practical Inquiry model). In this way learners become aware of and understand the dynamic of purposeful inquiry (fourth principle). This will create an important awareness of their role in the progression of their activities and tasks as well as provide greater assurance of efficiency and effectiveness in monitoring and managing the achievement of intended learning outcomes. It has been shown that awareness of this type of engagement and contribution encourages students to reflect on their thinking, explore metacognitive regulation, and encourage productive activities (Garrison, 2017). The practical advantage of shared metacognition awareness is the facilitation and direction of timely progression through the inquiry phases and achievement of intended outcomes.

An essential aspect of planning is to ensure an introduction and understanding of the process of Practical Inquiry (i.e., metacognitive awareness) as an essential predicate to implementing and supporting shared metacognition. Furthermore, this overview of inquiry should be done collaboratively to enhance and reinforce an awareness and appreciation of the phases of inquiry. Understanding of inquiry encourages and supports the assumption of responsibility and control for the inquiry process.

Facilitation

The facilitation component of teaching presence that relates to metacognition is the responsibility for implementing and supporting of shared metacognition. The value of this is highlighted in a study of metacognition where it was suggested "that there might be benefits to conceptual learning when teachers support metacognition, particularly those supports that focus on personal knowledge, monitoring, evaluating, directive manners, and domain-general frames" (Zepeda, et al., 2019, p. 536–537). Moreover, they state that "Teachers in classrooms with high-growth scores on a conceptual learning assessment used more metacognitive talk than teachers in classrooms with low-growth scores" (p. 522). These findings support the argument that metacognitive talk ("discourse" in CoI terminology) concerning the inquiry process and task goals have enormous value, pragmatically, in understanding and promoting shared metacognition in a collaborative learning environment. This supports the conclusion that communities of inquiry have enormous opportunities to exploit shared metacognition through critical reflection and discourse.

Metacognition is dependent upon effective teaching presence to monitor and manage the inquiry process. That is, learners must assume responsibility to shape, facilitate, and direct the inquiry process. Successful learners exhibit teaching presence by taking responsibility for their and others' progress through the inquiry cycle. Metacognitively aware learners shape the discourse by sharing information, critiquing ideas, offering solutions, and directing the inquiry process. In this regard, a study by Janssona et. al (2021) explored how students support inquiry collaboratively. The encouraging results were

> … that the students supported both their own process of inquiry as well as other students' process of inquiry. Furthermore, the results indicate that students acquired metacognitive development through self- and co-regulation when they expressed teaching presence. (p. 1)

Looking more closely at the manifestation of teaching presence the study concluded that by "answering questions, clearing up misunderstandings, and helping peers, students also supported other students' process of inquiry … [and] students were willing to aid other students by helping them regulate their learning by giving them direction and support" (p. 8). This is supported by another study that found feedback in discourse had a significant effect on the students' awareness of their reflective thinking skills. Yilmaz (2020) concluded that "students can gain awareness of their behaviours during the online learning environment" (p. 910) and "that sending feedback … had a statistically significant effect on the students' perceptions of community of inquiry and reflective thinking skills" (p. 909).

To reiterate, shared metacognition begins with relevant, puzzling, and challenging questions manifested through discussions that precipitate reflection and strategic direction of the inquiry process. Practices that encourage shared metacognitive monitoring and management will enhance responsibility and control of the inquiry process and the effectiveness of the learning process and outcomes. More specifically, facilitating inquiry through participant-shared metacognition of the participants regularly identifying and labeling their contributions from the perspective of the phases of inquiry effectively moves discourse toward intended outcomes in a timely manner. In short, the facilitation function represents the strategic enactment and management of the inquiry process that includes setting goals, questioning ideas, considering alternate hypotheses, and ensuring progression. Facilitating self and co-regulation of learning go to the essence of shared metacognition and the facilitation of a community of inquiry.

Direct Instruction

Direct instruction is the third category of teaching presence that needs to be explored to understand and support shared metacognition in a learning community. Direct instruction from a shared metacognitive perspective should be approached with the intent of improving collaborative inquiry competence through the awareness and management of inquiry leading to higher levels of academic achievement. Direct interventions that support effective and efficient learning experiences are predicated upon "a pedagogically experienced and knowledgeable teacher who can identify worthwhile content, organize learning activities, guide the discourse, offer additional sources of information, diagnose misconceptions, and provide conceptual order when required" (Garrison, 2017, p. 76). Directing instruction is an essential dynamic to guide learners in monitoring and managing the inquiry process. To be clear, shared metacognition must be assumed by all members of a learning community. Working symbiotically, individual and group direction will ensure the productive progression of inquiry toward purposeful learning outcomes. Not to be neglected, this includes sustaining social presence to ensure collaborative inquiry that moves to resolution.

The value of direction for metacognitive awareness and management was demonstrated in a study by Vuopala et al. (2019), where they concluded that "prompting regulation activities among students, such as task-related monitoring, teachers can support students to engage in metacognitive processes that are related to high-level knowledge co-construction" (p. 247). Moreover, regarding metacognitive training, Emory and Luo (2020) state that "Although direct instruction can be effective, cognitive modeling offers the possibility to further engage the learner, and potentially develop skills more effectively" (Implications). This also suggests that caution must be exercised in that direct instruction must always be well timed and propitious.

Direct instruction is productive when it stimulates reflection about ideas and the qualitative progression of inquiry. Deep and meaningful learning depends on diagnosing misconceptions and formative evaluation. This can mean intervention to present relevant content and regulatory arguments that provide a metacognitive perspective. At the same time, paradoxically, research has shown that too much direct instruction may seriously limit metacognitive reflection and discourse (Garrison, 2017). The point is that students must accept their responsibility to monitor and manage the inquiry process individually and collaboratively. This requires judgement where the situation may call for learner management, while at other times the discussion may need to end to achieve developmental progress. Direct instruction must encourage participants to not only collaboratively look deeper into a topic but understand shared metacognitive monitoring and management.

We need to continue to explore the positive and negative influences of direct instruction on shared metacognitive awareness and management of inquiry. It is important to make sound judgements as to what kind of direct interventions enhance metacognitive awareness and stimulate discourse that moves collaborative inquiry forward. Conversely, this includes knowing when interventions may restrict the progression of inquiry. Discretion is required to use direct intervention to encourage further reflection before providing answers that risks curtailing discourse. Teaching presence in general and especially direction must be distributed and assumed collectively. In this regard, it is important to metacognitively pause and get an overview of the inquiry process and assess if a new tactic is warranted.

Assessment

The final area associated with the practical implications of shared metacognition is assessment that helps focus and sustain collaborative inquiry. It is well known that assessment can have a significant impact on how students approach learning, especially regarding encouraging personal and shared responsibility of the inquiry process. Sustained, formative evaluation is required to address the complexity of the development of a community of inquiry. This is important from both a cognitive and social presence perspective. At the end of a course, it is often appropriate to extract key concepts, assess the inquiry process, and direct students to further learning challenges. Summative assessment can create a sense of accomplishment, offer direction for further study, and provide a record of achievement. Finally, it is only through rigorous and systematic assessment and evaluation that shared metacognition is possible to develop an understanding of the complex issues associated with judging the dynamics of an educational experience.

Shared metacognition is associated with assessment and feedback that informs individuals and the group how they could improve their approach to learning and intended outcomes. This was supported in a study that found metacognitive monitoring was significantly related to learning outcomes. Zhao and Ye (2020) concluded "that metacognitive calibration is significantly related to learning performance, which is consistent with prior literature and indicates that students with more accurate metacognitive calibration also tend to perform better on online learning tasks" (p. 447–448). The goal in a learning community is to create an environment based on authentic and constructive feedback that can inform the development of collaborative thinking and learning.

Needed Research about Shared Metacognition

The CoI theoretical framework provided the context to define socially shared metacognition as well as the means to rigorously test the construct conceptually and operationally for its structural and transactional integrity. The shared metacognition construct offers the theoretical foundation and genesis of a quantitative instrument to explore the complex transaction of a community of inquiry. This instrument has the potential for significant theoretical and practical insights into the pragmatic complexities of CoI. The shared metacognition construct has been operationalized and the resulting Shared Metacognition Questionnaire validated (Garrison & Akyol, 2015a, 2015b). Moreover, the questionnaire has been further validated through confirmatory factor analysis (Kilis & Yildirim, 2018b). This reinforces our expectation that the Shared Metacognition Questionnaire is a stable and worthwhile tool to research the dynamics of shared metacognition in collaborative learning environments that go beyond self-regulation of learning (see Appendix).

The primary research question beyond confirming the shared metacognition construct should be to study how to develop awareness and management of shared metacognition and how this awareness can be used to achieve deep learning outcomes. Vaughan & Wah (2020) pioneered this line of research and concluded that teaching presence must "intentionally design, facilitate, and direct a collaborative constructive learning environment in order for students to learn how to co-regulate their learning (shared metacognition)" (p. 1). Considering this, any number of practical research issues evolve from an awareness of shared metacognition. For example, from a teaching presence perspective we could explore the effect of shared metacognitive awareness on cognitive and social presence. All indications are that shared metacognitive awareness expedites the inquiry process and creates an efficient and effective outcome. Similarly, regarding social presence, it is expected that metacognitive awareness enhances open communication through an understanding of the integral role of reflection and discourse. There are any number of specific examples of ideas that link shared metacognitive awareness to practical inquiry, learner characteristics, and disciplinary demands. These ideas should be explored through practical applications suggested by the shared metacognition construct.

Metacognitively, the educational challenge is how best to develop the awareness and regulatory strategies to monitor and manage inquiry in a collaborative learning environment. The primary question is how we can develop shared metacognitive awareness and regulation in a community of inquiry to enhance the inquiry process and learning outcomes. The following is an initial list of possible research questions with practical implications:

- Can shared metacognitive instructional awareness expedite the inquiry process (move through phases efficiently)?
- Can shared metacognitive instructional awareness of the inquiry process enhance the effect of the presences in a CoI?
- How does shared metacognition evolve over the duration of a course?
- Will shared metacognition awareness enhance intended learning outcomes?
- What effect will a shared metacognitive awareness have on the dynamic balance of personal and shared metacognition?

Additional areas for exploring shared metacognitive monitoring and management of a community of inquiry from a cognitive presence perspective are related to the expectations of assessment of cognitive development; organization and limitation of curriculum; selection of appropriate learning activities; provision of time for reflection; integration of small discussion groups and sessions; provision of opportunities to model and reflect upon the inquiry process; design of higher-order learning assessment rubrics.

Beyond these research questions there are any number of important issues that can provide insight into the shared metacognition construct and its practical implications. Suggestions about how to proceed with research to understand approaches to design shared metacognitive strategies can be enormously valuable. Cacciamani et. al (2021) offer suggestions in the context of a study that addresses metacognition from a pragmatic collective cognitive perspective that assesses knowledge individually and collectively. The problem addressed is "how to design instruction in the online learning environment to promote students' collective cognitive responsibility for Knowledge Building ..." (Introduction). While they do not use the terms "shared metacognition" and "co-regulation," they address shared metacognition by focusing on students monitoring "not only their own but also other students' progress towards the shared goal to create new knowledge for the community" (Self-Regulation Skills). Specific design insights for successful collective cognitive responsibilities (shared metacognition) are to provide an online discussion forum for more time to reflect and promote knowledge and strategy assessment. This is more than consistent with a CoI, and an example how to design a study to better understand shared metacognition.

Shared metacognition training should be a high priority for those committed to developing our understanding of the CoI framework and designing shared metacognitive learning experiences. This must begin with an understanding of a community of inquiry and the practical inquiry dynamic, specifically. Beyond this, Emory and Luo (2020) cautioned that “the complexities involved in metacognitive training as an intervention … should specifically consider the timing, format, and intensity of such training …” (Implications). That is, training should be continuous, with the community reflecting periodically on their strategies and progress. It must be kept in mind that shared metacognition goes to the essence of CoI. Therefore, considerable research to support the training and development of communities of inquiry through shared metacognition is warranted.

Finally, from the perspective of studying shared metacognition, it is important to emphasize that we have invaluable tools at the ready. The *Shared Metacognition Questionnaire* can quantitatively assess the self and co-regulation components of the construct. However, shared metacognition should be studied in the context of the larger community of inquiry. In this regard, the *Community of Inquiry Questionnaire* can be extremely useful adjunct to explore how the shared metacognition components relate to and impact CoI presences. Together, these instruments can be used to analyze the relationships of these dynamics to learning outcomes. Both instruments have been validated (Garrison, 2017). That said, it is also important not to discount gathering qualitative data to provide context in understanding the dynamics of monitoring and managing collaborative inquiry.

Conclusion

The centrality and importance of shared metacognition in a community of inquiry cannot be overstated. Inquiry would be serendipitous and less productive without conscious intention to take responsibility and control of the inquiry process. Shared metacognition drives collaborative inquiry and can only function effectively with competent shared metacognition. It is hard to see effective inquiry without awareness and strategies associated with the inquiry process. Self and co-regulation of the inquiry process drives knowledge development and deep approaches to learning. In a modern connected society, learners must be cognizant of the collaborative process of thinking and learning. Shared metacognition provides the construct to understand how learners can actively manage inquiry and collaboratively constructing deep and meaningful learning.

Declarations

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References

Cacciamani, S., Perrucci, V., & Fujita, N. (2021). Promoting students' collective cognitive responsibility through concurrent, embedded and transformative assessment in blended higher education course. *Technology, Knowledge & Learning*. https://doi-org.ezproxy.lib.ucalgary.ca/10.1007/s10758-021-09535-0

Dindar, M., Järvelä, S., & Järvenoja, H. (2020). Interplay of metacognitive experiences and performance in collaborative problem solving. *Computers & Education*, 154, https://doi-org.ezproxy.lib.ucalgary.ca/10.1016/j.compedu.2020.103922.

Emory, B., & Luo, T. (2020). Metacognitive training and online community college students' learning calibration and performance. *Community College Journal of Research and Practice*, *45*(10). http://dx.doi.org/10.1080/10668926.2020.1841042

Garrison, D. R. (2018a). Validity of Community of Inquiry. *CoI Blog*.http://www.thecommunityofinquiry.org/editorial15

Garrison, D. R. (2018b). Shared Metacognition. CoI Blog. http://www.thecommunityofinquiry.org/editorial16

Garrison, D. R. (2017). *E-Learning in the 21st century: A Community of Inquiry framework for research and practice* (3rd ed.). Routledge/Taylor and Francis.

Garrison, D. R., & Akyol, Z. (2015a). Toward the development of a metacognition construct for the community of inquiry framework. *Internet and Higher Education*, *24*, 66–71. http://dx.doi.org/10.1016/j.iheduc.2014.10.001

Garrison, D. R., & Akyol, Z. (2015b). Corrigendum to "Toward the development of a metacognition construct for communities of inquiry." *The Internet and Higher Education*, *26*, 56. http://dx.doi.org/10.1016/j.iheduc.2015.03.001

Janssona, M., Hrastinski, S., Stenbom, S., & Enoksson, F. (2021). Online question and answer sessions: How students support their own and other students' processes of inquiry in a text-based learning environment. *Internet and Higher Education*, *51*, 1–10. https://doi.org/10.1016/j.iheduc.2021.100817

Kilis, S., & Yildirim, Z. (2018a). Investigation of community of inquiry framework in regard to self-regulation, metacognition and motivation. *Computers & Education*, 126, 53–64. https://doi.org/10.1016/j.compedu.2018.06.032

Kilis, S., & Yildirim, Z. (2018b). Metacognition within a communities of inquiry questionnaire: Validity and reliability study of Turkish adaptation. *KEFAD*, *19*(1), 680–690. http://kefad.ahievran.edu.tr/

Vaughan, N., & Wah, J. L. (2020). The Community of Inquiry framework: Future practical directions-shared metacognition. *International Journal of E-Learning & Distance Education*, *35*(1), 1–25.

Vuopala, E., Näykki, P., Isohätälä, J., & Järvelä, S. (2019). Knowledge co-construction activities and task-related monitoring in scripted collaborative learning. *Learning, Culture and Social Interaction*, *21*, 234–249. https://doi.org/10.1016/j.lcsi.2019.03.011

Yilmaz, R. (2020). Enhancing community of inquiry and reflective thinking skills of undergraduates through using learning analytics-based process feedback. *Journal of Computer Assisted Learning*, *36*(6), 909–921. https://onlinelibrary-wiley-com.ezproxy.lib.ucalgary.ca/doi/epdf/10.1111/jcal.12449

Zepeda, C. D., Hlutkowsky, C. O., Partika, A. C., & Nokes-Malach, T. J. (2019). Identifying teachers' supports of metacognition through classroom talk and its relation to growth in conceptual learning. *Journal of Educational Psychology*, *111*(3), 522–541. http://dx.doi.org/10.1037/edu0000300

Zhao, L., & Ye, C. (2020). Time and performance in online learning: Applying the theoretical perspective of metacognition. *Decision Sciences Journal of Innovative Education*, 18(3), 435–455. https://doi-org.ezproxy.lib.ucalgary.ca/10.1111/dsji.12216

Appendix

Shared Metacognition Questionnaire

When I am engaged in the learning process as an individual: SELF-REGULATION

I1: I am aware of my effort
I2: I am aware of my thinking
I3: I know my level of motivation
I4: I question my thoughts
I5: I make judgments about the difficulty of a problem
I6: I am aware of my existing knowledge
I7: I assess my understanding
I8: I change my strategy when I need to
I9: I am aware of my level of learning
I10: I search for new strategies when needed
I11: I apply strategies
I12: I assess how I approach the problem
I13: I assess my strategies

When I am engaged in the learning process as a member of a group: CO-REGULATION

G1: I pay attention to the ideas of others
G2: I listen to the comments of others
G3: I consider the feedback of others
G4: I reflect upon the comments of others
G5: I observe the strategies of others
G6: I observe how others are doing
G7: I look for confirmation of my understanding from others
G8: I request information from others
G9: I respond to the contributions that others make
G10: I challenge the strategies of others
G11: I challenge the perspectives of others
G12: I help the learning of others
G13: I monitor the learning of others

Manifestations of Cognitive Presence in Blended Learning Classes of the Philippine K–12 System

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Abstract
Through an exploratory case study, this research sought to determine the applicability of the Community of Inquiry in the K–12 setting. There are research gaps to leverage support for blended learning and flexible learning options to benefit Filipino youth and school-leavers under the Alternative Delivery Mode of the Philippine K–12 system. This study was driven by the following research questions: How is cognitive presence manifested in the blended learning interactions? In what ways do the interactions of cognitive presence with the other presences characterize learning community building? Three blended learning classes were examined based on data collected through surveys, student focus group discussions, teacher interviews, class observations and archived data. Through constant comparison analysis and descriptive statistics, evidence revealed cognitive presence across its categories in the form of connectedness, collaborative work, trust and reciprocation, and shared views on technology by K–12 teachers and learners. The analysis affirmed "regulating learning" as the intersection of cognitive presence and teaching presence. Implications for practice and recommendations for further research are discussed through the study's proposed modifications on the cognitive presence categories, indicators, and the survey instrument for the K–12 setting where teacher-directed pedagogies or collaborative inquiry processes have not been thoroughly co-opted.

Keywords: cognitive presence, blended learning, Community of Inquiry, K–12 Philippines, self-regulation, shared metacognition

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Research gaps exist in the context of learning communities at the K–12 levels, which have increasingly introduced flexible modes of delivery referred to as cyber schools or virtual schools in Western countries (Borup et al., 2020; Molnar et al., 2019) or open high schools and alternative delivery modes in developing countries (Villanueva, 2021). These settings need to ensure student interaction through computer-mediated communications and other media technologies to accommodate a growing population of marginalized secondary-level learners seeking access to education and alternative ways to learn. Unlike undergraduate or graduate-level students, adolescent learners are generally described as nascent while acquiring skills in metacognition and self-regulation (Meusen-Beekman et al., 2015) and therefore in need of support and encouragement within learning communities. However, research into blended and online learning at the K–12 levels need frameworks to guide its pedagogy and practice (Barbour, 2018). There have been few frameworks formulated for K–12 blended learning (BL) which draw from the longstanding work of Garrison et al.'s (2001) Community of Inquiry (CoI) validated in higher education. Research into CoI and BL environments has been recommended (Harrell & Wendt, 2019), and likewise in the K–12 setting (Garrison, 2017).

As such, the purpose of this study was to apply the CoI and its elements to understand the teacher and student BL interactions and experiences in the Philippine K–12 system. This article particularly examines the manifestations of cognitive presence (CP) and analyzes its interaction with the other CoI elements in three BL classes. The initial section covers a summary of research in CP, the CoI framework and its corresponding instrument. Then, the methodology briefly outlines the participants' profile and qualitative data collection and analysis entailed. The findings elaborate on CP through its categories and indicators as well as the constructs of self-regulation and co-regulation. The discussion analyzes the CP manifestations and reveals learning community building through the interactions of the presences. The final section discusses proposed modifications to the CP indicators and the survey instrument. It includes implications for practice and recommendations for further research on the CoI to inform K–12 BL practices and teacher professional development.

Community of Inquiry

The CoI's primary function is "to manage and monitor the dynamic for thinking and learning collaboratively" (Garrison, 2017, p. 24), indicated through the interplay of its three elements or presences. Teaching presence (TP) is reported to sustain the balance among the other elements towards the achievement of learning outcomes (Garrison & Cleveland-Innes, 2005) and particularly valuable in K–12 learning community building (Villanueva, 2021). Social presence (SP) "is the ability of participants to identify with a group, communicate openly in a trusting environment, and develop personal and affective relationships progressively by way of projecting their individual personalities" (Garrison, 2017, p. 25). CP is defined "as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison et al., 2001, p. 11) and the most critical element indicative of higher-order learning (Layne & Ice, 2014). Hence, research continues to understand its role within learning communities.

Castellanos-Reyes (2020) indicated that research on the CoI has spanned two decades, with 2000 to 2009 as the initial phase for establishing the framework in higher education. Research in this period revolved around the content analysis of transcripts, with TP being proven to influence CP and SP greatly. The next phase, 2010 to 2019, included further research to test the applicability of the CoI instrument. Studies have shown the CoI survey instrument as valid and reliable in higher education (Arbaugh et al., 2008; Stenbom, 2018). While most research has transpired in Canada and the U.S. being English speaking countries, to date, the CoI instrument has been translated to Chinese (Ma et al., 2016), Korean (Yu & Richardson, 2015), Portuguese (Moreira et al., 2013), Turkish (Olpak & Kiliç Çakmak, 2018) and adapted in Filipino for the K–12 (Villanueva, 2020).

The second decade of research using the CoI also involved criticism on the framework which resulted in calls for additional presences (Castellanos-Reyes, 2020; Kozan & Caskurlu, 2018), namely emotional presence (Cleveland-Innes & Campbell, 2012; Majeski et al., 2018), autonomy presence (Lam, 2015) and learning presence (Pool et al., 2017; Shea et al., 2012). These proposed presences were in addition to the three existing elements, but a consensus has not eventuated. Reflection as an indicator of CP was also proposed, a process valuable to high-level thinking and deeper learning (Redmond, 2014). Hence, further application of the CoI to address these gaps have been suggested (Castellanos-Reyes, 2020; Kozan & Caskurlu, 2018), particularly for K–12 blended and online learning in keeping with earlier recommendations by Garrison (2017).

Very few studies have assured the framework's applicability at the K–12 (Harrell & Wendt, 2019). For example, Villanueva (2021) proposed for further research its modified CoI framework with changes to the TP categories and indicators and a CoI teacher self-reflection tool. A recent study by Sanders and Lokey-Vega (2020) applied the CoI among teachers in a virtual high school in the U.S. and proposed a modified K–12 CoI through an additional presence termed as collegial presence. This presence referred to supervising adults, support staff or tutors considered as colleagues who assist students in their learning. Findings from the study, however, were only limited to teacher perspectives. Hence, the K–12 setting remains to be a robust area for the sustained application of the CoI.

Cognitive Presence

Within CP lies the practical inquiry cycle of critical self-reflection and conscious use of strategies for higher learning through the phases of inquiry, namely: triggering events, exploration, integration, and resolution. Studies have revealed the challenge of elevating participant engagement towards integration and resolution phase (Anderson & Kanuka, 1999; Vaughan & Garrison, 2005), raising questions about whether meaningful and deep learning can be achieved in learning communities. Morueta et al. (2016) found that in CP, the most common student actions were exploration and integration, while the least common were triggering actions and resolution and suggested the need to ensure the interaction of CP with the other presences within the CoI. Chen et al. (2019) found that students maintained low-level CP while engaged in peer-facilitation and concluded that the types of questioning pursued by peers can positively affect the quality of CP.

Akyol and Garrison (2011) aimed to build on CP by validating the construct of metacognition. Metacognition is viewed as intentional actions to assess the learning process critically; hence they claimed that within the model, there is an embedded practical inquiry cycle. Garrison and Akyol (2015b) elaborated on the dimensions of metacognition as knowledge of cognition, monitoring cognition, and regulation of cognition. A “Shared Metacognition Questionnaire” was developed for use alongside the CoI instrument by Arbaugh et al. (2008), which included self-regulation and co-regulation. Self-regulation includes skills in planning and organizing one’s learning, monitoring one’s understanding of tasks and strategies to direct one’s learning (Zimmerman, 1990). Co-regulation entails actions or behaviors from an abled member to support others while interacting and working on tasks considered as "solo, cooperative or collaborative products" (Hadwin et al., 2011, p. 69). The current CoI has the intersection of CP and TP as monitoring and regulating learning (Akyol & Garrison, 2011) over the initial intersection ascribed as selecting content by Garrison et al. (2001). These suggestions have given new focus and purpose to the role of self-regulation and metacognition within blended and online learning communities.

Despite studies validating the CoI survey instrument to measure all presences (Arbaugh et al., 2008), there is still a lack of research and theoretical analysis that establishes how the presences work in unison (Parker & Herrington, 2015). Thus, this study sought to address this gap by applying the CoI framework where BL is emerging in contexts still dominated by traditional and didactic instruction (Espiritu & Budhrani, 2019). Some Filipino adolescent learners are engaged in alternative learning programs at the secondary level (DepEd Order No. 54 s.12, Phils), where social learning and self-regulation are valuable (Matuga, 2009; Wong, 2019). Positive experiences resulting from their BL interactions may lead them to consider flexible learning options in higher education. Hence, this study found potential in drawing from a valid framework in online higher education research, such as the CoI, to ascertain ways the framework can be used to inform K–12 BL practices and teacher professional development.

Research Questions

This study posits that perspectives on BL interactions and experiences of both students and teachers as members of K–12 learning communities are important to affirm the place of the CoI in K–12 BL research. Therefore, this article pursued this through the following research questions:

(1) How is CP manifested in the BL interactions?

(2) In what ways do the interactions of CP with the other presences characterize learning community building?

Examining CP along these lines are needed to further establish the CoI as applicable to the K–12 setting, especially where BL is emerging to include its possibilities to inform and guide the professional development of teachers for BL.

Methodology

This exploratory case study was undertaken in three public schools within one urban district supervised by one City School Division Office of the Department of Education in the capital region of the Philippines. Purposeful and convenience sampling were used to identify the case sites. Network sampling, a common form of purposeful sampling, may be carried out by identifying selected participants, which can easily refer other schools or programs while convenience sampling allowed for selection based on location and availability of respondents (Merriam, 2009). As such, courtesy calls and informal school visits were undertaken through the researcher's known network of educators. Two prospective school sites were identified by teachers themselves and the Division of City Schools. Another site was referred by these schools which were conveniently situated within the researcher's locality. Unlike most schools in the district, these three schools satisfied certain criteria set, namely having either a school-administered LMS or a class subject or teacher-driven group on a social media platform demonstrating online interaction with content and/or interaction with peers and teachers.

Students also had email accounts and access to the internet, laptops, computers, or mobile phones whether in school or at home.

The data collection in this study entailed a mixed method approach from three BL classes, with school and participant profiles depicted in Table 1. The schools were designated letter codes as A, B, and C.

Table 1
Summary of Participants Across Data Collection Methods

Classes and Grade Level	**Kind of BL Program**	**CoI Survey Part 1** **n= 40 students**	**CoI Survey Part 2** **n = 24 students**	**Student FGD** **n= 8 groups 29 students**	**Teacher Interviews** **n = 5 teachers**	**Class Observations** **n = 3 classes**
School A Grade 10 Class	Open High School Class level BL	7	4	1 (4 students)	1	1
School B Grade 7 Class	School-wide eLearning program	18	13	3 (11 students)	2	1
School C Grade 10 Class	Block section in a Science High School with an eLearning program	15	7	4 (14 students)	2	1

Table 1 presents the demographics of the classes in the study. Less than half of the total student population in each class participated in the study, with parental approval for those below 18 years of age. Data collection from the students included a bilingual version (Filipino and English) adapted from Arbaugh et al.'s (2008) CoI survey instrument as Part 1 (five-point Likert-scale) and a Part 2 (open-ended questions). Examples of CoI Part 2 questions to elicit BL experiences were: "What do you like about your blended learning experiences? Feel free to mention positive experiences with having blended learning" and, "Are there instances when you need to monitor or co-regulate each other's online work and behavior as classmates? If so, in what ways?" The focus group discussions (FGD) with students were also undertaken for 30 to 45 minutes per session to elicit descriptions of BL in both face-to-face and online scenarios, for example, "How would you describe the class interactions while doing blended learning?" and "Which learning activities would you say encouraged you to interact and learn more during your face to face/online learning?"

In addition, teachers in the BL classes of the student participants were interviewed for 30 to 45 minutes using semi-structured questions to gather in-depth data on BL experiences. Teachers also completed a questionnaire with corresponding questions closely similar to the student FGD questions that relate to the presences. Due to hectic schedules, teachers could only devote limited time to undertake the interview, hence a questionnaire was provided to ensure sufficient data collection from the teacher's perspective. Class observations of actual BL interactions were undertaken using an observation template to document manifestations of the presences. Archived data of virtual class interactions in their learning management system

(LMS) and Facebook Messenger were also gathered, guided by the CoI protocol validated in prior research.

Qualitative studies aim to produce knowledge and interpretations deemed as trustworthy while emphasizing the uniqueness of settings and contexts (Wahyuni, 2012) but takes on a different form through characteristics of credibility, consistency, and reflexivity (Krefting, 1991). To further increase the credibility of the findings, triangulation was applied through the use a mixed method approach based on multiple data sources, ensuring thick and accurate descriptions of human experience (Merriam, 2009; Stake, 1995). Descriptive statistics for the CoI survey Part 1 were generated using the SPSS software and the Lime Survey program, which included mean, median, and standard deviation. These results supported the qualitative findings.

For the qualitative data, constant comparison analysis was used as a systematic process to examine varied meanings to generate a set of themes based on textual data (Leech & Onwuegbuzie, 2008). Relationships among portions of the data were identified (Merriam, 2009) and through the coding process, which entailed three phases: open coding, axial coding, and selective coding (Saldaña, 2016). Open coding was employed manually on the FGD transcripts that became the basis for summative notes, both of which were furnished the participants for proper member checks. Thus, an intra-coder reliability was attained, with the researcher as the sole coder maintaining consistency in the coding at the CoI category level and indicator level, followed by participant validation. These actions were described as a proper alternative to inter-coder reliability (Castleberry & Nolen, 2018).

Another round of coding was undertaken through the NVivo software for electronic coding, which facilitated axial and selective coding. The axial coding meant going beyond the initial coding to interpret meanings (Merriam, 2009), and writing analytical memos to reflect on the codes generated, their patterns and connections, and the coding process (Saldaña, 2016). Responses which fall in either of the two presences or elements within the CoI were mapped out within the intersections of the presences, then coded at the category level and indicator level. These guided the data analysis of the intersections of the presences to reveal its confluences.

Findings

Findings from the CoI Survey Parts 1 and 2 survey and class observations highlighted the manifestations of CP across its categories and indicators. The interaction of CP with the other presences was revealed through the teacher interviews and student FGDs. The following sections expound on these.

Findings from the CoI Survey

The CoI framework posited that students actively participated in their learning through the collaborative inquiry cycle (Garrison, 2017). CP of this nature is ascertained through specific results from the CoI Survey Part 1. Items in this portion of the survey are framed from the students' view. Out of the 12 items under CP in the survey, five items started with "I", as seen in Table 1. These items signify the individual learner as an active participant of their learning through critical thinking, exploration, and application of knowledge and problem-solving. Among all CoI Part 1 Survey items, CP items gained the highest mean ratings compared to SP and TP items (on a scale of 1 to 5, with 5 as the highest). CP items indicated even ratings and positive results, as seen in Table 2. Selected items under CP covered the whole range, with isolated ‘Strongly disagree’ and ‘Disagree’ responses. Generally, the mean scores are high, and the SD results skewed left towards 'Strongly agree' and 'Agree' responses.

Table 2
Descriptive Statistics of CP Items of the CoI Survey Part 1

CP Category	Survey Item	*M*	*SD*
Triggering event	CP23 The problems posed increased my interest in issues tackled in class.	3.63	1.102
	CP24 The online learning activities engaged my curiosity.	4.13	0.822
	CP25 I felt motivated to explore content-related questions.	4.02	0.920
Exploration	CP26 I utilized a variety of information sources to explore problems posed in this subject.	4.05	0.904
	CP27 Brainstorming and finding relevant information helped me resolve content related questions.	4.27	0.506
	CP28 Online discussions were valuable in helping me appreciate different perspectives.	4.10	0.841
Integration	CP29 Combining new information helped me answer questions raised in the class activities.	4.38	0.667
	CP30 Learning activities helped me construct explanations/solutions.	4.33	0.764
	CP31 Reflection on content and discussions helped me understand fundamental concepts in this subject.	4.23	0.660
Resolution	CP32 I can describe ways to test and apply the knowledge created in this subject.	4.00	0.751
	CP33 I have developed solutions to problems that can be applied in practice.	4.15	0.802
	CP34 I can apply the knowledge created in this subject to my other classes or other related activities in school.	4.28	0.716

Most students believed that their experiences of participating in BL were challenging and engaging in piquing their curiosity and motivation to explore questions indicated by high mean ratings in Items CP24 and CP25. The lowest mean score was found in the category of Triggering Event, with Item CP23 having 3.63. This item referred to problem-posing to gain interest in discussion and participation compared to other CP items. It is possible that problem-posing activities were not the usual ways to introduce a new subject content to gain student interest.

The category of Integration gained the highest ratings at 92% (combined agree and strongly agree) with Items CP29-CP30 with the highest mean as seen in Table 2. Item CP29 is related to the connection and convergence of ideas in response to questions discussed in class. Items CP30 and CP31 imply knowledge construction and reflection as part of critical thinking among students. The three CP items under Resolution also received high ratings at 83% (combined agree and strongly agree) based on the average results across three schools. These items referred more to student effort and action to apply knowledge. For example, item CP33 included problem-solving and knowledge application, while Item CP34 was about the broader application of knowledge to other subjects. However, Item CP32 under Resolution received a range of top three responses. This item referred to the student's ability to describe ways to apply and test knowledge.

Responses to the CoI Survey Part 2 revealed positive experiences related to CP with students, indicating that their ability to think more broadly was tested through the BL modules, learning activities, quizzes, and assessments. Students felt more actively engaged in their learning while working on different content and learning activities thereby fulfilling role expectations. Students attested how their teachers also ensured cooperative and collaborative learning to enhance their online and face-to-face experiences. There were also teacher-driven discussions and facilitation, which mainly triggered thinking and engagement through varied questions.

Findings from Student FGD

Data from student FGD also provided support for students engaging in group work and collaborative learning. To qualify further manifestations of these interactions, data were examined in the light of CP categories and indicators. Samples revealed explicit actions students take to attain shared goals, to accomplish the required work, or to co-regulate learning. The student responses also indicated the interaction of CP and TP and CP and SP, especially during group work and collaboration, with examples of co-regulation and metacognition.

Students related their group learning experiences with the use of technology. For example, students at School A and School C indicated that they engaged in group chats mainly to exchange information, discuss ideas, or work together to understand a lesson further. Grade 10 students at School C mentioned:

> We do group works mostly online or meeting up when we do not have classes. We usually talk using social media apps like Facebook and FB Messenger. We assign tasks to each member and encourage them to participate with the group. We get references from the lessons posted in the platform or we follow the instructions/activity given by the teacher through the platform.
>
> Being together for 4 years, I can say that our bond has been strengthened, we know each other more now. We can expand our knowledge using our platform and with the help of our teachers.

Students at School B engaged in cooperative and collaborative learning activities but more in their face-to-face classes. One student described group work, stating, "It's fun, noisy, chaotic and yet we are able to do what is asked of us." However, collaborating online is not without its challenges. A Grade 10 student from School A mentioned, "Sometimes we have group work or collaborative work given while online … the quality is not so good because the others do not help or participate in the work." Though students from School B described their interactions as mostly constructive and positive, issues arose relating to their work quality and peer relations. Students themselves perceived these to be part of undertaking group work, recognizing their similarities and differences.

Student responses were also considered in the light of metacognition as part of CP reported in research by Garrison and Akyol (2015a). Student descriptions of online work implied forms of metacognition through self-regulation, as seen in Table 3.

Table 3
Aligning Items: Samples of CP with Self-Regulation and Co-Regulation

CP Survey Items Arbaugh et al. (2008)	**Student Responses on questions related to: peer support, regulation of behavior, group work and collaboration, the role of ICTs**	**Shared Metacognition Questionnaire Items Garrison and Akyol (2015a) SR – Self-regulation CR – Co-regulation**
Exploration 26. I utilized a variety of information sources to explore problems posed in this subject.	I see to it that I write every reminder or work given by the teacher so that I am able to pass to a classmate the activities. (Student_A)	SR11 I apply strategies. CR 8 I request information from others.
28. Online discussions were valuable in helping me appreciate different perspectives	They ask, and I get to answer them correctly, and I can also contribute my answers, and so we learn more. (Student_B)	CR 7 I look for confirmation of my understanding from others. CR 9 I respond to the contribution others make. CR 11 I challenge others' perspectives
Integration 29. Combining new information helped me answer questions raised in the class activities.	I do the research and tasks for us. (Student_B) I am able to explain so that they will be able to understand more each problem. (Student_B)	SR11 I apply strategies. CR12 I help the learning of others.
Resolution 32. I can describe ways to test and apply the knowledge created in this subject.	By watching tutorials regarding this certain app and applying it until I master it, then upgrading to another app that can boost my creativeness much further. (Student_C)	SR6 I am aware of my existing knowledge. SR11 I apply strategies.

In Table 3, items from the Shared Metacognition Questionnaire of Garrison and Akyol (2015a) were added to show corresponding self-regulation and co-regulation taking place. Students attested to regulating their learning when online and working independently. In addition, one student indicated, "I am more comfortable by myself because I am able to focus." Another student said, "Sometimes I prefer that I study on my own because I feel I can understand more. It seems like his way of teaching is different. She/he has her/his own different ways, while mine is different."

At the same time, students also revealed that completing online work was a challenge to keeping focused on the task at hand as they get distracted with Facebook, YouTube, Wattpad, and having multiple tabs open while engaged in online work. Other students also mentioned delaying work by playing online games. To cope with distractions, students have indicated ways to manage their time better, such as taking note of deadlines. They also passed on reminders and announcements to each other, especially to those who had been absent during their face-to-face sessions.

In summary, findings from student participants revealed varied ways CP is manifested, which were interpreted alongside the categories and indicators within the CoI framework. Results also indicated the interaction of CP with TP and SP, especially during group work and collaboration, with examples of co-regulation and metacognition.

Findings from the Teacher Interviews and Questionnaire

Data from the teacher participants were necessary to provide evidence on what entailed as learning with academic goals in mind given the ways in which content and instruction were organized and delivered. The construct of CP in research is explained through the practical inquiry which Filipino teachers may not consciously be aware of but perhaps experience. As such, the study brought these to light in ways the participants describe the interactions in their BL classes. Manifestations of CP based on teacher participant responses alluded to CP as critical thinking and reflection among students taking place within the BL classes, as described below:

> Through critical thinking, students focus on the processes of learning rather than just attaining facts about phenomena. Critical thinking helps learners to create and apply new knowledge to real-world situations. The elearners think critically and become actively responsible for their own education. (School C Teacher)

> In terms of encouraging them to reflect on their learning, I usually do it face-to-face by asking them how they are going to apply what they have learned to their everyday lives. And if there is still time, I let them do some activities in connection to the lesson. (School B Teacher)

Ms. Lota, the Filipino teacher at School C, felt that critical thinking was innate for those capable students who were predisposed to use it. As such, it may affect the outcomes of their BL experiences. She indicated: “If the students are quite intelligent or knowledgeable or capable, then BL becomes more appropriate, especially among those who can really rely on their own thinking…It’s really meant for those who are more capable.” These responses revealed that teachers put value on the kind of thinking they encourage among students through the corresponding learning content and activities. These findings were aligned with the students’ ratings and descriptions of their BL experiences based on the CoI survey results.

Findings from Class Observations and Archived Virtual Classroom Data

In terms of the CP categories and specific indicators, Information Exchange and Connecting Ideas were manifested across the three schools because teachers described them and witnessed them in the class observations. Data from the class observations were counted and juxtaposed with archived data coding frequency count. Data were gathered through live class observations, with the researcher jotting down notes on a class observation template, then writing field notes and memos thereafter. The CP indicators were summarized against coding frequency counts indicating a total count of 48 across the categories of CP in the class observations and archived online class data. The CP category of Exploration received the highest coding count at 22 for both face-to-face and online class interactions, while Integration and Resolution received the least, with eight counts each.

These findings provided evidence of CP among students when they were engaged in Exploration but mainly through information exchange in face-to-face class observations and archived data of virtual classes. The category of Triggering Event was manifested minimally in both the class observations and archived data. For example, Facebook Messenger posts poll activities where students recorded and justified their responses with explanations in English, giving way to essay-writing activities during their face-to-face time. Integration was also indicated through convergence among group members and through connecting ideas during small group discussions. Manifestations of Resolution were primarily found in face-to-face classes. In contrast, Reflection as an indicator of CP was found in face-to-face class observations and archived data.

Thus far, manifestations of CP among students were primarily evidenced through findings from student and teacher participants and face-to-face class observations. Unfortunately, minimal results supported CP through online work due to limitations in the archived virtual classroom data. Overall, however, findings revealed manifestations of CP through collaborative work, critical thinking, self-regulation, co-regulation, and metacognition.

Discussion

RQ1: How is CP manifested in the BL classes?

This article sought to apply the CoI framework to understand BL experiences at the K–12 levels through the manifestations of CP. Manifestations of CP were evident as attested by students and teachers across the categories of triggering event, exploration, integration, and resolution, supported by positive results based on quantitative measures of CP in research. Teachers described learning activities which promote critical thinking and reflection in their BL classes. Students mainly experienced CP through their collaborative work and interacting with content, teachers, and peers. Among the categories, exploration was highly evident in both face-to-face and online classes and through initiating online facilitation, regulating their online browsing, monitoring the status of group work, checking on a peer's understanding and searching for additional information to help themselves learn. These were revealed through group work and collaborative activities but mostly observed in face-to-face classes. Overall, students felt that their BL experiences kept them active and curious to learn more and challenged their ways of thinking and working with others.

RQ2: In what ways do the interactions of CP with the other presences characterize learning community building?

In terms of the interactions of CP with the other presences, this study demonstrated student actions in cooperative and collaborative learning tasks that may lead to improved cognition, reflection, and knowledge creation expected of collaborative inquiry. Though these outcomes were not elaborately described in this study due to the limited classroom observations, its link to learning community building were justified based on the findings that relate to the interactions of CP with the other presences. Learning communities are not just defined by social interactions, shared values, and shared roles to achieve common goals. The learning and reflection are valuable within a community of inquiry. Within the CoI, these are said to be manifested through dialogue, reflection, and critical discourse as members of the learning community engage in the cycle of collaborative inquiry (Garrison, 2017; Redmond, 2014; Reilly, 2014). Critical thinking and other high order learning skills are examined through the construct of CP (Layne & Ice, 2014; Richardson & Ice, 2010) within learning communities. Though the complete cycle of the phases of practical inquiry has not been completely covered by this study, the presence of critical thinking may be inferred as taking place through the manifestations of CP. As for dialogue, reflection and critical discourse, this study revealed minimal evidence through classroom observation and archived data to validate the teachers' responses.

This study found learning community building as characterized by CPs interactions with the other presences through the evidence of cooperative and collaborative work driven by the CP among the students. These collaborations resulted in connectedness and the attainment of shared goals indicative of learning communities (Villanueva, 2021). The results revealed that students anticipated going to school to be with their classmates and teachers and not merely to socialize. This emphasized the school setting as a place to learn from and with each other. The students indicated their sense of connectedness and belongingness while engaged in BL. As they learned together within a shared space, students' "collective identity" was acknowledged because they contributed to each other's learning as it became seen and felt. Kennedy and Kennedy (2013) discussed collective identity concerning community building among group members through metacognitive goals and reflexivity. Learning community, therefore, was a matter of thinking about attaining social and cognitive goals. In this study, the collective identity was reinforced through a combination of student-initiated small-group work online and teacher-planned group activities when in school.

The BL environment in the Philippine K–12 system provided the context to further examine the interactions of CP with TP and SP through the constructs of self-regulation and co-regulation as studied by Garrison and Akyol (2015b). As such, this study affirms the stance of Garrison (2017) to maintain the integrity of the three presences while recommending further research into the meanings placed by learning community members on the intersections of the presences to assure the applicability of the CoI framework in other settings. The following sections unpack these further by discussing regulating learning and supporting discourse as the intersections of the presences, thus revealing learning communities.

Regulating learning: The intersection of TP and CP

Self-regulation is a valuable area of research among primary and secondary school students (Blume et al., 2021; Meusen-Beekman et al., 2015). This is particularly relevant given the growth of BL and online learning for younger students (Halverson et al., 2017; Martin et al., 2021) and limited studies on the CoI's applicability in the K–12 setting (Sanders & Lokey-Vega, 2020). This study found evidence of self-regulation and co-regulation as seen through the examples of interaction with content and interaction with students. Swan (2003) referred to these types of interactions as the space where CP and SP exist. Through their individual and collaborative work, student manifestations of CP were re-examined to match with the CP categories and Shared Metacognition Questionnaire formulated by Garrison and Akyol (2015a). Samples of CP were found in student responses through the CoI Survey Part 2 and student FGD. These samples identified the explicit actions taken by the students to monitor their learning and guide that of others, particularly when they were working in groups. The students were accountable for their actions and contributions in pursuit of their learning goals.

Findings also revealed that the manifestations of CP among K–12 student participants were aligned with the definitions and examples of self-regulation in research (Blume et al., 2021; Schunk & Zimmerman, 2012). These self-regulated learning strategies correspond to seeking information, keeping records, and monitoring and seeking social assistance from others. BL meant greater opportunities for student control and flexibility in how students could interact with content and with peers and as afforded by technology. Due to the flexibility allowed by BL, students attested to learning time management, discipline, and responsibility while improving their technology skills for learning (Villanueva, 2021). These skills also imply self-regulation as CP manifested by adolescent learners in this study.

Shared metacognition was defined as the construct that signifies "an awareness of one's learning in the process of constructing meaning and creating understanding associated with self and others" (Garrison, 2018, p. 2). The construct was described to capture two distinct but interrelated elements of self-regulation and co-regulation. In this study, finding manifestations of CP revealed that the construct of one could not be studied independently from the other. This study supports Garrison and Akyol's (2011) proposed regulating learning as the intersection of TP and CP with evidence from the K–12 setting. Therefore, exploring the use of categories and indicators alongside the constructs of shared metacognition of CP contributed to the understanding of BL in the K–12 setting.

Supporting discourse: The intersection of CP and SP

Supporting discourse is at the intersection of CP and SP within the CoI framework. In an earlier study, Morueta et al. (2016) examined the relationship between CP and SP. Their study reported the positive relationship between SP and CP, especially when TP is inaccessible or not visible. Similarly, in this study, CP and SP are positively related, with students further qualifying the group cohesion and collaborative learning they have experienced as a highlight of their BL experiences. To some extent, students have indicated the role of technology and the choice of media which support their positive views of BL. For example, students have mentioned sustaining online interactions with their classmates on days they are not in school and learning independently afforded by the school's LMS platform and Facebook Messenger. The choice of social networking technologies reported among higher education students enabled the interactions to take place (Bateman, 2021) and enhanced their face-to-face discussions and sense of community (Milošević et al., 2015). The same is valid within the K–12 context.

This study also revealed that BL interactions entailed explicit student actions to help themselves learn. Lam (2015) also found similar student behaviors through a case study that explored student experiences in a higher education BL course. The study gathered qualitative data through interviews and field notes but without the use of the CoI instrument. It concluded by proposing an extension of the CoI framework to include “autonomy presence,” defined as "the drive to inquiry that leads to sharing and discussion initiated by individuals" (Lam, 2015, p. 51). However, this current study's findings characterized these student-driven actions as co-regulation amidst small group social interactions. Hence, this study asserts that 'autonomy presence' need not be accommodated within the CoI as a separate presence. Some studies will go as far as to suggest the inclusion of collegial presence (Sanders & Lokey-Vega, 2020) and learning presence (Pool et al., 2020; Shea et al., 2012). This study instead argues for a better understanding and appreciation of the intersections of the presences.

Implications for Practice and Recommendations for Future Research

Meaningful learning community building through the interactions of the presences have been documented in this study. This study therefore recommends teacher professional development in the areas of instructional design including the development of study guides, assessment guides, learning modules that would be grounded on the development of the presences. In addition, teacher training workshops could be implemented for the course design team to revisit and improve current learning modules to integrate learning community building strategies for a more engaging teaching and learning experience. As COVID continues to impact on learning and teaching across the globe, teachers and students need to understand how to create presence in an online space and teachers should understand how to facilitate discussion and learning online.

This research is limited due to the small sample size and small geographical location; however, the range of different data collection devices assists in overcoming these limitations.

This research demonstrated meaningful use of valid measures of learning communities through the CoI framework and widened its applicability in educational environments in developing countries such as the Philippines and within the K–12 context. However, it was found that the CP items of the CoI survey did not explicitly reveal the self-regulating task students can perform. Aspects of self-regulation and co-regulation were not accounted for within the CoI categories nor the CoI instrument. In addition, student actions while learning independently were manifested as TP under the proposed category of self-direction of students (Villanueva, 2021).

Hence, this study suggests that in the context of K–12 BL, the categories and indicators of CP undergo modification as indicated in Appendix A (in yellow highlights). Self- and Co-regulation and Reflection have been included as CP categories within the CoI. These new categories have corresponding items for accommodation as indicators. For example, under CP is Reflection as a category with indicators of 'reflecting on content' and 'reflecting on the learning process' made explicit. The other categories from the collaborative inquiry under CP have been replaced with the category 'Critical Thinking and Dialogue', but its corresponding indicators are maintained. These proposed changes are based on the manifestations of indicators found in the study but not necessarily on how it is defined through a constructivist learning theory. Keeping the indicators within the framework will provide support for K–12 BL programs transitioning to constructivist learning communities. Consequently, the suggested modification will also apply to the K–12 CoI survey instrument proposed by Villanueva (2020) and with the corresponding CP items suggested in this study (see Appendix B). Further research on these proposed changes is recommended to gain a greater understanding of ways to develop self-regulation and metacognition among younger students.

Conclusion

This study has initiated the application of the CoI survey instrument adapted for use in the Philippine K–12 setting which resulted to a deepened understanding of BL interactions through the element of CP within the CoI framework. This resulted in an interpretation of CP through self-regulation and co-regulation, leading to an appreciation of the interaction of CP with the other presences. Evidence of learning communities as outcomes of BL interactions was examined through meanings and manifestations of CP drawn from shared experiences of connectedness, collaborative work, and shared views on technology from Filipino K–12 teachers and learners. Overall, this study provided evidence of learning community building which has implications for future research on the applicability of the CoI in the K–12 setting. This study addressed the call for keeping the integrity of the presences within the CoI while exploring the potential to strengthen it in learning environments where either BL programs are still emerging amidst teacher-directed pedagogies or where the collaborative inquiry cycle has not been thoroughly co-opted.

Declarations

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This study received approval from the ethics review board of the USQ Human Research Ethics Committee, with approval ID H18REA165.

References

Akyol, Z., & Garrison, D. R. (2011). Assessing metacognition in an online community of inquiry. *The Internet and Higher Education, 14*(3), 183–190. https://doi.org/10.1016/j.iheduc.2011.01.005

Anderson, T., & Kanuka, H. (1999). Using constructivism in technology-mediated learning: Constructing order out of the chaos in the literature. *Radical Pedagogy, 2*(1), 1–25. http://radicalpedagogy.icaap.org/content/issue1_2/02kanuka1_2.html

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J., & Swan, K. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *The Internet and Higher Education, 11*(3), 133–136. https://doi.org/10.1016/j.iheduc.2008.06.003

Barbour, M. (2018). A history of K–12 distance, online, and blended learning worldwide. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of research on K–12 online and blended learning* (2nd ed., pp. 21–40). Carnegie Mellon University ETC Press.

Bateman, T. (2021). Using academic social networks to enhance the student experience in online education. *Online Learning, 25*(4), 295–323. https://doi.org/10.24059/olj.v25i4.2532

Blume, F., Schmidt, A., Kramer, A. C., Schmiedek, F., & Neubauer, A. B. (2021). Homeschooling during the SARS-CoV-2 pandemic: The role of students' trait self-regulation and task attributes of daily learning tasks for students' daily self-regulation. *Zeitschrift für Erziehungswissenschaft, 24*(2), 367–391. https://doi.org/10.1007/s11618-021-01011-w

Borup, J., Walters, S., & Call-Cummings, M. (2020). Student perceptions of their interactions with peers at a cyber charter high school. *Online Learning, 24*(2), 207–224. https://doi.org/10.24059/olj.v24i2.2015

Castellanos-Reyes, D. (2020). 20 years of the Community of Inquiry framework. *TechTrends, 64*, 557–560. https://doi.org/10.1007/s11528-020-00491-7

Castleberry, A., & Nolen, A. (2018). Thematic analysis of qualitative research data: Is it as easy as it sounds?. *Currents in Pharmacy Teaching and Learning, 10*(6), 807–815. https://doi.org/10.1016/j.cptl.2018.03.019

Chen, Y., Lei, J., & Cheng, J. (2019). What if online students take on the responsibility: students' cognitive presence and peer facilitation techniques. *Online Learning, 23*(1), 37–61. https://doi.org/10.24059/olj.v23i1.1348

Cleveland-Innes, M., & Campbell, P. (2012). Emotional presence, learning, and the online learning environment. *The International Review of Research in Open and Distributed Learning, 13*(4), 269–292. https://doi.org/10.19173/irrodl.v13i4.1234

Espiritu, J., & Budhrani, K. (2019). Cultivating an e-learning culture. *Scientia Pedagogica Experimentalis, 56*(1), 3–32. https://www.lotuswebtec.com/en/spe/current-issue-spe.html

Garrison, D. R. (2018, October 28). Shared metacognition. *The Community of Inquiry*. http://thecommunityofinquiry.org/editorial16

Garrison, D. R. (2017). *E-learning in the twenty-first century: A community of inquiry framework for research and practice*. Routledge.

Garrison, D. R., & Akyol, Z. (2011). Assessing metacognition in an online community of inquiry. *The Internet and Higher Education, 14*(3), 183–190. https://doi.org/10.1016/j.iheduc.2011.01.005

Garrison, D. R., & Akyol, Z. (2013). The community of inquiry theoretical framework. In M. G. Moore & W. C. Diehl (Eds.), *Handbook of distance education* (pp. 122–138). Routledge.

Garrison, D. R., & Akyol, Z. (2015a). Developing a shared metacognition construct and instrument: Conceptualizing and assessing metacognition in a community of inquiry. *The Internet and Higher Education, 24*, 66–71. https://doi.org/10.1016/j.iheduc.2014.10.001

Garrison, D. R., & Akyol, Z. (2015b). Thinking collaboratively in educational environments: Shared metacognition and co-regulation in communities of inquiry. In J. Lock, P. Redmond, & P. Danaher (Eds.), *Educational developments, practices and effectiveness* (pp. 39–52). Palgrave Macmillan. https://doi.org/ 10.1057/9781137469939_3

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7–23. https://doi.org/10.1080/08923640109527071

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education, 10*(3), 157–172. https://doi.org/10.1016/j.iheduc.2007.04.001

Garrison, D. R., & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education, 19*(3), 133–148. https://doi.org/10.1207/s15389286ajde1903_2

Hadwin, A., Järvelä, S., & Miller, M. (2011). Self-regulated, co-regulated, and socially shared regulation of learning. In D. H. Schunk & B. Zimmerman (Eds.), *Handbook of self-regulation of learning and performance* (pp. 65–84). Routledge. https://doi.org/10.4324/9780203839010

Halverson, L. R., Spring, K. J., Huyett, S., Henrie, C. R., & Graham, C. R. (2017). Blended learning research in higher education and K–12 settings. In M. J. Spector, B. B. Lockee, & M. D. Childress (Eds.), *Learning, design, and technology: An international compendium of theory, research, practice, and policy* (pp. 1–30). Springer. https://doi.org/10.1007/978-3-319-17727-4

Harrell, K., & Wendt, J. (2019). The impact of blended learning on community of inquiry and perceived learning among high school learners enrolled in a public charter school. *Journal of Research on Technology in Education, 51*(3), 259–272. https://doi.org/10.1080/15391523.2019.1590167

Kennedy, D., & Kennedy, N. S. (2013). Community of philosophical inquiry online and off: Retrospectus and prospectus. In *Educational communities of inquiry: Theoretical framework, research and practice* (pp. 12–29). IGI Global.

Krefting, L. (1991). Rigor in qualitative research: The assessment of trustworthiness. *American Journal of Occupational Therapy, 45*(3), 214–222. https://doi.org/10.5014/ajot.45.3.214

Kozan, K., & Caskurlu, S. (2018). On the Nth presence for the community of inquiry framework. *Computers & Education, 122*, 104–118. https://doi.org/10.1016/j.compedu.2018.03.010

Lam, J. Y. (2015). Autonomy presence in the extended community of inquiry. *International Journal of Continuing Education and Lifelong Learning, 8*(1), 39–61. https://search.informit.org/doi/10.3316/INFORMIT.705821081676347

Layne, M., & Ice, P. (2014). Merging the best of both worlds: Introducing CoI-TLP model. In B. Sutton & A. Basiel (Eds.), *Teaching and learning online: New models of learning for a connected world* (Vol. 2, pp. 3–20). Routledge.

Leech, N. L., & Onwuegbuzie, A. J. (2008). Qualitative data analysis: A compendium of techniques and a framework for selection for school psychology research and beyond. *School Psychology Quarterly, 23*(4), 587–604. https://doi.org/10.1037/1045-3830.23.4.587

Ma, Z., Wang, J., Wang, Q.Z, Kong, L., Wu, Y., & Yang, H. (2016). Verifying causal relationships among the presences of the Community of Inquiry framework in the Chinese context. *International Review of Research in Open and Distributed Learning, 18*(6), 213–230. https://doi.org/10.19173/irrodl.v18i6.3197

Majeski, R. A., Stover, M., & Valais, T. (2018). The community of inquiry and emotional presence. *Adult Learning, 29*(2), 53–61. https://doi.org/10.1177/1045159518758696

Martin, F., Bacak, J., Polly, D., & Dymes, L. (2021). A systematic review of research on K12 online teaching and learning: Comparison of research from two decades 2000 to 2019. *Journal of Research on Technology in Education*, 1–20. https://doi.org/10.1080/15391523.2021.1940396

Matuga, J. M. (2009). Self-regulation, goal orientation, and academic achievement of secondary students in online university courses. *Journal of Educational Technology & Society, 12*(3), 4–11. https://www.jstor.org/stable/jeductechsoci.12.3.4

Merriam, S. B. (2009). *Qualitative research: a guide to design and implementation*. Jossey-Bass.

Meusen-Beekman, K.D., Joosten-ten Brinke, D. & Boshuizen, H.P. (2015). Developing young adolescents' self-regulation by means of formative assessment: A theoretical perspective. *Cogent Education, 2*(1), 1071233. https://doi.org/10.1080/2331186X.2015.1071233

Milošević, I., Živković, D., Arsić, S., & Manasijević, D. (2015). Facebook as virtual classroom—Social networking in learning and teaching among Serbian students. *Telematics and Informatics, 32*(4), 576–585. https://doi.org/10.1016/j.tele.2015.02.003

Molnar, A., Miron, G., Elgeberi, N., Barbour, M. K., Huerta, L., Shafer, S. R., & Rice, J. K. (2019). *Virtual Schools in the U.S. 2019*. National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2019

Moreira, J., Ferreira, A., & Almeida, A. (2013). Comparing communities of inquiry of Portuguese higher education students: one for all or one for each? *Open Praxis, 5*(2), 165–178. https://www.learntechlib.org/p/130639/

Morueta, R., López, P., Gómez, Á., & Harris, V. W. (2016). Exploring social and cognitive presences in communities of inquiry to perform higher cognitive tasks. *The Internet and Higher Education, 31*, 122–131. https://doi.org/10.1016/j.iheduc.2016.07.004

Olpak, Y. Z., & Kiliç Çakmak, E. (2018). Examining the reliability and validity of a Turkish version of the community of inquiry survey. *Online Learning, 22*(1), 147–161. https://doi.org/10.24059/olj.v22i1.990

Parker, J., & Herrington, J. (2015, November 29). *Setting the climate in an authentic online community of learning* [Conference presentation]. Annual Meeting of the Australian Association of Research in Education, Notre Dame University, Fremantle, Western Australia. https://files.eric.ed.gov/fulltext/ED593827.pdf

Pool, J., Reitsma, G., & Van den Berg, D. (2017). Revised community of inquiry framework: Examining learning presence in a blended mode of delivery. *Online Learning, 21*(3), 153–165. http://doi.org/10.24059/olj.v21i3.866

Redmond, P. (2014). Reflection as an indicator of cognitive presence. *E-Learning and Digital Media, 11*(1), 46–58. https://doi.org/10.2304/elea.2014.11.1.46

Reilly, C. (2014, October 27). *Online teaching as the art of hosting: Designing social interactions to promote engagement* [Conference presentation]. E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, New Orleans, LA, United States. https://www.learntechlib.org/p/148876/

Republic of the Philippines, Department of Education. (2012). *Policy guidelines on the implementation of alternative delivery modes*. DepEd Order No. 54 s.12. https://www.deped.gov.ph/2012/06/15/do-54-s-2012-policy-guidelines-on-the-implementation-of-alternative-delivery-modes-adms/.

Richardson, J., & Ice, P. (2010). Investigating students' level of critical thinking across instructional strategies in online discussions. *The Internet and Higher Education, 13*(1), 52–59. https://doi.org/10.1016/j.iheduc.2009.10.009

Saldaña, J. (2016). *The coding manual for qualitative researchers*. Sage.

Sanders, K., & Lokey-Vega, A. (2020). K–12 community of inquiry: A case study of the applicability of the community of inquiry framework in the K–12 learning environment. *Journal of Online Learning Research, 6*(1), 35–56. https://www.learntechlib.org/primary/p/210589/

Schunk, D. H., & Zimmerman, B. J. (2012). *Motivation and self-regulated learning: Theory, research, and applications*. Routledge.

Shea, P., Hayes, S., Smith, S. U., Vickers, J., Bidjerano, T., Pickett, A.,Gozza-Cohen, M., Wilde, J. & Jian, S. (2012). Learning presence: Additional research on a new conceptual element within the community of inquiry (COI) framework. *The Internet and Higher Education, 15*(2), 89–95. https://doi.org/10.1016/j.iheduc.2011.08.002

Stake, R. E. (1995). *The art of case study research*. Sage.

Stenbom, S. (2018). A systematic review of the community of inquiry survey. *The Internet and Higher Education, 39*, 22–32. https://doi.org/10.1016/j.iheduc.2018.06.001

Swan, K. (2003). Learning effectiveness online: What the research tells us. In J. Bourne & J. C. Moore (Eds.), *Elements of Quality Online Education, Practice and Direction* (pp. 13–45). Sloan Center for Online Education.

Vaughan, N., & Garrison, D. R. (2005). Creating cognitive presence in a blended faculty development community. *The Internet and Higher Education, 8*(1), 1–12. https://doi.org/10.1016/j.iheduc.2004.11.001

Villanueva, J. A. R. (2021). Teaching presence in K–12 blended learning classes under the alternative delivery mode. *International Journal on Online Distance and eLearning 7*(1), 31–52. https://ijodel.com/june-2021-issue/

Villanueva, J. A. R. (2020). *Investigating experiences and outcomes of K–12 blended learning classes through the Community of Inquiry framework* [Doctoral dissertation, University of Southern Queensland]. USQ ePrints. https://eprints.usq.edu.au/40350/

Wong, R. (2019). Basic psychological needs of students in blended learning. *Interactive Learning Environments*, 1–15. https://doi.org/10.1080/10494820.2019.1703010

Yu, T., & Richardson, J. (2015). Examining reliability and validity of a Korean version of the community of inquiry instrument using exploratory and confirmatory factor analysis. *The Internet and Higher Education, 25*, 45–52. https://doi.org/10.1016/j.iheduc.2014.12.004

Zimmerman, B. J. (1990). Self-regulating academic learning and achievement: The emergence of a social cognitive perspective. *Educational Psychology Review, 2*(2), 173–201. https://doi.org/10.1007/BF01322178

Appendix A

Additional Tables

Table A.1

Proposed Changes within the CP of the CoI: Categories and Indicators for the K–12 (Villanueva, 2021)

CoI Element	Categories	Indicators
Cognitive Presence*	• Self- and Co-regulation • Reflection • Critical Thinking and Dialogue	• Monitoring/Managing cognition • Reflecting on content/learning process • Sense of puzzlement • Information exchange/Exploration • Connecting ideas • Applying new ideas

Note. Adapted from Garrison and Arbaugh (2007). Adapted with permission from Elsevier.

Table A.2

Proposed Changes to the Cognitive Presence Items of the K–12 CoI Survey Instrument (Villanueva, 2020)

Cognitive Presence Category and Survey Items	Indicators
Self-and co-regulation+	
(1) I am aware of my effort and motivation.	Monitoring cognition
(2) I assess how I approach the problem.	
(3) I look for confirmation of my understanding from others.	Monitoring cognition
(4) I challenge the perspectives of others.	Managing cognition
Reflection+	
(5) I reflect upon the comments of others.	Reflecting on the learning process
(6) I reflect on the content and discussion to help me understand concepts in the subject.	Reflecting on the content
Critical thinking and dialogue	
(7) Learning activities engaged my curiosity.	Sense of puzzlement
(8) Brainstorming and finding relevant information helped me and my classmates resolve content-related questions.	Information exchange
(9) New concepts were explored sufficiently in this subject.*	Exploration
(10) Group interactions and discussions were valuable in helping me, and my classmates appreciate different perspectives.	Connecting ideas
(11) Combining new information helped me answer questions raised in-class activities.	Connecting ideas
(12) Learning activities helped me construct explanations or solutions.	Applying new ideas
(13) I can apply the knowledge created in this subject to my other classes or school-related activities.	Applying new ideas

Notes. Adapted from "The CoI Survey" from Arbaugh et al. (2008). *TP item rewritten and moved to CP; +Proposed items under this category from D. R. Garrison and Z. Akyol (2015a). Copyright 2015 by Elsevier. Adapted with permission.

Perceived and Actual Cognitive Presence: A Case Study of an Intentionally-Designed Asynchronous Online Course

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Abstract
Online instructional design and how to engage students cognitively in online asynchronous courses have been an ongoing question. This case study presents an intentional design of an asynchronous online graduate course to foster cognitive presence. The research questions investigate students' cognitive presence (CP) captured by two measures: Community of Inquiry (CoI) survey (for self-report) and Linguistic Inquiry and Word Count (LIWC) software (for actual behaviors) in this online course. Additionally, it also addresses how cognitive presence is related to other presences and how the online course design elements were perceived by students. Results showed that students perceived high levels of cognitive presence and they showed high cognitive presence in their discussion board acts. There was a relationship between three presences; and findings showed that teacher and social presence were strong predictors of perceived cognitive presence. Although students in the study rated themselves high on the CoI instrument and scored high on the LIWC for cognitive presence, self-presentation bias still emerged. Strategies that helped students to stay cognitively present in this asynchronous online course included: instructor responsiveness in discussion posts and creating dialogue, creating course assignments as online hands-on project, interviewing guest speakers on specific course topics, weekly recap and orientation videos, feedback, case-based discussions, and other elements.

Keywords: community of inquiry, cognitive presence, cognitive engagement, online Course

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Online course offerings in higher education in the United States continue to grow in number. Seaman et al. (2018) reported that 6.4 million students took an online course in 2016, an annual growth rate of 5.6%, which was up from 3.9% the previous year. On top of the regular growth patterns projected for online course offerings, the COVID-19 pandemic resulted in an urgent transition to online learning to provide safe learning environments for students (Hodges et al., 2020). As a result of the pandemic in March 2020 for over 1,300 institutions of higher education in the U.S. transitioned to online (Marsicano, 2020).

In line with the ever-increasing demand for online courses, in the past several years, researchers have investigated questions related to whether to transition or offer online courses or programs in regular traditional brick-and-mortar universities. Research questions posed included if online classes were as good as face-to-face (Cole et al., 2014; Shelly et al., 2008; Wisneski et al., 2017), or if faculty was ready to teach online (Martin et al., 2019), or if students should be allowed to take online courses for their degree completion when they are enrolled in a campus program (Wavle & Ozogul, 2019) and such. But now, with the COVID-19 disruption, providing online course options in programs and offering various degree programs fully online becoming the new normal for many higher education institutions (Xie et al., 2020) as the purpose of online has changed to support continuity of instruction and various audiences (Lockee, 2021). However, what happened during the pandemic was unique in many respects; teaching was switched to online, primarily synchronous modalities, and was supported by substantial administerial and emergency financial resources (Hodges et al., 2020; Manfuso, 2020). Based on the trends and newfound further appreciation for online courses, it is important to investigate how to systematically design asynchronous learning environments within the affordances and limitations of the online context and bring empirically tested design ideas to instructors and practitioners

To study the online courses, the Community of Inquiry (CoI) framework is a widely used theoretical framework. The framework presents a social-constructivist orientation toward learning (Akyol & Garrison, 2011) and focuses on how to foster learning by increasing levels of three overlapping presences: cognitive presence, teaching presence, and social presence (Garrison et al., 2010; Garrison & Arbaugh, 2007). Cognitive presence refers to learners' ability and behaviors of constructing and confirming meaning in CoI (Garrison et al., 2001). Along with the other two presences, cognitive presence is viewed as one of the important elements of online course design, and the prior literature reported that it is contributing to fostering learning in online environments (Garrison et al., 2001; Sadaf & Olesova, 2017). Cognitive presence and other presences are generally captured by the CoI survey instrument. The CoI survey was developed and validated by Arbaugh et al. (2008), which relies on student perceptions of their own presences.

Purpose of the Study

This study aimed to further our understanding of cognitive presence by capturing it through actual student behaviors in addition to self-report of the CoI instrument, as self-report data may contain self-presentation bias (Kopcha & Sullivan, 2007). The purpose of the study was to explore how an asynchronous online course was designed to foster cognitive presence and how students were cognitively engaged as measured by the CoI survey and through their discussive acts in the online discussion space. Additionally, the correlations between three presences and how the specific design elements perceived by students as contributing to their cognitive presence were explored. The specific research questions were:

1. To what extend were students cognitively engaged in the online course as measured by the CoI scale and by the LIWC software?
2. How cognitive presence was correlated with social presence and teaching presence in this course?
3. What did students perceive as specific design elements or strategies that contributed to their cognitive presence?

The findings of this study are intended to help instructors or instructional designers to design asynchronous online courses, better understand the relationship between the three presences, and uncover how students' perceptions and actual behaviors of cognitive presence appear in relation to each other. This study may serve as a basis for capturing cognitive presence from multiple perspectives and guide course instructors while making instructional strategy choices regarding course design and fostering cognitive presence in asynchronous courses.

Literature Review

CoI Framework

The CoI framework, developed by Garrison et al. in 2000, has been used to develop and evaluate online learning experiences for over twenty years. CoI provides a conceptual framework to study the effectiveness of online learning and to define, describe, and measure the elements of a collaborative, educational experience (Garrison et al., 2010a). The CoI framework assumes that the development of the community is critical to online learning (Swan et al., 2009). The CoI framework consists of three core components: social presence, cognitive presence, and teaching presence (see Figure 1).

Figure 1
Community of Inquiry Framework (Garrison et al., 2000)

Figure 1 shows that social presence, teaching presence, and cognitive presence are all interrelated to create an effective online educational experience for the learner. The interaction between social presence and cognitive presence is supporting discourse; the intersection between teaching presence and social presence is setting the climate for online learning; and the intersection between cognitive presence and teaching presence is content selection.

Social Presence. Social presence refers to the extent that learners can present themselves as "real people" in an online learning environment (Garrison et al., 2000). Social presence emphasizes social interaction, which supports critical thinking and deep learning (Garrison & Akyol, 2013). It is considered as a process of sustaining relationships among participants and involving in open communication (Garrison, 2009). Social presence is categorized into three indicators: (1) open communication, where students have mutual trust and express ideas with risk-free; (2) affective expression, where students express emotions and camaraderie using personal expressions of feelings, beliefs, and values; and (3) group cohesion, where students build and maintain a sense of community with a feeling of belongingness and group commitment (Garrison et al., 2000; Swan & Shih, 2005; Tolu & Evans, 2013).

Teaching Presence. Teaching presence aims to realize meaningful and educational learning outcomes through designing, facilitating, and directing cognitive and social presences (Tolu & Evans, 2013). Teaching presence consists of three elements: design and organization, the facilitation of learning, and direct instruction in online courses (Garrison et al., 2000; Garrison & Akyol, 2013; Tolu & Evans, 2013). The primary responsibility of teaching presence is to enhance social and cognitive presence through design, facilitation learning, and direct instruction (Garrison et al., 2000). Despite that teaching presence is usually undertaken by instructors, it can be distributed to any participants in the CoI, such as students, teaching assistants, and course materials. Teaching presence unifies all the elements of CoI together to build a learning community to enhance learning outcomes and meet learning needs (Garrison, 2011).

Research has indicated that students' perceived learning and interaction with instructors are positively correlated with their perceived learning (Jiang & Ting, 2000; Richardson & Swan, 2003). Similarly, Shea et al. (2005) also found that teaching presence is strongly correlated with learner satisfaction and perceived learning. Moreover, researchers have found that teaching presence is critical for students' success in online learning (Garrison et al., 2010a; Vaughan & Garrison, 2006) and plays a critical role in building online communities of inquiry (Kozan, 2016; Shea & Bidjerano, 2009; Zhu et al., 2019).

Cognitive Presence. Cognitive presence refers to the extent to which learners can construct and confirm meaning in an online CoI (Garrison, 2016). It, based on Dewey's practical inquiry model, involves four phases: triggering event, exploration, integration, and resolution (Garrison et al., 2001). The first phase is triggering an event, in which an issue or problem is identified that needs further inquiry for resolution. The second phase, exploration, refers to searching for information and brainstorming ideas. Followed by exploration is integration, in which learners connect ideas and construct meanings to find solutions. The final phase is resolution, in which learners select and test solutions and come up with resolution (Tolu & Evans, 2013). The four phases were iterative and cyclical (Garrison & Arbaugh, 2007) based on the practical inquiry model. Thus, it is critical to understand cognitive presences to help students' meaningful deep learning.

Cognitive Presence and Its Relation to Other Presences

Given the importance of cognitive presence, research on its relationship to other presences has been conducted by researchers. Researchers have found that the exploration phase appeared more often than the resolution and integration phases (e.g., Galikyan & Admiraal, 2019; Kanuka et al., 2007; Kilis & Yildirim, 2019). This finding was considered as the influence of teaching presence on the cognitive presence (Garrison, 2007; Garrison & Akyol, 2013; Garrison & Arbaugh, 2007). For example, Garrison and Arbaugh (2007) stated that teaching presence, such as facilitation, direction, and course design, can enhance the resolution phase of cognitive presence. The reaching resolution phase was achieved in the study by Kilis and Yildirim (2019) via teaching presence, and Galikyan & Admiraal (2019) found that resolution is very limitedly accounted for cognitive presence, but both integration and resolution had a role in student performance in the online environment. Stated another way, teaching presence is critical to improving learners' critical thinking to achieve higher levels of cognitive learning (Garrison & Akyol, 2013). Moreover, researchers (e.g., Akyol & Garrison, 2008; Ke, 2010) found that teaching presence and cognitive presence have a significant relationship.

In addition, researchers also explored the relationship between cognitive presence and social, teaching presences. Archibald (2010) used the standard multiple regression approach and found that teaching presence and social presence are significantly related to cognitive presence. Moreover, in that study the social presence accounted for the variance of cognitive presence more than teaching presence. Similarly, Gutierrez-Santiuste et al. (2015) found that cognitive presence can be predicted by social presence better than by teaching presence. Rolim et al. (2019) examined the relationship between social and cognitive presences and found that social presence is more associated with the exploration and integration phases of cognitive presence. Using the structure equational model, Kozan and Richardson (2014) found that cognitive presence has a strong influence on the relation between teaching and social presence; however, cognitive presence and teaching presence relationship, and cognitive presence and social presence relationship are not significantly influenced by the third presence. In addition, Shea and Bidjerano (2009) and Garrison et al. (2010b) found that both teaching presence and social presence have a significant direct effect on cognitive presence.

Instructional Strategies for Cognitive Presence

Cognitive presence is defined as the ability "to construct meaning through sustained communication" through the four iterative and cyclical phases (i.e., triggering event, exploration, integration, and resolution). This iterative cycle may show up in; organization, instructor facilitation, and the actual instruction of the course. In terms of course organization, course topics selected based on real-life situations to stimulate brainstorming and critical thinking (Kilis & Yildirim, 2019), inspiring bringing students own experiences to share with peers, weekly course announcements (Holbeck & Hartman, 2018) found to contribute to the cognitive presence.

In terms of instructor facilitation, instructors' participation in the online discussion by focusing participants on relevant topics (Shea & Bidjerano, 2009), instructor's explanation of the purpose of activities and assessments in the online course (Kumar et al., 2019), instructor timely feedback and timely response to questions (Martin et al., 2018) and instructor video presence (Seckman, 2018). In terms of instruction, the way the online class activities are designed to foster students' higher-order thinking resulted in higher cognitive presence. The prior research results showed that providing meaningful learning experiences (Ghazali & Nordin, 2019) and giving opportunities to use critical discourse can contribute to the cognitive presence (Kanuka & Garrison, 2004). Other instructional strategies that showed outcomes for cognitive presence were using case studies (Richardson & Ice, 2010), using role-playing in the discussion boards (Darabi et al., 2011), providing opportunities for classmates to get to know each other (Shea & Bidjerano, 2009), providing opportunities for reflection and collaboration (Garrison, 2003), and using relevant course material (Kumar et al., 2019).

Linguistic Inquiry and Word Count

With the evolution of the social-constructivist perspective on learning and knowledge building (Brown & Adler, 2008) and the advantages of using student actual online behavior, some studies have used Linguistic Inquiry and Word Count (LIWC) metrics to understand online cognitive engagement. Cognitive engagement is defined as students' effort and willingness to invest in learning while using cognitive and metacognitive strategies to promote understanding (Fredericks, Blumenfeld, & Paris, 2004). Four determinants in the learning environment may effect students cognitive engagement, and in the instructional design of courses these may be used as strategies to foster cognitive engagement; students value judgement, students competence, autonomy and relatedness (Blumenfeld, Fredericks, & Krajcik, 2006). In online courses, various strategies may be used to foster cognitive engagement and contribute to four determinants. Discussion boards postings, in-class activities are displays of cognitive engagement in online courses. For example, researchers have studied students' cognitive engagement via linguistic differences in discussion forum contributions measured by LIWC (Joksimović et al., 2014; Xu et al., 2013). In addition, Yoo and Kim (2014) explored the relations between linguistic characteristics and student learning outcomes. Specifically, Kovanović et al. (2016) focused on investigating learners' cognitive presence in online discussion using LIWC tools (Tausczik & Pennebaker, 2010). Wen et al. (2014) also found that LIWC word categories, such as cognitive words, first-person pronouns, and positive words, could be utilized to measure student cognitive engagement in massive open online courses. Similarly, Cui and Wise (2015) utilized simple word frequency analysis to investigate the types of contributions that are most likely to be acknowledged by instructors. These studies demonstrated that learners' online interaction behavior might impact their knowledge construction, and learning performance could be explored using a linguistic approach.

The way LIWC assists in analysis of the discussion postings via an internal dictionary. Previously, Pennebaker et al. (2003) used LIWC to identify language use differences in gender. This study primarily includes automated counts of nine key linguistic features:

(1) First-person singular pronouns
(2) Social words
(3) Positive emotions
(4) Negative emotions
(5) Cognitive processes
(6) Analytic
(7) Clout
(8) Authenticity
(9) Emotional tone

Based on Pennebaker et al. (2015) and the LIWC2015 operator's manual, a high score for Analytic demonstrates that the language is formal, logical, and involves hierarchical thinking; on the contrary, a lower score in this category signifies more informal, personal, and narrative thinking. The Clout score means to what extent the author's language is confident and reflective of high expertise. Authenticity signifies to what extent the author's language is honest, personal, and disclosing. Lastly, Emotional tone refers to what extent the language is a positive expression. For example, a low score in the emotional tone indicates more negative expression, which suggests the author is anxious or sad. These nine linguistic features are related to the three CoI presences. Adopted from the study of Zhu et al. (2018), cognitive presence in the form of cognitive engagement was analyzed using cognitive processes and analytic categories, social presence was analyzed using the first-person singular pronouns, social words, positive emotions, negative emotions, authenticity, and emotional tone.

Methods

Research Site, Participants and Course Context

This study was conducted in a public university in the midwestern of United States. The research site of the study was a graduate-level fully online course offered asynchronously through an online learning management system. Two sections of the course, taught by the same instructor included in the study in the spring and summer semesters.

Participants were students who enrolled in a fully online graduate course in education. There was a total of 17 students enrolled in the course. The majority of the students enrolled in this course reported their gender as female (82%), and the rest reported as male (18%). Student ages in the online course varied. Thirty-five percent of the students reported being between 31 and 15 years old, followed by students who reported being over 50 years old (24%), followed by 26–30 years old (12%), 41–45 years old (12%), 45–46 years old (12%), and 36–40 years old (6%). In terms of prior online course-taking experience, nearly 60% of participants reported taking at least ten online courses before, 12% reported taking more than six online courses. Only 30% of participants have taken no more than five online courses. Therefore, most online students in the study were familiar with the online learning environment and taking online courses.

The course instructor taught the course 14 times online prior to this study. The course context was provided to the researchers by the instructor, and the instructor showcased their signature elements prior to the study. The course design included the following elements that the course instructor emphasized as their strategies to provide a cognitive presence to students; each week had an announcement, content revealed weekly, and each week instructor recorded themselves summarizing the prior week and orienting students to the following week, each week had a to-do list included readings from textbooks, published articles from recent years, weekly instructor videos, weekly content presentation via screencast, and biweekly pre-recorded evaluation expert guest speaker interviews related to the topic of the week, and biweekly case study discussions, weekly hands-on in-class activities rotating group or individual work, and simulated project-based assignments of writing two evaluation projects and doing a simulated evaluation project from start to end (to include client relationships, politics, data issues, self-presentation bias, triangulation…etc.). Course instructor also included a weekly discussion thread called “hallway conversations” for students to be able to post any question to the instructor or each other as if they ran into the instructor or each other in a hallway and the instructor committed to checking this thread twice a day.

Data Sources and Procedures

To explore student perceptions of online learning and their behavior in online courses, this study utilized an explanatory sequential mixed methods design (Creswell & Clark, 2017). The researchers used the CoI survey data results to form and construct the interview questions and select interviewees. The reason for choosing the mixed methods approach is to triangulate data and provide both a general picture and detailed descriptions of the online learning phenomena.

The authors collected the data sequentially through three key data sources: (1) online CoI survey with 17 participants; (2) discussion forum posts from the same 17 survey participants; (3)

interviews with nine students who volunteered for an interview. Using different data sources enabled the researchers to cross-check the findings (Patton, 1990). The mixed-method approach provided more nuanced understandings of student perceptions and captured their actual behavior rather than only relying on perceptions (Baxter & Babbie, 2004). The CoI survey was administered at the end of the semester. Based on the survey results, a semi-structured interview protocol was developed and finalized. Then the researchers conducted interviews with volunteering students and analyzed interview data. Later, researchers downloaded all discussion forum data that included all in-class activities and analyzed the data by using LIWC software. The authors received approval from the ethics review board of the university for this study. Below, we describe the three data sources in detail.

Survey. The authors adopted the survey from the CoI framework that was developed to understand the dynamics of online learning experiences in line with the traditional values of higher education to support discourse and reflection (Garrison et al., 2000), and the instrument developed to capture three areas of CoI framework was validated by the authors through a principal component analysis to be a valid measure for teaching, social, and cognitive presences (Arbaugh et al., 2008).

This 34-item survey instrument was used in the study with the goal of capturing student perceptions of teaching, social and cognitive presences in this online higher education course. The final survey included three additional questions capturing students' demographics (gender, age, and prior online learning experience) and the original 34 questions about the CoI instrument. There were no open-ended questions. The survey was transferred to the Qualtrics survey tool, a sharable link was generated, and the link was sent to students' email in the learning management system during the last week of the course.

Interview. The semi-structured interview form included 15 questions with some sub-probing questions. Four questions were asked about students' general online learning experiences. Four questions were related to cognitive presence. Five questions were about their perceptions of social presence and the instructor's facilitation of social presence. Lastly, two questions were related to students' perceptions of the instructor's teaching presence. Two researchers conducted the interview together through Zoom, a synchronous videoconferencing tool. Interviews were video-recorded and later transcribed verbatim within Kaltura. Two researchers reviewed the transcriptions to make sure they were accurate. During the interviews, while one researcher led the interview, the other researcher took notes and asked follow-up questions. After each interview, researchers reflected on the interview process. Each interview lasted around 20 to 30 minutes.

Online discussion posts. During the semester, in each week long session, in-class activities took place in discussion posts (e.g., case discussion, guest speaker discussion, evaluation concepts, evaluation models discussion). Discussion posts were prompted by the instructor of the course. At the end of the semester, the researchers downloaded all the online discussion forum data from the instructor and students into a single location on a password-protected computer. Then the researchers ran the analysis on discussion data on LIWC 2015 software.

Data Analysis

To capture the overall cognitive presence, we administered the CoI to all students after the course was completed. Additionally, we analyzed all student-generated text from online course discussions with the LIWC software. We then extracted two metrics from this analysis: a self-reported CP and an LIWC CP. We standardized both scores, so the maximum possible score was five. We utilized these two measures to report the perceived and actual cognitive engagement levels in the online course and to capture if there was self-presentation bias in perception versus actual student behaviors (Kopcha & Sullivan, 2007).

We inductively coded interview transcripts for emerging themes using content analyses (Elo & Kyngäs, 2008). Inductive coding can help researchers gain unexpected insights from the data. The two researchers read the transcripts and coded data individually. After that, these two researchers met to discuss the discrepancies and reached a consensus on categories and themes with 90% interrater agreement.

To capture the actual behaviors of students in the course, we analyzed word frequencies using the licensed version of the LIWC tool developed by Pennebaker et al. (2001). LIWC has an internal dictionary that was used to analyze the discussion forum data. We ran LIWC for the messages from 17 survey participants and the instructor separately. We used LIWC results to triangulate whether it is actually reflected in students' online cognitive presence ratings and what contributed to those results through the interviews.

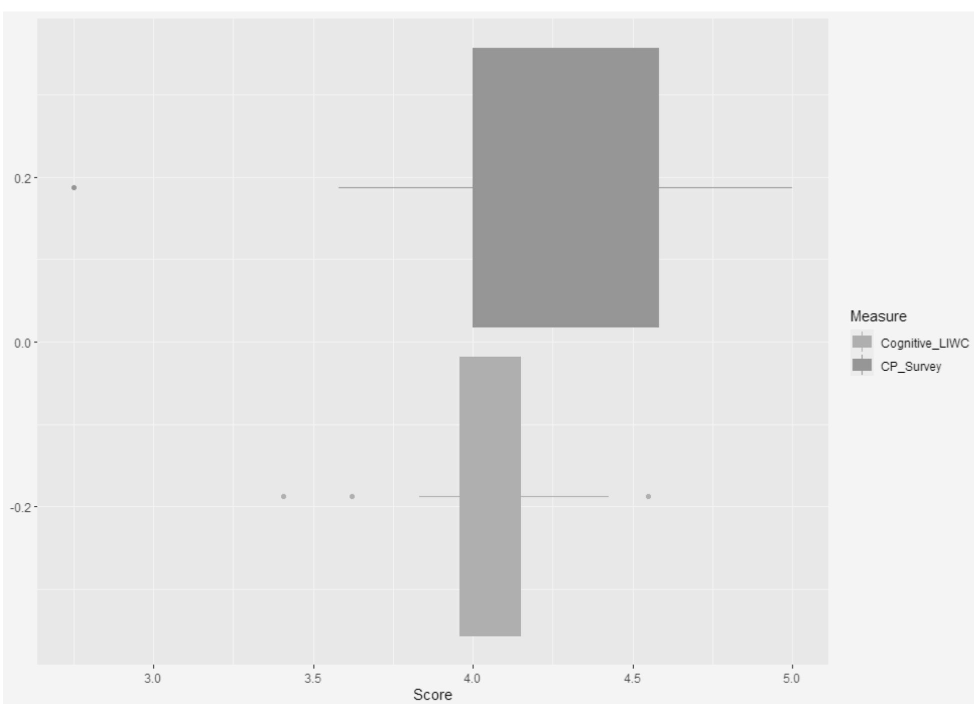
Results

In this section, results are presented by each research question.

(1) To what extent were students cognitively engaged in the online course as measured by the CoI scale and by the LIWC software?

Students showed high cognitive engagement across both LIWC and CoI instruments. On the CoI, the mean self-reported cognitive engagement was 4.25 out of 5, and the mean LIWC measured cognitive engagement was 4.0 out of 5. Figure 2 shows that there was substantially more variance in students' self-reported cognitive engagement in CoI than in the LIWC measure of cognitive engagement.

Figure 2
Summary of Cognitive Engagement



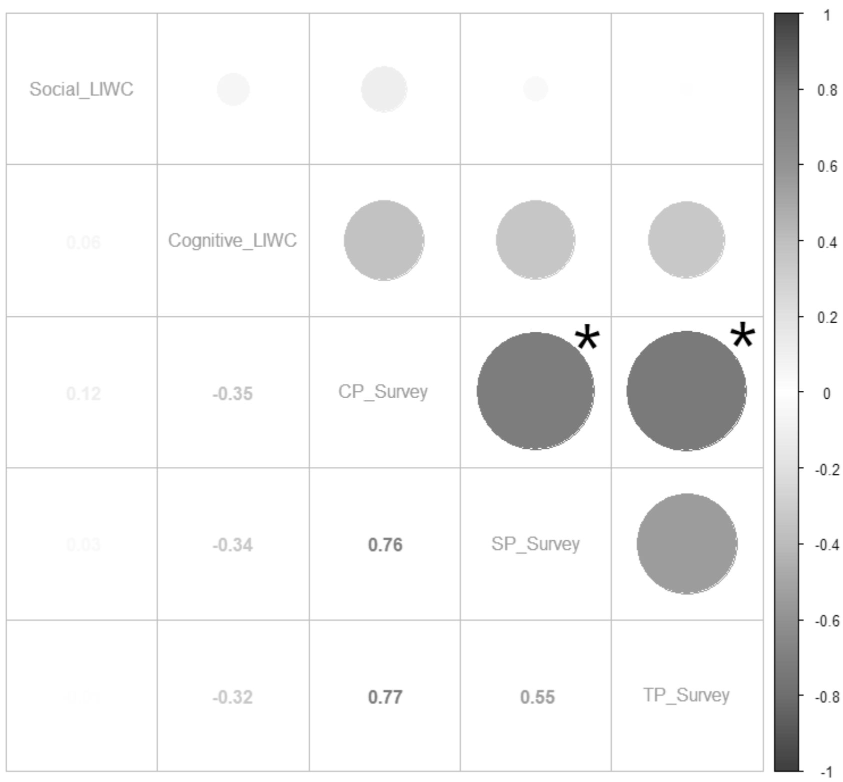
(2) How CP was correlated with social presence (SP) and teaching presence (TP) in this course?

Our second research question investigated the correlation between cognitive presence (CP) and the other two presences: social (SP) and teaching presence (TP). The ratings on each presence were as follows; M = 4.25 SD = 0.24 for cognitive presence, M = 4.44 SD = 0.23 for teaching presence, and M = 4.20 SD = 0.16 for social presence.

To determine the relationship between CP, SP, and TP, we descriptively analyzed the correlation between perceived levels of social, teacher, and cognitive engagement and also analyzed the LIWC measures of cognitive and social engagement. This descriptive analysis revealed a strong correlation between student self-perceptions of social, teaching, and cognitive presence. This same correlation was not present in LIWC measures of social and cognitive presence, with both appearing relatively independent of each other. Additionally, LIWC measured cognitive presence was negatively correlated with self-report measures of cognitive and social. Because of this, LIWC measures of cognitive and social presence were not included in the linear model. Based on this analysis, we created a linear regression that predicted self-assessed CP with self-assessed SP and self-assessed TP. Figure 3 shows the correlation between the three presences, as well as their correlation with LIWC measures of SP and CP.

Figure 3

Correlation Between Measures of Cognitive, Social, and Teaching Presence



Note. * denotes significant correlation at $p < 0.05$

Table 1 gives the summary of the linear model that predicted perceived CP with perceived SP and TP. The model confirms the descriptive correlational analysis, showing that both perceived teacher and social presence are strong predictors of perceived cognitive presence. The model has an extremely high R^2 value of 0.71, suggesting that when students in this course reflect on their course experience in an online community, they are relying on a single perception of quality as a whole and do not make strong distinctions between cognitive, social, and teaching presence in an online classroom.

Table 1
Linear Model of Perceived Cognitive Presence

Variable	**Estimate**	**Standard Error**	**T-Value**	***P*-value**
Intercept	-0.973	0.822	-1.184	0.256
Social Presence	0.518	0.175	2.954	0.010
Teaching Presence	0.6851	0.213	3.204	0.006

$F(2,14) = 21.25$. Adjusted $R^2 = 0.71$, $p < 0.001$

(3) What did students perceive as specific design elements or strategies that contributed to their cognitive presence?

During the interview, when asked what made students engaged with the course content and triggered their interest. All students interviewed stated that they were satisfied with the online asynchronous course and the course content was very relevant to them. When specifically defined for them and asked about cognitive presence, students mentioned there might have been differences from week to week on their cognitive engagement. Students commonly mentioned that there were limitations to their cognitive presence based on their familiarity with the topic, and the time they allotted to work on the course while balancing work, personal life, and school commitments. When asked what kept them cognitively present in the course, students' responses fell into specific categories. Students most frequently pointed out the instructor being very responsive in discussion posts and creating dialogue, creating course assignments as online hands-on project, interviewing guest speakers on the course topics, weekly recap and orientation videos of the instructor, feedback, case-based discussions, and overall teacher being present in the course as main strategies that worked for them keeping them cognitively present.

A few of them pointed out that they have meaningful and hands-on activities in an online course that made them think deeply and thus contributed to their engagement with the course content. For example, one student said, "With what she gave, you had to really think about from A to Z as an outside perspective, because all of my evaluation experiences went as an internal evaluation. Or I've never been like an external reviewer. So individually was good. Because you know you had to rely on yourself to get through it. Another student mentioned, "… the individual project where she gave you this scenario, and you had to put together an evaluation proposal individually, which was good."

Two other students emphasized guest speakers being presented in an interview form versus guest speakers just doing a presentation in the course gained their attention. One of them mentioned that this course had a very different style than the other courses they took, mentioned enjoying guest speakers being interviewed by the course instructor on the topic of the week, "There was another course that had like guest speakers as well, but it felt designed specifically for the course, not just an explanation of what someone does or what project they are working on." Another one mentioned, "she would tie the guest speakers into her own weekly screencasts, a kind of picky back on it. So yeah, I thought that was an effective way to do it."

Additionally, for the general organization of the course, all interviewed students mentioned they found the weekly orienting and summary videos very helpful. A student stated, "I thought that the weekly videos kind of help things you know keep moving from one week to the next wrap up the where we're going." Watching her video kind of getting an understanding of what happened last week, what's going to happen this week. Then doing the readings or postings or whatever that she had for the chapters, and then doing weekly assignments. And then knowing kind of on the horizon what was happening on the bigger assignments. I think that was, for me, worked out the best because I could organize my time." One other said, "I really enjoyed the way she gave us face to face, not necessarily lectures each week. But kind of touching base. Gaining as much face to face in an online class I think helps make that connection and make you feel let you get to know your professor a little better." One student mentioned, "she always did like a weekly introduction and kind of review from last week and what we're doing for this week. That was really nice because she would always, if she found a good point in the discussion post she would bring that up. So it's really nice to know that she is reading it. She is actually involved in our class instead of just us talking to each other, so that was really nice. I like that."

Feedback quality and promptness was another area brought up by the students as a course element that engaged them. Students said the instructor gave frequent, timely, and very detailed feedback to each student. The statement from a student "I like how much feedback she gave to us. Some classes I take, you really do not get back on… I felt like she was pretty consistent with giving feedback on posting, or questions she asked. "feedback that's an important piece that you know it's not just what do you do, but commentary kind of reflection and redesign in places or different things like I had for one of these assignments I wasn't really sure if I was heading in the right direction and so I sent it, and I got feedback soon, and so I kind of could mold it back in" Finally, one of the students said for the overall design:

> I really liked her design, where she would introduce a concept and give us a little mini-lecture in the video. And, then, we would go to the discussion boards and have a conversation around that. And I really like how she threw questions out at us and let us, kind of, grapple with it, with each other before jumping in, kind of, redirecting if needed. And then, I also really liked that she brought experts from the field. I thought that was really and valuable for us to hear. We talk about theory. A lot of times, theory and practice are really different. So, I really liked how she bridged that gap.

Discussion

Students self-rated their cognitive presence high, and their actions in the discussion board showed high LIWC scores for cognitive engagement in this intentionally designed course. For both of the instruments, the ratings and actual acts of cognitive engagement were very close to the highest rating possible, suggesting a ceiling effect. This might be due to the prior teaching experience of the instructor with the course, and instructional strategies embedded in the course possibly contributed to the high cognitive presence, as echoed in the student interviews. The instructional strategies embedded in the course by the instructor possibly contributed to the high cognitive presence, as echoed in the student interviews. The instructional strategies such as using critical discourse in discussion boards (Kanuka & Garrison, 2004; Shea & Bidjerano, 2009), providing meaningful experiences (Kilis & Yildirim, 2019; Kumar et al., 2019), feedback (Martin et al., 2018), instructor video presence (Seckman, 2018), using case studies (Richardson & Ice, 2010), were embedded in the course frequently, and these perceived as contributing to the student's cognitive presence in the asynchronous course. As the topic of the course was evaluation, these strategies might have been natural to embed to this course, but there may be other instructional strategies to contribute further to the cognitive presence, such as using role-playing in the discussion boards (Darabi et al., 2011), providing opportunities for classmates to get to know each other (Shea & Bidjerano, 2009) and such.

When evaluating their course experience, students did not appear to strongly differentiate between their ratings of cognitive, social, and teacher engagement. This aligns with some of Arbaugh and colleagues' (2008) initial concerns with the validation of the CoI instrument, where they found a majority of the variance in survey responses could be accounted for by a single factor. Although there may be some potential for improving survey reliability and validity, it may also be that students experience a "convergence of opinion" over time, whereby they resolve their difference in opinion across the three CoI categories to a single opinion of course quality. If this is the case, it is important that instructors recognize that aggregated student survey data is limited in the insight it can give. Instead of making modifications to online learning environments based on inconclusive differences in the ratings of different survey items, it may be more useful for instructors to ask for more detailed qualitative feedback from students and to rely on existing design principles when working on designing or improving online asynchronous instruction.

When compared to LIWC scores of cognitive presence, there was a much higher variance in student ratings of cognitive presence in the CoI instrument. This may be due to the selective nature of graduate programs. Because all students were admitted and selected the same institution for their graduate work, they most likely all share similar proficiency in their chosen area of study. This may explain the homogony across LIWC scores. However, this homogony in scores hides a diversity of experience where the cognitive effort and experiences of students who express similar behaviors in online behavior are substantially different. It is only through the self-reported cognitive presence measure that these differences are detected. This pattern is important for instructors in asynchronous online instruction to account for in their course design. Because the instructor's perceptions of their students are much more limited than they are in an in-person or even synchronous online learning context, they may perceive false cognitive homogony among their students. Activities that encourage self-expression and frequent opportunities to reflect on their perceptions of the course may be critical for students in asynchronous learning environments.

Even there was a higher variance in the student ratings in CoI versus LIWC scores, the ratings were high for both. Interestingly regardless of them being both very high, the negative correlation between the LIWC and CoI scores may still indicate that there might be a self-presentation bias (Kopcha & Sullivan, 2007). In this study, the negative correlation did not reach significance. High ratings and high scores on both instruments for cognitive presences almost present a ceiling effect in this study. It is not surprising as the participants of this study were high-performing graduate students, and the course was designed to include instructional strategies to foster cognitive presence, but the negative directional correlation between CoI and LIWC cognitive and social presences is still needed to be noted. High scores and high ratings may be due to that all participants of the study being graduate students, the majority of the students being between the ages 26 and 45, and these students being invested in the course as this was a required course. Even they scored high on LIWC, they still rated themselves higher compared to their actual behaviors. This may be important to consider when trying to capture cognitive engagement and what other measures can be incorporated when measuring cognitive presence. Adding also a measure of course performance may shed further light on the cognitive engagement of students. Different audiences, such as undergraduate students, may show a bigger discrepancy between their actual behaviors versus self-report behaviors of cognitive engagement.

Learners' cognitive presence was influenced by various elements. Instructors' facilitation is critical for online learners' cognitive presence. This study revealed that immediate feedback, hands-on activities, interactive guest speakers, etc., helped students' cognitive presence in the course. This aligned with the prior study findings that teaching presence has a positive influence on cognitive presence (Garrison & Arbaugh, 2007). Therefore, it is critical for instructors in asynchronous courses to increase their teaching presence to design the course, facilitate the online course, and provide instructions to promote cognitive presence based on the needs and background of online learners.

Limitations and Future Research

This study has some limitations. First, this case study was conducted in one graduate-level online educational course. In light of the findings of this study, there is a need for future research in order to validate the findings with different participants and in different contexts, as online course and program offerings increase daily post COVID-19. This study could be replicated with other asynchronous courses with undergraduate students to investigate how instructional strategies that were embedded in course designs result in student perceived cognitive presence and actual cognitive engagement.

Second, this study did not examine learning outcomes. Despite missing learning outcomes, this study increased the trustworthiness of the study using diverse data sources, such as surveys, interviews, and discussion forums. In the future, replicating this study by adding a third measure such as pre-and post-tests on course learning outcomes may add another dimension to capture cognitive presence.

Conclusion

The findings of the study offered insights to when an online asynchronous course was designed with intentions to include specific strategies to have students cognitively engaged, it showed promising results for student cognitive presence. In this study, students perceived themselves cognitively present and they actually showed high cognitive presence in their acts of engagement with course activities hosted in the discussion board. There was a relationship between three presences, and findings showed that teacher and social presence are strong predictors of perceived cognitive presence. Although students in the study rated themselves high on the CoI instrument and scored high on the LIWC for cognitive presence, there still was observation of self-presentation bias. Students rated themselves higher than they were actually cognitively present in the course. The strategies that helped students to stay cognitively present in this asynchronous online course were the instructor being very responsive in discussion posts and creating dialogue, creating course assignments as online hands-on project, interviewing guest speakers on the course topics, weekly recap and orientation videos, feedback, case-based discussions, and overall teacher being present in the course.

Declarations

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References

Akyol, Z., & Garrison, D. R. (2008). The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence. *Journal of Asynchronous Learning Networks*, *12*(3–4), 3–22. https://files.eric.ed.gov/fulltext/EJ837483.pdf

Allen, I. E., Seaman, J., Poulin, R., & Straut, T. T. (2016). Online report card: Tracking online education in the United States. *Sloan Consortium*, 1–4. http://onlinelearningsurvey.com/reports/onlinereportcard.pdf

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. P. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *The Internet and Higher Education*, *11*(3-4), 133-136.

Archibald, D. (2010). Fostering the development of cognitive presence: Initial findings using the community of inquiry survey instrument. *The Internet and Higher Education*, *13*(1–2), 73–74. https://doi.org/10.1016/j.iheduc.2009.10.001

Arnold, N., & Ducate, L. (2006). Future foreign language teachers' social and cognitive collaboration in an online environment. *Language Learning and Technology*, *10*(1), 42. http://llt.msu.edu/vol10num1/arnoldducate/default.html

Blumenfeld, P. C., Kempler, T. M., & Krajcik, J. S. (2006). Motivation and cognitive engagement in learning environments. In R. K. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences*. (pp. 475–488). Cambridge University Press.

Bonk, C. J. (2020). Pandemic ponderings, 30 years to today: Synchronous signals, saviors, or survivors? *Distance Education*, *41*(4), 589–599.

Brown, J. S., & Adler, R. P. (2008, January/February). Minds on fire: Open education, the long tail, and learning 2.0. *EDUCAUSE Review*, *43*(1), 16–32. https://net.educause.edu/ir/library/pdf/ERM0811.pdf

Cole, M. T., Shelley, D. J., & Swartz, L. B. (2014). Online instruction, e-learning, and student satisfaction: A three year study. *The International Review of Research in Open and Distributed Learning*, *15*(6) 112–131.

Creswell, J. W., & Plano-Clark, V. L. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage.

Cui, Y., & Wise, A. F. (2015). Identifying content-related threads in MOOC discussion forums. *Proceedings of the 2nd ACM Conference on Learning @ Scale (L@S 2015)* (pp. 299–303). ACM. https://doi.org/10.1145/2724660.2728679

Darabi, A., Arrastia, M. C., Nelson, D. W., Cornille, T., & Liang, X. (2011). Cognitive presence in asynchronous online learning: A comparison of four discussion strategies. *Journal of Computer Assisted Learning*, *27*(3), 216–227.

Ertmer, P. A., & Koehler, A. A. (2015). Facilitated vs. non-facilitated online case discussions: Comparing differences in problem space coverage. *Journal of Computing in Higher Education*, *27*(2), 69–93.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59–109.

Galikyan, I., & Admiraal, W. (2019). Students' engagement in asynchronous online discussion: The relationship between cognitive presence, learner prominence, and academic performance. *The Internet and Higher Education*, *43*, 1479–1493.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7–23.

Garrison, D. R. (2003). Cognitive presence for effective asynchronous online learning: The role of reflective inquiry, self-direction and metacognition. *Elements of Quality Online Education: Practice and Direction*, *4*(1), 47–58.

Garrison, D. R. (2009). Communities of inquiry in online learning. In P. L. Rogers, G. A. Berg, J. V. Boettcher, C. Howard, L. Justice, & K. D. Schenk (Eds.), *Encyclopedia of distance learning* (2nd ed., pp. 352–355). IGI Global.

Garrison, D. R. (2011). *E-learning in the 21st century: A framework for research and practice*. Routledge.

Garrison, D. R. (2016). *E-Learning in the 21st century: A Community of Inquiry framework for research and practice* (3rd ed.). Routledge.

Garrison, D. R., & Akyol, Z. (2013). The Community of Inquiry Theoretical Framework. In M. G. Moore (Ed.), *Handbook of Distance Education* (pp. 104–119). Routledge.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2–3), 87–105. https://doi.org/10.1016/S1096-7516(00)00016-6

Garrison, D. R., and Anderson, T. (2003). *E-Learning in the 21st century: A framework for research and practice.* Routledge Falmer.

Garrison, D. R., Anderson, T., & Archer, W. (2010a). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education, 13*(1–2), 5–9. https://doi.org/10.1016/j.iheduc.2009.10.003

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: review, issues, and future directions. *The Internet and Higher Education, 10*(3), 157–172. https://doi.org/10.1016/j.iheduc.2007.04.001

Garrison, D. R., Cleveland-Innes, M., & Fung, T. (2010b). Exploring causal relationships among cognitive, social and teaching presence: Student perceptions of the Community of Inquiry framework. T*he Internet and Higher Education*, *13*(1–2), 31–36. https://doi.org/10.1016/j.iheduc.2009.10.002

Gutiérrez-Santiuste, E., Rodríguez-Sabiote, C., & Gallego-Arrufat, M. J. (2015). Cognitive presence through social and teaching presence in communities of inquiry: A correlational–predictive study. *Australasian Journal of Educational Technology*, *31*(3). https://doi.org/10.14742/ajet.1666

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, 27.

Holbeck, R., & Hartman, J. (2018). Efficient strategies for maximizing online student satisfaction: Applying technologies to increase cognitive presence, social presence, and teaching presence. *Journal of Educators Online*, *15*(3), n3.

Jiang, M., & Ting, E. (2000). A study of factors influencing students' perceived learning in a web-based course environment. *International Journal of Educational Telecommunications*, *6*(4), 317–338. https://www.learntechlib.org/primary/p/8482/

Joksimovic, S., Gasevic, D., Kovanovic, V., Adesope, O., & Hatala, M. (2014). Psychological characteristics in cognitive presence of communities of inquiry: A linguistic analysis of online discussions. *The Internet and Higher Education*, *22*, 1–10. https://doi.org/10.1016/j.iheduc.2014.03.001

Kanuka, H., & Garrison, D. R. (2004). Cognitive presence in online learning. *Journal of Computing in Higher Education*, *15*(2), 21–39.

Kanuka, H., Rourke, L., & Laflamme, E. (2007). The influence of instructional methods on the quality of online discussion. *British Journal of Educational Technology, 38*(2), 260–271. https://doi.org/10.1111/j.1467-8535.2006.00620.x

Ke, F. (2010). Examining online teaching, cognitive, and social presence for adult students. *Computers & Education, 55*(2), 808–820. https://doi.org/10.1016/j.compedu.2010.03.013

Kilis, S., & Yildirim, Z. (2019). Posting patterns of students' social presence, cognitive presence, and teaching presence in online learning. *Online Learning, 23*(2), 179–195.

Kopcha, T. J., & Sullivan, H. (2007). Self-presentation bias in surveys of teachers' educational technology practices. *Educational technology research and development*, *55*(6), 627–646.

Kovanović, V., Joksimović, S., Waters, Z., Gašević, D., Kitto, K., Hatala, M., & Siemens, G. (2016). Towards auto-mated content analysis of discussion transcripts: A cognitive presence case. *Proceedings of the 6th International Conference on Learning Analytics & Knowledge (LAK '16)* (pp. 15–24). ACM. https://doi.org/10.1145/2883851.2883950

Kozan, K. (2016). A comparative structural equation modeling investigation of the relationships among teaching, cognitive and social presence. *Online Learning, 20*(3), 210–227. https://files.eric.ed.gov/fulltext/EJ1113302.pdf

Kozan, K., & Richardson, J. C. (2014). Interrelationships between and among social, teaching, and cognitive presence. *The Internet and Higher Education*, *21*, 68–73. http://dx.doi.org/10.1016/j.iheduc.2013.10.007

Lockee, B. B. (2021). Online education in the post-COVID era. *Nature Electronics*, *4*(1), 5–6.

Manfuso, L. G. (2020, May 7). From emergency remote teaching to rigorous online learning. *EdTech*. https://edtechmagazine.com/higher/article/2020/05/emergency-remote-teaching-rigorous-online-learning-perfcon

Marsicano, C. (2020). *COVID-19 data dashboard*. The College Crisis Initiative. https://collegecrisis.shinyapps.io/dashboard/

Martin, F., Wang, C., & Sadaf, A. (2018). Student perception of helpfulness of facilitation strategies that enhance instructor presence, connectedness, engagement and learning in online courses. *The Internet and Higher Education*, *37*, 52–65.

Pennebaker, J. W., Booth, R. J., Boyd, R. L., & Francis, M. E. (2015). *Linguistic inquiry and word count: LIWC2015 operator's manual*. Pennebaker Conglomerates. https://s3-us-west-2.amazonaws.com/downloads.liwc.net/LIWC2015_OperatorManual.pdf

Pennebaker, J. W., Francis, M. E., & Booth, R. J. (2001). *Linguistic inquiry and word count (LIWC): LIWC 2001*. Erlbaum.

Richardson, J. C., & Ice, P. (2010). Investigating students' level of critical thinking across instructional strategies in online discussions. *The Internet and Higher Education*, *13*(1-2), 52-59. https://doi.org/10.1016/j.iheduc.2009.10.009

Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks, 7*(1), 68–88.

Rolim, V., Ferreira, R., Lins, R. D., & Găsević, D. (2019). A network-based analytic approach to uncovering the relationship between social and cognitive presences in communities of inquiry. *The Internet and Higher Education*, *42*, 53–65. https://doi.org/10.1016/j.iheduc.2019.05.001

Sadaf, A., & Olesova, L. (2017). Enhancing cognitive presence in online case discussions with questions based on the practical inquiry model. *American Journal of Distance Education, 31*(1), 56–69.

Seaman, J. E., Allen, I. E., & Seaman, J. (2018). Grade increase: Tracking distance education in the United States. *Babson Survey Research Group*.

Seckman, C. (2018). Impact of interactive video communication versus text-based feedback on teaching, social, and cognitive presence in online learning communities. *Nurse Educator*, *43*(1), 18–22.

Shea, P., & Bidjerano, T. (2009). Community of Inquiry as a theoretical framework to foster “epistemic engagement” and “cognitive presence” in online education. *Computers and Education*, *52*(3), 543–553. https://doi.org/10.1016/j.compedu.2008.10.007

Shea, P., Li, C-S., Swan, K., & Pickett, A. (2005). Developing learning community in online asynchronous college courses: The role of teaching presence. *Journal of Asynchronous Learning Networks*, *9*(4), 59–82.

Shelley, D. J., Swartz, L. B., & Cole, M. T. (2008). A comparative analysis of online and traditional undergraduate business law classes. In C.V Slyke (Ed.), *Information Communication Technologies: Concepts, Methodologies, Tools, and Applications*. 3391–3404.

Swan, K., Garrison, D. R., & Richardson, J.C. (2009). A constructivist approach to online learning: The community of inquiry framework. In C. R. Payne (Ed.), *Information technology and constructivism in higher education: Progressive learning frameworks* (pp. 43–57). IGI Global.

Swan, K., Richardson, J., Ice, P., Shea, P., Cleveland-Innes, M., Diaz, S. & Garrison, R. (2008). Researching Online Communities of Inquiry: New CoI Survey Instrument. In J. Luca & E. Weippl (Eds.), *Proceedings of ED-MEDIA 2008—World Conference on Educational Multimedia, Hypermedia & Telecommunications* (pp. 5812–5820).Association for the Advancement of Computing in Education. https://www.learntechlib.org/primary/p/29188/.

Swan, K., & Shih, L-F. (2005). On the nature and development of social presence in online course discussions. *Journal of Asynchronous Learning Networks, 9*(3), 115–136.

Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology, 29*(1), 24–54. https://doi.org/10.1177/0261927X09351676

Tolu, A., & Evans, L. (2013). From distance education to communities of inquiry: A review of historical developments. In Z. Akyol & D. R. Garrison (Eds.), *Educational Communities of Inquiry: Theoretical Framework, Research, and Practice* (pp. 45–65). IGI Global. doi:10.4018/978-1-4666-2110-7.ch004

Vaughan, N., & Garrison, D. R. (2006). How blended learning can support a faculty development community of inquiry. *Journal of Asynchronous Learning Networks, 10*(4), 139–152. https://qubeshub.org/app/site/collections/4787/Vaughan_and_Garrison_2006.pdf

Wavle, S., & Ozogul, G. (2019). Investigating the impact of online classes on undergraduate degree completion. *Online Learning*, *23*(4), 281–295.

Wen, M., Yang, D., & Rosé, C. P. (2014). Linguistic reflections of student engagement in massive open online courses. *Proceedings of the 8th International AAAI Conference on Weblogs and Social Media* (pp. 525–534). AAAI Press. http://www.aaai.org/ocs/index.php/ICWSM/ICWSM14/paper/view/8057

Xie, X., Siau, K., & Nah, F. F. H. (2020). COVID-19 pandemic—online education in the new normal and the next normal. *Journal of Information Technology Case and Application Research*, *22*(3), 175–187.

Wisneski, J. E., Ozogul, G., & Bichelmeyer, B. A. (2017). Investigating the impact of learning environments on undergraduate students' academic performance in a prerequisite and post-requisite course sequence. *The Internet and Higher Education*, *32*, 1–10.

Xu, X., Murray, T., Woolf, B. P., & Smith, D. (2013, July). Mining social deliberation in online communication—If you were me and I were you. *Educational Data Mining 2013*. http://socialdeliberativeskills.com/documents/2013EDM_Xu_Camera_Ready.pdf

Yoo, J., & Kim, J. (2014). Can online discussion participation predict group project performance? investigating the roles of linguistic features and participation patterns. *International Journal of Artificial Intelligence in Education, 24*(1), 8–32. https://doi.org/10.1007/s40593-013-0010-8

Zhu, M., Herring, S. C., & Bonk, C. (2019). Exploring presence in online learning through three forms of computer-mediated discourse analysis. *Distance Education*, *40*(2), 205–225. https://doi.org/10.1080/01587919.2019.1600365

Predicting Cognitive Presence in At-Scale Online Learning: MOOC and For-Credit Online Course Environments

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Abstract
In this study, we work towards a strategy to measure and enhance the quality of interactions in discussion forums at scale. We present a machine learning (ML) model which identifies the phase of cognitive presence exhibited by a student's post and suggest future applications of such a model to help online students develop higher-order thinking. We collect discussion forum transcript data from two online courses: CS1301 (an introductory computer programming MOOC) offered by edX and CS6601 (a graduate course on artificial intelligence) which uses the Piazza online discussion tool. We manually code a random sample of students' posts based on the Community of Inquiry coding scheme and explore trends in cognitive presence within and across the courses. We further use this coded data to analyze the relationship between students' observed cognitive presence and course grades. In terms of testing and building an ML model, we use a Bidirectional Encoder Representations from Transformers model that uses a deep learning technique to train large text corpus and fine-tune the language model. Our results suggest that deeper cognitive engagement with course concepts, as expressed by higher cognitive presence, are associated with better learning outcomes for students in both course settings. Our ML approach achieves 92.5% accuracy on the classification task, motivating the use of ML for instructional interventions in online courses. We expect that our research study will not only contribute to extending the literature on cognitive presence but also have a beneficial impact on online instructors or curriculum developers in higher education.

Keywords: Cognitive presence, discussion forums, machine learning, higher education

Lee, J., Soleimani., F., Irish, I., Hosmer, J. Soylu, M., Y., Finkelberg, R., & Chatterjee, S. (2022). Predicting cognitive presence in at-scale online learning: MOOC and for-credit online course environments, *Online Learning, 26*(1), 58-79. DOI: 10.24059/olj.v26i1.3060

In this study, we explore how students develop higher-order thinking through participation in online discussion forums by adopting the community of inquiry (CoI) framework (Garrison, Anderson, & Archer, 2001). This conceptual framework has been widely used to guide research in educational experiences of students situated in various collaborative online learning environments such as asynchronous discussion forums (Galikyan, Admiraal, & Kester, 2021; Garrison, Anderson, & Archer, 2010). Specifically, we compare trends of students' cognitive presence between two different online course settings: an undergraduate-level massive open online course (MOOC) that is accessible to the public free of charge, and a graduate-level course which is part of an online degree program. Further, we explore the idea of automatically identifying students' levels of critical thinking from discussion forum transcripts. We present the application of a machine learning classification model for natural language processing which identifies the phase of cognitive presence observed in a student's forum post and suggest future applications of such systems to CoI-based interventions.

Review of Related Literature

Learning in Asynchronous Discussion Forums

Asynchronous discussion forums serve as a platform to support the learning process of online students by allowing them to build and share knowledge with others. Regarding learning in MOOCs, several studies have revealed that instructors perceive the beneficial role of online discussion features in facilitating quality learning (e.g., Askeroth & Richardson, 2019). Asynchronous discussion platforms are usually designed to help students learn from others by not only providing a venue for communication and interaction among students and instructors but also by enhancing content delivery (Baglione & Nastanski, 2007). Previous research suggests that various factors associated with the affordances of asynchronous discussion forums can impact students' participation in online discussion. Such factors include relational capital among participants (Chapman, Storberg-Walker, & Stone, 2008), visibility of social cues (Cheung, Hew, & Ng, 2008), and instructors' presence (An, Shin, & Lim, 2009; Baran & Correia, 2009). Other factors can also mediate between students' engagement with online discussion and learning. For example, participation in online discussions at a deep level (e.g., reflecting, refining meaning) has been found to be related to high academic achievement (Bliuc et al., 2009; Galikyan et al., 2021). Thus, it is critical to design online discussion environments that sustain a sense of community and support students socially and cognitively.

Despite its beneficial influence on students' learning, online discussion forums pose some challenges in terms of promoting active participation among students, effectively facilitating conversation, organizing an optimal structure for co-constructing knowledge, and dealing with time constraints commonly confronted by instructors (Mazzolini & Maddison, 2007; Zhu, Bonk, & Sari, 2018). To overcome these challenges, deNoyelles, Zydney and Chen (2014) proposed a list of strategies for instructors based on the CoI framework. For example, an instructor can use social modeling cues (e.g., calling a student by name), graded discussion assignments, discussion prompts, facilitation techniques (e.g., questioning), modest feedback (e.g., posting less often but in a meaningful way) and protocol prompts with structured goals and roles in a specific deadline. Beyond these strategies, the purposeful design of online platform interfaces (Quintana, Pinto, & Tan, 2021; Zhu et al., 2018) and implementation of instructional strategies to improve students' cognitive engagement (Garrison & Akyol, 2015; Kilis & Yildirim, 2019) have been shown to enhance successful and engaging online learning.

Cognitive Presence in Online Learning Contexts

According to the CoI framework, collaborative knowledge construction can be fostered through the critical dimensions of teaching, social, and cognitive presence. Previous research has stressed the importance of facilitating cognitive presence to help students engage with critical thinking and deepen their inquiry process in online courses (Garrison, Anderson, & Archer, 2010; Sadaf & Olesova, 2017; Shea & Bidjerano, 2009). From the perspective of the practical inquiry model (i.e., the model of critical thinking), which serves as the theoretical basis of CoI, our study focuses on measuring online students' levels of cognitive presence which can be manifested in four phases, including: triggering event (phase 1), exploration of ideas (phase 2), integration of the ideas generated in the exploratory phase (phase 3), and resolution of the problem or issue (phase 4) (Garrison et al., 2001; Sadaf & Olesova, 2017). Among these four phases of cognitive presence, the phase of integration has been found as the most difficult to detect because it is often difficult to catalyze the advancement from the exploration phase without appropriate support from instructors or advanced peers (Garrison et al., 2001).

A substantial body of research has provided helpful insights into facilitating high levels of cognitive presence in online learning contexts. Some researchers have emphasized the beneficial impact of case-based discussions in which students engage with real-life cases and authentic problem-solving processes (Guo et al. 2021; Kilis & Yildirim, 2019; Sadaf, Kim, & Wang, 2021; Sadaf & Olesova, 2017). Other researchers have stressed the importance of designing online course features that can create an "optimal social space" in which learners share their resources and experiences and develop supportive social networks (Amemado & Manca, 2017). Similarly, Darabi et al. (2011) found that, compared to the traditional approach of asking unstructured probing questions, strategies of scaffolding in which student mentors raise questions that focus on advancing the discussion towards a consensus for finding a solution appeared to help facilitate cognitive presence.

Yet, despite the valuable knowledge gained regarding the facilitation of deeper cognitive engagement of online students, further research is required to understand the impact of cognitive presence on actual learning outcomes (Sadaf et al., 2021). Moreover, extant research has heavily focused on small-scale and for-credit online courses. In fact, researchers have identified challenges of promoting in-depth online discussions, especially in low-stakes MOOC environments with high student drop-out rates (Gao, Zhang, & Franklin, 2013; Hew & Cheung, 2014; Nandi, Hamilton, & Harland, 2012). Moreover, instructors in large-scale online courses are likely to feel overwhelmed by students' posts and struggle to measure the quality of their interactions. Taking these factors into account, we aim to explore the development of cognitive presence observed in discussion forum posts in two different types of online courses—an undergraduate-level MOOC and for-credit online master's course—and examine the relationship between cognitive presence and learning outcomes within each course setting.

Application of Machine Learning and Learning Analytics to Educational Data

Although we can draw meaningful implications about online students' cognitive engagement from the CoI framework, challenges remain with respect to common practices for implementing the CoI coding scheme due to its subjective and manual nature. For instance, the conventional coding process to identify the four phases of cognitive presence typically requires systematic training and time commitment from coders to ensure the reliability of text data interpretation. This can be problematic, especially when analyzing large-scale forum data because of time and resource constraints. To address this problem, we explored machine learning algorithms and their related natural language processing techniques to create a scalable language model that can train the coding scheme and ultimately predict the cognitive presence of a large amount of discussion forum posts within a short period of time.

Online educational platforms are well suited to apply machine learning techniques because of the massive amount of data being collected for learning (see Appendix). Previous research has used data in the field of education to test the performance and accuracy of various machine learning models designed to discover hidden and complex patterns in online students' learning behaviors (Al-Shabandar et al., 2019; Hew et al., 2020). These efforts have encouraged the community to continue utilizing technical but interdisciplinary approaches to better support educational environments. Closely related to these research efforts, the notion of learning analytics has become increasingly popular in higher education settings. Learning analytics has been generally defined as the measurement, collection, analysis and reporting of data about learners and learning environments for purposes of understanding and optimizing the learning process (Siemens & Long, 2011). With higher education institutions being a part of the digital age by integrating online platforms in their learning environment, large data sets are now available throughout the learning process. Researchers have used various learning analytics techniques such as classification, clustering, and text mining (Leitner, Khalil, & Ebner, 2017). These techniques have been used to detect student behavior and predict student performance (Al-Shabandar et al., 2019), identify students at risk (Chen et al., 2018), analyze students' forum interactions, and provide visualization to inform instructors and other key stakeholders (Authors, 2020). However, more research is needed to understand how learning analytics helps improve online instructional practices and students' learning outcomes (Viberg et al., 2018). This encourages researchers to explore other measures, such as cognitive presence, to predict students' performance in online learning environments.

Our work is motivated by the recent trend of applying educational theoretical frameworks and machine learning to understand students' cognitive presence in discussion forums. For example, several studies explored a set of linguistic features of online discussion messages (e.g., LIWC, Coh-Metrics, word embedding similarity) to test which features have predictive relationships with cognitive presence; based on this information researchers developed machine learning models that can automatically classify the level of cognitive presence in the data (e.g., Kovanović et al., 2016; Neto et al., 2021). Similarly, in another study (Hayati, Idrissi, & Bennani, 2020), the authors used text mining and machine learning algorithms to classify students into one of four levels of cognitive engagement including passive, active, constructive, and interactive (Chi & Wylie, 2014) based on their level of cognitive presence and social interactions within discussion forums. Our work intends to offer a technique that examines quality interaction measured by a critical thinking framework to better understand students' learning outcomes. We also acknowledge scalability by designing a model that can exist in low- and high-stakes education environments at scale (Pelánek, 2020).

Research Questions

Our study was guided by three research questions. First, how do online students develop cognitive presence in two different course settings? Second, to what extent does cognitive presence contribute to enhancing students' course grades? Third, can we develop a ML model to detect the level of cognitive presence in discussion forum posts?

Method

Participants and Settings

Our study focused on analyzing discussion forum data collected from two online courses, including an introductory undergraduate-level computer programming MOOC (CS1301) and an online master's degree course about artificial intelligence (CS6601). The CS1301 MOOC is available free of charge to anyone who has signed up for the edX platform. According to the course description, knowledge of basic arithmetic and high school-level algebra is desirable; however, no prior knowledge of computer programming is required from students. Thousands of students are typically enrolled in this low-stakes course; for example, we observed nearly 45,000 students who were enrolled during the Fall 2017 semester. On the other hand, CS6601 has a much smaller class size than CS1301 (e.g., 796 students in Spring 2020), and it is considered a high-stakes for-credit course. The course requires prior knowledge of college-level mathematical concepts and computer programming and algorithms. As one of the core courses in the Online Master's in Computer Science program, CS6601 is designed to incorporate intensive readings, assignments, and independent work. These two courses were taught by various instructors and offered by the same institution—a technology-focused public university in the US.

Data Sources and Procedures

Regarding data collection from CS1301, the research team was provided with the securely encrypted course data from edX, which consisted of course enrollment and participation information from users who have accepted the terms of edX's Privacy Policy. The data were also compliant with the General Data Protection Regulation (GDPR) law, which protects the privacy rights of E.U. residents. Prior to any data analysis, all identifying information was removed from raw data, including usernames within the discussion forum transcript data. For CS6601, we proceeded with data collection based on the institutional review board (IRB)-approved study protocol. We obtained informed consent from the instructor of CS6601 who agreed to provide fully anonymized Piazza transcript data for the purpose of research. Student demographic information was not collected because it was beyond the scope of our present research.

Data sources consisted of a total of 2,341 posts that came from two sets of anonymized transcript data collected from each of the two courses (see Table 1). The CS1301 data was collected during the Fall 2017 and Fall 2018 semesters via edX, a major MOOC provider. This includes a total of 848 comments that were pulled through a stratified random sampling technique. The stratification was based on the number of total comments posted within a certain discussion thread in order to capture the dynamic nature of conversation flows across the discussion board. Regarding CS6601, which was taught during the Spring 2020 semester, we analyzed 1,493 posts collected through the Piazza discussion forum tool. The CS6601 dataset consisted of randomly sampled posts associated with two specific assignments which elicited the most active participation in online discussion. In both courses, participation in the discussion forum was voluntary and was not counted for final grading. However, students in CS6601 were encouraged to post questions to Piazza prior to scheduling an office hours appointment.

Table 1
Description of Student Participation in Online Discussion Forums

	CS1301 (MOOC)	**CS6601 (For-Credit Course)**
Total Number (#) of Posts Coded	848	1,493
Total # of Student Contributors	362	186
Total # of Instructor (TA) Contributors	1 (1)	1 (13)
Total # of Discussion Threads Generated	350	155
Average # of Posts per Thread	2.4	9.6
Average # of Posts per Student	2.5	5.7

Measures

The key measures used in this study include indicators of cognitive presence and final course grades (numeric scores). To measure the cognitive presence of students in discussion forums, collected transcripts were manually coded based on Garrison et al.'s (2000) CoI coding scheme. Detailed descriptions of each cognitive presence phase and sample quotes are presented in Table 2. For coding analysis of the CS1301 data, two pairs of student research assistants were trained by a researcher experienced in qualitative research. They read the assigned posts and labeled each post with one of the five cognitive presence phases. The inter-rater reliability indicated by the level of agreement between the two coders ranged from 76% to 83%. Likewise, another two pairs of trained student researchers hand coded the CS6601 data under the supervision of the same researcher during the Spring 2021 semester, resulting in inter-rater reliability scores of 94% to 95%.

Table 2
Four Phases of Cognitive Presence and Sample Comments

Cognitive Presence (CP) Index	**CP Phase**	**CP Phase Description**	**Sample Quotes**
0	Non-CP	● Non-cognitive comments ● Socializing comments ● Logistics & technical Q&As	● *Perfect, thanks.* ● *Which chapter is this?*
1	Triggering event	● Expressing confusion ● Disagreement/conflict with prior knowledge ● Clarification questions about a problem	● *I'm so confused by this problem* ● *What do you mean by undersampling, <NAME>?*
2	Exploration of ideas	● Describing/diagnosing a problem ● Sharing hypotheses ● Exploring new ideas or introducing suggestions	● *gah! Still having trouble with the k folds test; it looks like it's breaking something in my confusion matrix* ● *as far as I understood once I re-watched the video, that we're dealing with console-like interfaces to help us focus, examples of those are Pycharm and IDLE, correct?*
3	Integration of ideas	● Giving/proposing someone solutions by	● *In the instructions, it tells you to take the symbol itself ... You don't*

		building on other's comments ● Using textbook references or other credible sources to help find solutions	*need to use unicode for this problem.* ● *For the returns in generate_k_folds function, you are supposed return a list of k folds as explained in the function notes.*
4	Resolution of problem or issue	● Confirmation or validation of the proposed solutions ● Elaborating why/how the solution works in details	● *I had a similar issue at first and realized it was because my local test was calling dt.accuracy() inside of the wrong function, and so with the wrong input data.* ● *That means that your input should not require an argument for those attributes and still run. Eg: … is not required as it has a default value, but it can still be changed if an argument is passed in. Thus, it is optional*

Data Analysis

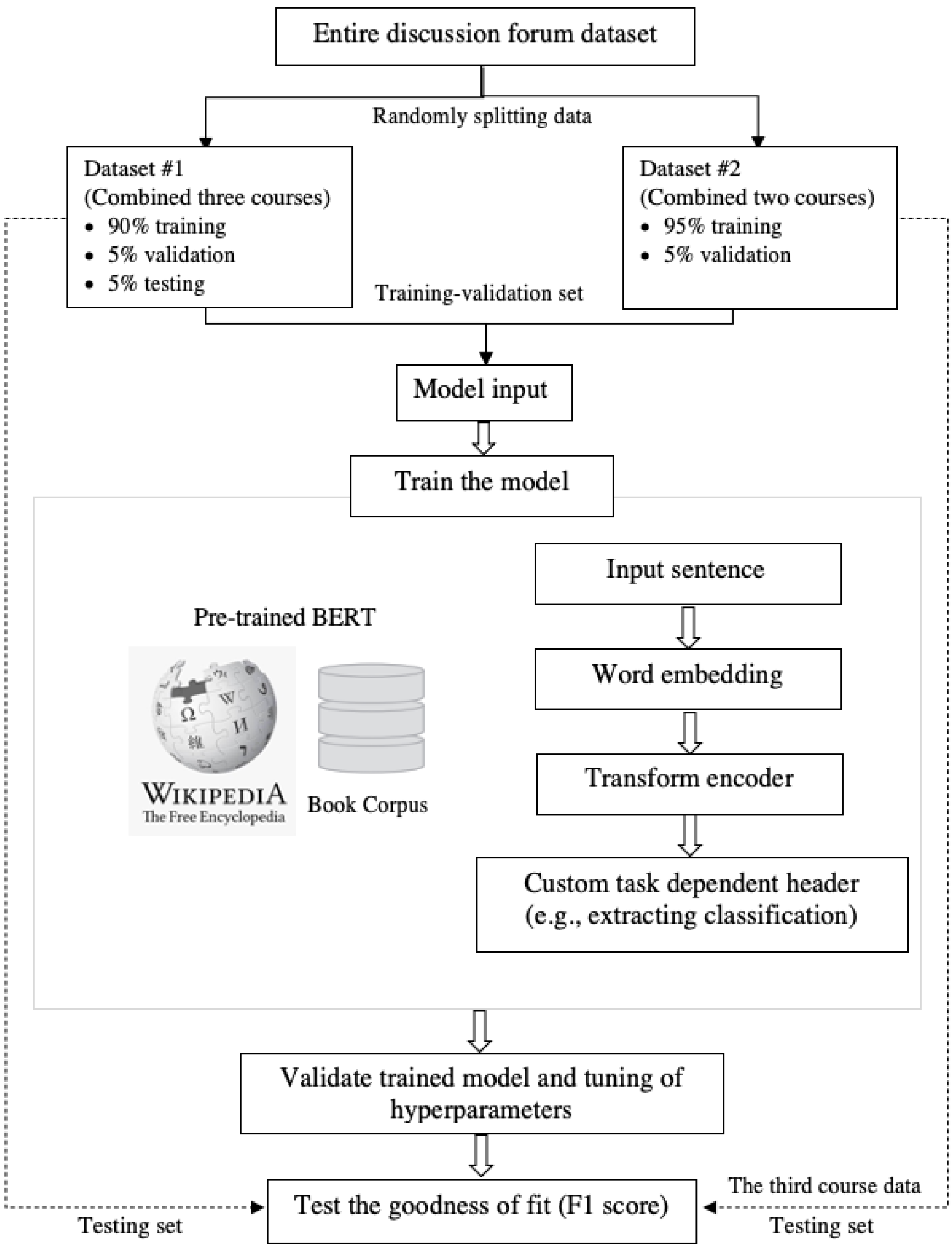
Inferential statistics. To analyze quantitative data, we used IBM SPSS (version 25) to conduct descriptive and correlation analyses to determine associations among cognitive presence scores, final grade scores, and other key variables such as instructor or TA involvement in a discussion thread. Inferential statistics techniques, including the Chi-square test and independent samples t-test, were also used to compare cognitive presence-related trends between sub-groups within and across the courses.

ML-based classification technique. By using the set of manually coded text data that consisted of forum posts and their corresponding cognitive presence scores, we explored an ML approach as a primary technique to automatically identify cognitive presence levels of individual posts generated by participants in discussion forums for online courses. In this case, we were interested in applying a deep neural network technique in which the relationships between input and output elements are predicted based on artificial neural networks that adopt sophisticated and complex modeling algorithms to enable the model to learn and improve predictions over time (Arisoy, 2012).

To effectively train the proposed ML model, we used a transformer-based deep learning model referred to as Bidirectional Encoder Representations from Transformers (BERT), which pre-trains and fine-tunes relevant text data (for an overview see Rogers, Kovaleva, Rumshisky, 2020). BERT was created by Google in 2018 and this is a widely used state-of-the-art technique in many natural language processing tasks to develop language models by learning language representations from unlabeled or uncoded text (Devlin et al., 2019). This model was pre-trained on a large database (around 2,500 million words from Wikipedia and 800 million words from book corpus) and developed by using two different training methods such as Masked Language Model and Next Sentence Prediction. Its size and power make it easily adaptable to novel natural language tasks where there is insufficient data to train a model from scratch.

To fine tune the transformer model, we created training, validation, and test data sets. We tested two different strategies for selecting the subset of data. First, we aggregated all the posts into one large data set and then randomly split it into 90% training, 5% validation, and 5% testing. Next, we clustered posts by course (i.e., CS1301, CS6601) and split them into 95% training and 5% validation. We then took posts from the other course as a test data set to see how well our model will generalize to posts that were not included in the training data set. Our model used an adaptive SGD algorithm commonly referred to as AdamW, which runs until there is no longer an improvement on the validation data set (Loshchilov & Hutter, 2019). We then selected the model that performed best on the validation data set and compared that to our test dataset. Finally, we computed the F1 score on the test data set as a measure of accuracy, or performance indicator. Figure 1 illustrates the conceptual framework that guided our ML-based classification technique.

Figure 1
Machine-Learning Framework for Classifying Cognitive Presence Phases



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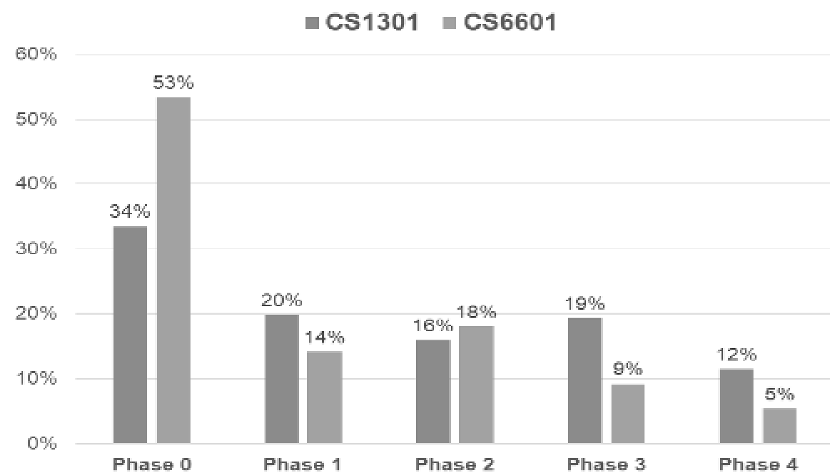
Results

Progression of Cognitive Presence Phases in Online Discussion Forums

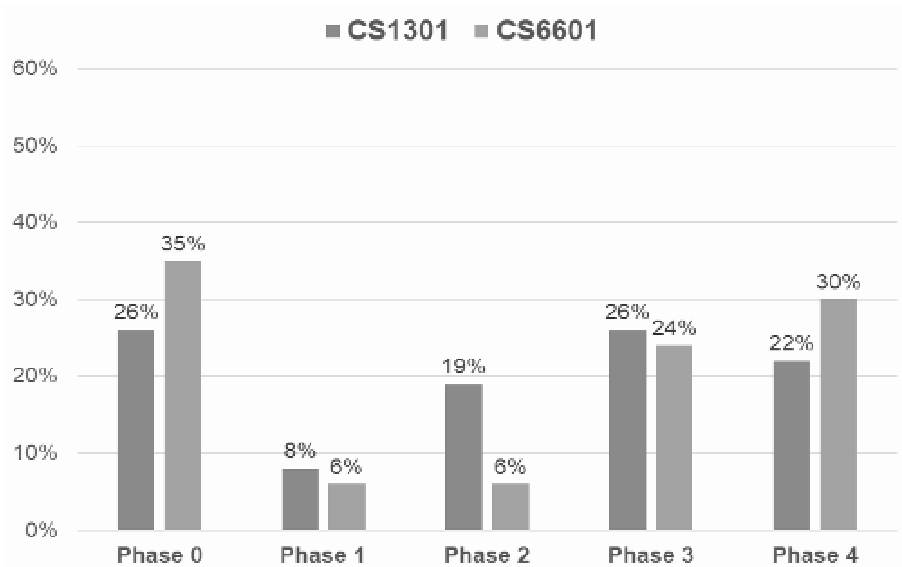
First, we examined how online students' cognitive presence develops within the course and whether patterns of idea progression differed by course type. A chi-square test showed that the distribution of cognitive presence phases in students' posts statistically differed between the CS1301 and CS6601 course, X^2 (4, N = 1,896) = 108.90, p < .001. For example, the proportion of Phase 0 comments (e.g., logistics, social) were higher in CS6601 (53%) than in CS1301 (34%) (see Figure 2). This might be because the CS6601 data set specifically came from assignment-related discussion boards and therefore students often asked about the assignment logistics (e.g., deadline extension, grade review). Among comments demonstrating cognitive presence (i.e., Phases 1-4), 46% of total comments in CS1301 (n=540) and 45% of the total in CS6601 (n=678) reflected advanced phases such as integration of ideas and resolution of problems, indicating very similar trends. Interestingly, students in CS1301 posted Phase 1 comments more frequently (30% of total cognitive presence posts) than did those in CS6601 (24% of total). This suggests that MOOC students might introduce problems or seek the input of others more actively, compared to graduate students.

Figure 2
Distribution of Cognitive Presence Phases: CS1301 (MOOC) versus CS6601 (For-Credit Course)



In order to compare progression trends within a specific discussion context, we clustered posts by common discussion thread identifiers and calculated maximum scores of cognitive presence phases for every individual discussion thread. In this case, the maximum cognitive presence score indicated how far participants within a certain discussion thread were able to progress across the four phases of cognitive presence. Then, we compared between the two courses the percentages of threads that generated the maximum cognitive presence score corresponding to each of the four phases (see Figure 3). A chi-square test revealed that the distribution of maximum cognitive presence phases at the thread level statistically differed between the CS1301 and CS6601 course, X^2 (4, N = 505) = 19.13, p < .001. Specifically, compared to CS1301, we observed greater proportions of threads that eventually reached either Phase 0 or Phase 4 in CS6601. This suggests that the graduate-level CS6601 participants frequently stayed in non-cognitive topics but at the same time they were actively engaged with the problem-solving process to the extent that they advanced to the final phase of cognitive presence. Another notable difference between the two courses was that the percentage of threads that reached Phase 2 was much higher in CS1301 than in CS6601, suggesting that the MOOC discussion forum participants might struggle with going beyond the phase of tackling and exploring problems. This could be also explained by the relatively weak presence of the course instructor or TA as only 36% of the threads in the CS1301 data (total n=350) involved the instructor or TA whereas this figure was 92% in CS6601, pertaining to almost all of the threads that were collected (total n=155).

Figure 3
Distribution of Maximum Cognitive Presence Phases at the Discussion Thread Level: CS1301 versus CS6601



Within each course, we further compared threads that involved the instructor or TAs with threads without their involvement to test whether teaching presence would make any difference in facilitating rapid progression toward the advanced phases, indicated by the degree of changes between the minimum and maximum phases of cognitive presence. According to the t-test results of independent samples, among the CS1301 MOOC students, those who interacted with either the instructor or TA in a discussion thread were likely to show a greater change (M = 1.17) than those who interacted only with their peer students (M = .58), t (338) = 3.99, p < .01. With respect to CS6601, we observed the opposite trend in which students who interacted with the instructor or TAs in a discussion thread tended to exhibit a smaller progression of cognitive presence (M = 1.07) than their peer-only counterparts (M = 1.92), t (150) = -2.15, p < .05. It is possible that students enrolled in a high-stakes online graduate course are poised to deploy critical thinking to solve a problem in the course materials while receiving minimal support from the teaching staff. However, this finding should be viewed with caution given that threads from CS6601 predominantly involved the participation of the instructor or TAs, contributing to an imbalance in the sample sizes between the two groups compared (i.e., 142 threads with teaching presence versus 13 threads without teaching presence).

Online Students' Cognitive Presence and Course Achievement

With respect to the second research question, we examined the relationship between students' levels of cognitive presence and their course achievement. According to correlation analysis results, the maximum cognitive presence scores of individual students had statistically significant, positive, and yet low correlations with final grades in both courses (see Table 3). However, we observed a significant correlation between the students' average cognitive presence scores and their final grades only in CS1301, whereas it was statistically non-significant in CS6601. Based on these findings, we decided to use maximum cognitive presence scores as a primary indicator of the level of cognitive presence that a student was able to achieve in online discussions. Interestingly, there was no significant correlation between the total number of posts that individual students have generated and course grades for CS1301, whereas we observed a significant, positive, and low correlation between the two variables in the CS6601 data. This suggests that, in the MOOC environment, the quantity of participation in discussion forums alone is not meaningfully associated with course achievement. Yet, it is noteworthy that, for both courses, there was a significant, positive, and low to medium correlation between the number of posts and their maximum cognitive presence scores.

Table 3
Bivariate Correlations Among Cognitive Presence Score Variables and Course Grade

	CS1301				CS6601			
	1	2	3	4	1	2	3	4
1. N of Posts	—				—			
2. Max. CP	.26**	—			.39**	—		
3. Avg. CP	.13*	.91**	—		.04	.79**	—	
4. Course Grade	.08	.16**	.14**	—	.21**	.16*	.07	—

Next, we compared the mean course grade scores between students who exhibited different levels of cognitive engagement. In this case, we focused on comparing student subgroups within each course based on how far a student was able to progress through the phases of cognitive presence during online discussions. Within each of the two courses, we calculated the median value of maximum cognitive presence scores among participating students, resulting in a value of 1 for CS1301 and 2 for CS6601. Then, students whose maximum cognitive presence score was either below or corresponding to the median value were assigned to the Low subgroup. Those who had produced a maximum cognitive presence score above the median value were assigned to the High subgroup. That is, in the CS1301 data, students who reached the Phase of 2, 3 or 4 in the discussion forums were categorized as High; while students whose maximum cognitive presence score was either 0 or 1 were categorized as Low. In the CS6601 data, students whose maximum cognitive presence score was either 3 or 4 were categorized as High and those who scored 0, 1 or 2 were categorized as Low.

The independent samples t-test results revealed that the High subgroup was likely to report higher course grades than did the Low subgroup in both courses (see Table 4). In other words, regardless of whether it was a low- or high-stakes course, students who had engaged in higher-order thinking during the collaborative knowledge building process tended to perform better compared to those who had posted only non-cognitive comments or tried to tackle a problem rather at the surface level. The results support the importance of fostering critical thinking in discussion forums to enhance learning outcomes. Interestingly, when the threshold for the subgroup categorization in the CS6601 data was lowered to be equivalent to the CS1301 threshold (i.e., Phase 1), the High and Low subgroups no longer showed a significant difference. This implies that progressing beyond the phase of exploring ideas might have an even stronger impact on the learning outcomes of graduate students.

Table 4
Comparison of Mean Final Course Grades: Independent Samples T-Test Results

	High CP Group			**Low CP Group**			***t*-test**
	n	M	SD	n	M	SD	**(df)**
CS1301	157	49.03	42.23	205	38.29	41.08	-2.44* (360)
CS6601	61	93.97	5.70	115	91.25	6.93	-2.63** (174)

Note. * Indicates $p < .05$. ** indicates $p < .01$.

Applying Machine Learning to Cognitive Presence Identification

For our third research question, we applied ML algorithms to automate the classification of cognitive presence in discussion forum texts. We used a held-out validation data set in which we combined manually coded forum posts collected from both CS1301 and CS6601 and then randomly split the data into training, validation, and test sets. Our pre-trained BERT model was fine-tuned on the training data which accounted for 90% of the entire data set. Eventually, our model achieved a F1 score value of 92.5% on the test data, indicating a high level of accuracy of the model. The F1 score was not only close to our best interrater reliability score (95%) from manual coding but also even higher than the interrater reliability scores that we achieved when coding the CS1301 data. We consider the interrater reliability scores to be our best example of human-level performance on the task, and therefore we are encouraged that our model approached this level of accuracy.

As shown in Figure 4, when compared to the actual coding results, the final model generally performed well in learning to predict both the non-cognitive phase and four phases of cognitive presence. Additionally, as shown in the training curve in Figure 5, we observed that prediction errors, indicated by root mean square error (RMSE), decreased drastically over time as we repeated training sessions. These findings suggest the application of the ML approach to at-scale online learning data such as those data generated from discussion forum posts holds much promise.

Figure 4
Confusion Matrix with Actual versus Predicted CP Phase: Using Combined Data for Training and Testing

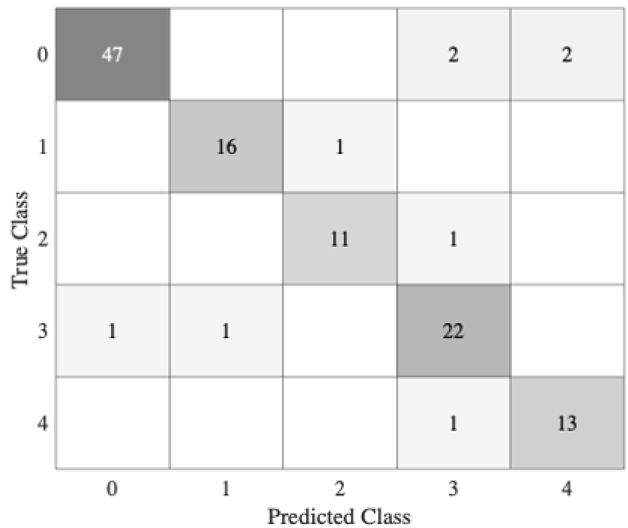
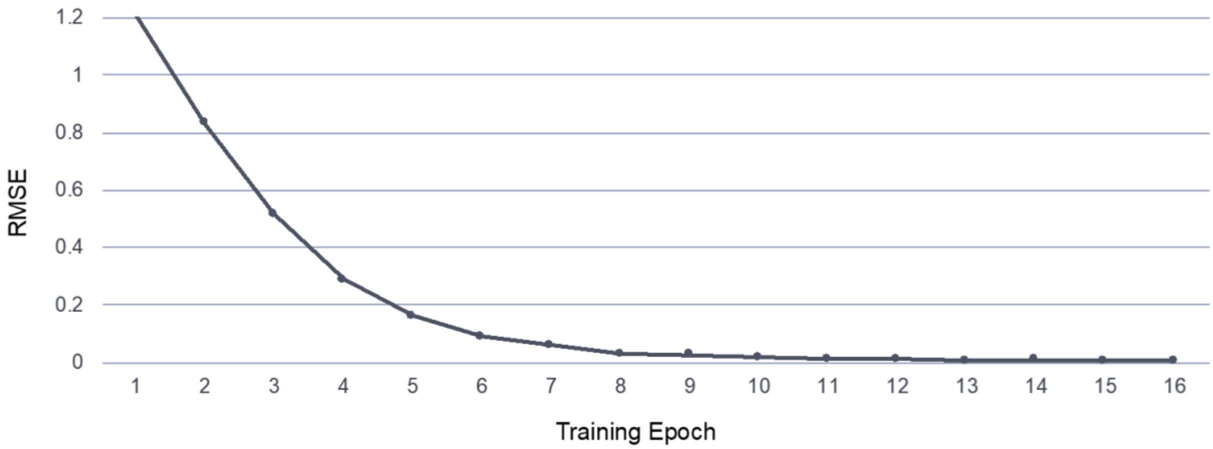


Figure 5
Combined Data Set Training Curve



Note. Training epoch refers to the number of passes of the entire training data set through the machine learning algorithms.

It is notable that we observed much less success in the model performance when we attempted to treat the data from each course separately by using data from one of the two courses to train the model (see Table 5). For example, when the model was trained and tested on the CS1301 data, it achieved a F1 score of only 46.4%. For the CS6601 data, the model performed slightly better than the CS1301 data and yet achieved a much lower F1 score (72.1%) compared to the combined data model (92.5%). Likewise, we observed lower model performances when we combined the data from the two courses for training and then tested the model against the data from a single course (see Table 6). The second procedure resulted in slightly improved accuracy in predicting the cognitive presence phases as indicated by higher F1 scores with 48.9% for CS1301 and 76.6% for CS6601. However, the results clearly suggest that the models in both procedures failed to obtain human-level accuracy in this prediction task.

Table 5
Confusion Matrix with Actual versus Predicted CP Phase: Using Training and Test Data from Specific Course Data

	CS1301 (F1 Score: 0.464)					**CS6601 (F1 Score: 0.721)**				
	Predicted					***Predicted***				
Actual	0	1	2	3	4	0	1	2	3	4
0	12	1	1	0	0	43	0	0	2	0
1	3	7	4	1	0	3	5	3	0	0
2	0	6	1	1	0	2	1	6	1	1
3	1	0	2	0	2	1	0	2	1	0
4	0	0	0	0	1	2	0	0	1	2

Table 6
Confusion Matrix with Actual versus Predicted CP Phase: Using All Data for Training and Using Specific Course Data for Test Data

	CS1301 as Test Data (F1: 0.489)					**CS6601 as Test Data (F1: 0.766)**				
	Predicted					***Predicted***				
Actual	0	1	2	3	4	0	1	2	3	4
0	16	0	1	0	0	31	1	1	1	0
1	3	0	3	1	0	1	6	5	0	0
2	2	0	4	3	0	2	2	10	1	0
3	1	0	3	2	1	1	0	1	6	1
4	0	0	0	1	1	0	0	0	0	4

Overall, our results indicate that a small number of training samples from a single course is not sufficient to fine-tune large, general-purpose language models to the cognitive presence identification task. This is intuitive, as learning to effectively identify cognitive presence requires the ability to generalize across discussion forums with a wide range of interactions and language usage. These results suggest that ML systems for cognitive presence identification should be generalizable to multiple related courses rather than specialized for a single course, since such systems are able to learn more effectively to identify cognitive presence without overfitting to the language of a particular course. Although we only explore this phenomenon in two computer science courses, future work should extend this to more, potentially unrelated, courses to determine the extent to which this is beneficial.

Discussion

Findings from this study contribute to the current literature on cognitive presence in several ways. First, our findings suggest that how students' cognitive presence manifests and progresses may differ by course type and design. As indicated by the relatively high proportion of non-cognitive phase comments posted by graduate students enrolled in CS6601, discussion forums designed to discuss any questions about specific homework or assignments of a course may hinder the opportunity for students to reach higher levels of cognitive presence. Additionally, students' prior knowledge and motivation appeared to be another factor influencing their development of cognitive presence. Our findings indicate that students enrolled in the

CS1301 MOOC tended to focus on generating posts that reflect lower levels of cognitive presence such as those related to triggering events or exploration. This might be due to students participating in discussions with varying degrees of prior knowledge, mostly weak knowledge, of the course topic (i.e., computing in Python). Also, while neither CS1301 and CS6601 required students to engage in discussion as part of the course grading, a very small subset of the CS1301 students contributed to the discussion and participating students tended to generate even fewer posts, compared to the CS6601 students. In order to facilitate progression toward higher levels of cognitive presence, instructors need to consider incorporating the practical inquiry model-based questions (Sadaf & Olesova, 2017), which would allow students to approach a case or course concept by explicitly reflecting on the four levels of cognitive presence (e.g., proposing a solution through synthesis of ideas, applying the solution to a real-world situation). Furthermore, in terms of teaching in MOOC platforms, it is crucial to not only increase students' awareness of the value of contributing to online discussions but also to offer customized resources for students with different levels of background knowledge to help sustain their engagement with critical thinking.

Second, our study explored whether receiving support from either an instructor or TA(s) will have a positive impact on students' collaborative knowledge building process, as measured by the difference between the minimum and maximum cognitive presence score at the discussion thread level. We further examined whether we would observe such a positive impact in other online course environments. It is notable that we observed a relatively stronger impact of the instructor or TA involvement on students situated in the low-stakes MOOC (i.e., CS1301) than those in the high-stakes, for-credit online course (i.e., CS6601). It is possible that MOOC students may benefit more from immediate support from the instructor or TAs, as it may help students sustain engagement with higher-order thinking and advance their knowledge collaboratively with others in discussion. However, our findings capture only a partial snapshot of the CoI model. Previous research has revealed that an instructor's ability to facilitate both teaching and social presence plays a crucial role in enhancing students' cognitive presence (Garrison et al., 2010; Shea & Bidjerano, 2009). Future research will need to expand our current study by addressing how online students' development of cognitive presence can be affected and supported by teacher presence and social presence.

Third, beyond observing how students develop cognitive presence across various types of online courses, our study yields empirical evidence supporting the idea that cognitive presence matters for students' success in both undergraduate-level and graduate-level at-scale learning environments. Our findings are consistent with Sadaf et al.'s (2021) findings that higher levels of cognitive presence are closely associated not only with students' perceived learning but also with their actual final course grades. Moreover, by using the manually coded discussion forum data, our study showed that the extent to which a student is able to progress through the phases of cognitive presence in online discussion (as measured by the maximum cognitive presence score) can be used as a valuable metric to categorize High versus Low cognitive presence subgroups. It is worthwhile to note that the threshold level for identifying the High versus Low subgroup was higher in the CS6601 data than in the CS1301 data, suggesting that, for online graduate students who have advanced domain knowledge and professional experience, it seems more important to be more deeply and cognitively engaged during discussion. Yet, further research is required to replicate and validate our proposed metric in other asynchronous discussion forum contexts.

Fourth, our interdisciplinary approach combines educational psychology and computer science to provide insight into the potential value of the application of the machine-learning approach to the at-scale online learning context in enhancing students' cognitive engagement. Our automated classifier model revealed its robust capability to learn to detect the phases of cognitive presence in discussion forum posts, supporting findings of existing studies (e.g., Hayati et al., 2020; Hu et al., 2020; Neto et al., 2021). Consistent with Neto et al. (2021), we found that the model performance was successful particularly when we used the combined data set for both training and testing. By considering the recommendation from Neto et al., our study made further progress in testing the generalizability of the model by incorporating data sets collected from two different types of online courses (i.e., MOOC and for-credit online course) that cover related subject areas (i.e., computer science). We expect that these findings will provide useful information to online course designers and instructors. For example, our prediction model can be used to create a learning analytics tool designed to benefit students' online learning by enabling instructors to monitor how their students cognitively engage with, and demonstrate progress on, various topics over time in discussion forums. Moreover, based on the automated prediction of students' posts, our model can be implemented as part of instructional design to inform when a teacher or TA should intervene in students' discussion to help build critical thinking and sustain cognitive engagement.

However, our study findings should be interpreted cautiously due to some limitations. For example, we cannot rule out the possibility of sampling bias. In terms of CS1301, only a small subset of the MOOC students participated in discussion forums and these students are likely to be more motivated to learn course concepts than the majority of the enrolled students. Future research will need to examine whether discussion forum participants and non-participants systematically differ in terms of their academic and demographic backgrounds. Also, our findings pose generalizability issues due to relying on specific computer science subjects. In fact, a substantial number of students' posts included computer programming language and code. Accordingly, our proposed automation model, as is, is unlikely to adequately fit data from other discipline areas such as philosophy. Therefore, researchers should continue to investigate the extent to which the ML approach that we adopted will be applicable to course subjects other than computer science. Another limitation of our study is that we were not able to fully account for time-series aspects of the collected data in our statistical analyses due to difficulties with standardizing time zone differences among students participating around the globe. It would be worthwhile to explore whether there are any interesting associations between the development of online students' cognitive presence levels and timing of responses from their teacher, TAs, or peer students (e.g., can students reach higher cognitive presence phases more quickly when they receive support within a certain period?).

Conclusion

Consistent with prior research, our findings suggest that online discussion forums serve as a learning platform where students can actively develop higher-order thinking through the four phases of cognitive presence, whether they are enrolled in an open-access MOOC or a for-credit course. For both courses, discussion participants who engaged with the problem-solving process more deeply tended to achieve better course outcomes, corroborating the crucial role of cognitive presence in facilitating successful online learning. Finally, our exploratory application of ML provides insight into potential solutions to the challenge of measuring and leveraging cognitive presence in large-scale distributed learning environments in higher education.

Furthermore, the initial success of our machine learning approach to cognitive presence classification from forum data supports the design and development of instructional tools and technical interventions which allow instructors to more effectively monitor and support students' learning process at scale.

Declarations

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References

Al-Shabandar, R., Hussain, A. J., Liatsis, P., & Keight, R. (2019). Detecting at-risk students with early interventions using machine learning techniques. *IEEE Access, 7*, 149464-149478. https://doi.org/10.1109/ACCESS.2019.2943351

Amemado, D., & Manca, S. (2017). Learning from decades of online distance education: MOOCs and the Community of Inquiry Framework. *Journal of e-learning and Knowledge Society, 13*(2). https://www.learntechlib.org/p/180225/

An, H., Shin, S, & Lim, K. (2009). The effects of different instructor facilitation approaches on students' interactions during asynchronous online discussions. *Computers & Education, 53*(3), 749-760. https://doi.org/10.1016/j.compedu.2009.04.015

Arisoy, E., Sainath, T. N., Kingsbury, B., & Ramabhadran, B. (2012, June). Deep neural network language models. In *Proceedings of the NAACL-HLT 2012 Workshop: Will We Ever Really Replace the N-gram Model? On the Future of Language Modeling for HLT* (pp. 20-28). Association for Computational Linguistics. https://dl.acm.org/doi/abs/10.5555/2390940.2390943

Askeroth, J.H., & Richardson, J.C. (2019). Instructor perceptions of quality learning in MOOCs they teach. *Online Learning*, *23*(4), 135-159. https://doi.org/doi:10.24059/olj.v23i4.2043

Baglione, S., & Nastanski, M. (2007). The superiority of online discussion: Faculty perceptions. *The Quarterly Review of Distance Education, 8*(2), 139-150.

Baran, E., & Correia, A. (2009). Student-led facilitation strategies in online discussions. *Distance Education*, *30*(3), 339-361. https://doi.org/10.1080/01587910903236510

Bliuc, A., Ellis, R., Goodyear, P., & Piggott, L. (2009). Learning through face-to-face and online discussions: Associations between students' conceptions, approaches and academic performance in political science. *British Journal of Educational Technology*, *41*(3), 512-524. https://doi.org/10.1111/j.1467-8535.2009.00966.x

Chapman, D., Storberg-Walker, J., & Stone, S. (2008). Hitting reply: A qualitative study to understand student decisions to respond to online discussion postings. *E-Learning and Digital Media, 5*(1), 29-39. https://doi.org/10.2304%2Felea.2008.5.1.29

Chen, B., Chang, Y. H., Ouyang, F., & Zhou, W. (2018). Fostering student engagement in online discussion through social learning analytics. *The Internet and Higher Education*, *37*, 21-30. https://doi.org/10.1016/j.iheduc.2017.12.002

Cheung, W., Hew, K., & Ng, C. (2008). Toward an understanding of why students contribute in asynchronous online discussions. *Journal of Educational Computing Research*, *38*(1), 29-50. https://doi.org/10.2190%2FEC.38.1.b

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219-243. https://doi.org/10.1080/00461520.2014.965823

Darabi, A., Arrastia, M., Nelson, D., Cornille, T. and Liang, X. (2011). Cognitive presence in asynchronous online learning: A comparison of four discussion strategies. *Journal of Computer Assisted Learning, 27*(3), 216-227. https://doi.org/10.1111/j.1365-2729.2010.00392.x

deNoyelles, A., Zydney, J., & Chen, B. (2014). Strategies for creating a community of inquiry through online asynchronous discussions. *Journal of Online Learning and Teaching, 10*(1), 153-165.

Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2018). Bert: Pre-training of deep bidirectional transformers for language understanding. arXiv preprint arXiv:1810.04805. https://arxiv.org/abs/1810.04805

Galikyan, I., Admiraal, W., & Kester, L. (2021). MOOC discussion forums: The interplay of the cognitive and the social. *Computers & Education*, *165*, 104133. https://doi.org/10.1016/j.compedu.2021.104133

Gao, F., Zhang, T., & Franklin, T. (2013). Designing asynchronous online discussion environments: Recent progress and possible future directions. *British Journal of Educational Technology, 44*(3), 469-483. https://doi.org/10.1111/j.1467-8535.2012.01330

Garrison, D. R., & Akyol, Z. (2015). Toward the development of a metacognition construct for communities of inquiry. *The Internet and Higher Education, 24*, 66–71. https://doi.org/10.1016/j.iheduc.2014.10.001

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7-23. https://doi.org/10.1080/08923640109527071

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education, 13*(1-2), 5-9. https://doi.org/10.1016/j.iheduc.2009.10.003

Guo, P., Saab, N., Wu, L., & Admiraal, W. (2021). The Community of Inquiry perspective on students' social presence, cognitive presence, and academic performance in online project-based learning. *Journal of Computer Assisted Learning, 37*(5), 1479–1493. https://doi. org/10.1111/jcal.12586

Hayati H., Idrissi M. K., & Bennani S. (2020) Automatic classification for cognitive engagement in online discussion forums: Text mining and machine learning approach. In Bittencourt, I., Cukurova, M., Muldner, K., Luckin, R., & Millán, E. (Eds.), *Artificial Intelligence in Education. AIED 2020. Lecture Notes in Computer Science, vol 12164* (pp. 114-118). Springer, Cham. https://doi.org/10.1007/978-3-030-52240-7_21

Hew, K. F., & Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. *Educational Research Review*, *12*, 45-58. https://doi.org/10.1016/j.edurev.2014.05.001

Hew, K. F., Hu, X., Qiao, C., & Tang, Y. (2020). What predicts student satisfaction with MOOCs: A gradient boosting trees supervised machine learning and sentiment analysis approach. *Computers & Education*, *145*, 103724. https://doi.org/10.1016/j.compedu.2019.103724

Hu, Y., Donald, C., Giacaman, N., & Zhu, Z. (2020, March). Towards automated analysis of cognitive presence in MOOC discussions: A manual classification study. In *Proceedings of the Tenth International Conference on Learning Analytics & Knowledge* (pp. 135-140). https://doi.org/10.1145/3375462.3375473

Irish, I., Finkelberg, R., Nkemelu, D., Gujrania, S., Padiyath, A., Raman, S., Tailor, C., Arriaga, R., & Starner, T. (2020, August). PARQR: Automatic Post Suggestion in the Piazza Online Forum to Support Degree Seeking Online Masters Students. In *Proceedings of the Seventh ACM Conference on Learning@ Scale* (pp. 125-134). https://doi.org/10.1145/3386527.3405914

Kilis, S., & Yildirim, Z. (2019). Posting patterns of students' social presence, cognitive presence, and teaching presence in online learning. *Online Learning*, *23*(2), 179-195. https://doi.org/10.24059/olj.v23i2.1460

Kovanović, V., Joksimović, S., Waters, Z., Gašević, D., Kitto, K., Hatala, M., & Siemens, G. (2016, April). Towards automated content analysis of discussion transcripts: A cognitive presence case. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 15-24). https://doi.org/10.1145/2883851.2883950

Leitner, P., Khalil, M., & Ebner, M. (2017). Learning analytics in higher education—A literature review. In A. Peña-Ayala (Ed.), *Learning analytics: fundaments, applications, and trends* (pp. 1-23), Springer. https://doi.org/10.1007/978-3-319-52977-6_1

Mazzolini, M., & Maddison, S. (2007). When to jump in: The role of the instructor in online discussion forums. *Computers & Education., 49*(2), 193-213. https://doi.org/10.1016/j.compedu.2005.06.011

Nanzi, D., Hamilton, M., & Harland, J. (2012). Evaluating the quality of interaction in asynchronous discussion forums in fully online courses. *Distance Education, 33*(1), 5-30. https://doi.org/10.1080/01587919.2012.667957

Neto, V., Rolim, V., Cavalcanti, A. P., Lins, R. D., Gasevic, D., & Ferreiramello, R. (2021). Automatic Content Analysis of Online Discussions for Cognitive Presence: A Study of the Generalizability across Educational Contexts. *IEEE Transactions on Learning Technologies*, *14*(3), 299-312. https://doi.org/10.1109/TLT.2021.3083178

Pelánek, R. (2020, March). Learning analytics challenges: Trade-offs, methodology, scalability. In *Proceedings of the Tenth International Conference on Learning Analytics & Knowledge* (pp. 554-558). https://doi.org/10.1145/3375462.3375463

Quintana, R. M., Pinto, J. D., & Tan, Y. (2021). What we learned when we compared discussion posts from one MOOC hosted on two platforms. *Online Learning, 25*(4), 7-24. https://doi.org/10.24059/olj.v25i4.2897

Rogers, A., Kovaleva, O., & Rumshisky, A. (2020). A primer in bertology: What we know about how bert works. *Transactions of the Association for Computational Linguistics*, *8*, 842-866. https://doi.org/10.1162/tacl_a_00349

Sadaf, A., Kim, S. Y., & Wang, Y. (2021). A comparison of cognitive presence, learning, satisfaction, and academic performance in case-based and non-case-based online discussions. *American Journal of Distance Education*, *35*(3), 214-227. https://doi.org/10.1080/08923647.2021.1888667

Shea, P., & Bidjerano, T. (2009). Community of inquiry as a theoretical framework to foster "epistemic engagement" and "cognitive presence" in online education. *Computers & Education*, *52*(3), 543- 553. https://doi.org/10.1016/j.compedu.2008.10.007

Sadaf, A., & Olesova, L. (2017). Enhancing cognitive presence in online case discussions with questions based on the practical inquiry model. *American Journal of Distance Education, 31*(1), 56-69. https://doi.org/10.1080/08923647.2017.1267525

Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE Review*, *46*(5), 30-32.

Viberg, O., Hatakka, M., Bälter, O., & Mavroudi, A. (2018). The current landscape of learning analytics in higher education. *Computers in Human Behavior, 89*, 98-110. https://doi.org/10.1016/j.chb.2018.07.027

Zhu, M., Bonk, C. J., & Sari, A.R. (2018). Instructor experiences designing MOOCs in higher education: Pedagogical, resource, and logistical considerations and challenges. *Online Learning, 22*(4), 203-241. https://doi.org/10.24059/olj.v22i4.1495

Appendix

Table A.1
Summary of Existing Literature in the Application of Machine Learning to Online Learning Research

Example Literature		**Study Purpose & Scope of ML Application**	**Online Learning Setting**	**Methodology for ML Analysis**
Authors	Year			
Kovanović et al.	2016	Explored a set of linguistic features of online discussion messages and tested automation of cognitive presence classification	Online Master's level course in software engineering	Random forest classification
Al- Shabandar et al.	2019	Predicted online student performance/dropout and detected at-risk students based on their motivation trajectories & clickstream behaviors	Undergraduate-level MOOCs with various course topics	Random forest classification, generalized linear model, gradient boosting, neural networks, feature selection
Hew et al.	2020	Predicted student satisfaction with MOOCs using data collected through text mining	Randomly selected MOOCs from *Class Central* course metadata	Gradient boosting
Hayati, Idrissi, & Bennani	2020	Classified students into one of four levels of cognitive engagement (i.e., passive, active, constructive, interactive) based on their cognitive behaviors & social interactions within discussion forums	Online courses in software engineering	Support vector machines -based classifier
Neto et al.	2021	Explored a set of linguistic features of online discussion messages (written in Brazilian Portuguese) that can predict the phases of cognitive presence	Online undergraduate courses in biology & technology	Random forest classification

Designing an Online Discussion Strategy with Learning Analytics Feedback on the Level of Cognitive Presence and Student Interaction in an Online Learning Community

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Abstract
This study investigated the impact of using a discussion strategy with learning analytics on the level of student cognitive presence and interaction. The study used a quasi-experimental design with control and experimental groups. The experimental group applied open-ended discussion and elaborated feedback with learning analytics while the control group applied open-ended discussion and elaborated feedback without learning analytics. A mixed-method approach was used in this study. Data were collected through content analysis, social network analysis (SNA), and interviews. The results showed that the level of cognitive presence in the experimental group increased more than the control group. SNA revealed that students in the experimental group developed more cognitive learning ties with their peers during the process of developing cognitive presence. Interview data showed that students found that the discussion strategy with learning analytics made them aware of their level and quality of interaction and their role in building knowledge in an online learning community. In addition, they felt that the discussion strategy with learning analytics increased their motivation to participate in the discussion. This study provides recommendations on how students can enhance their cognitive presence and learning experience in an online learning community.

Keywords: Online discussion, cognitive presence, learning analytics, student interaction, social network analysis

Alwafi, E.M. (2022). Designing an online discussion strategy with learning analytics feedback on the level of cognitive presence and student interaction in an online learning community. *Online Learning, 26*(1), 80-92. DOI: 10.24059/olj.v26i1.3065

Recent years have witnessed heightened research interest in the relationship between online discussions and quality of learning. Online discussions can provide students with opportunities to build knowledge collaboratively by fostering critical discussions. Garrison, Anderson, and Archer (2001) developed the community of inquiry model (CoI) to improve students' engagement in an online learning environment. Cognitive presence is considered crucial to enhancing the depth of a discussion. Studies show that social interaction and the density of cognitive learning ties play a role in the cognitive process (Alwafi, Downey & Kinchin, 2020). Therefore, both cognitive presence and social interaction need to be considered in any assigned online discussion. Previous literature found that a teacher's use of discussion strategies such as open-ended and elaborated feedback can influence the level of cognitive presence and social interaction (Van Der Kleij et al., 2015; Lee & Recker, 2021). Prior studies also have found that incorporating learning analytics into learning activities can improve students' reflection and awareness of academic outcomes (Koh et al, 2019; Arnold, 2012). Several studies recommend incorporating learning analytics as feedback to increase students' awareness of knowledge building, cognitive presence, and learning behaviour (Kovanović, 2017). Based on a literature review, this study anticipated that a teacher's use of discussion strategies with learning analytics feedback would enhance the level of student cognitive presence and social interaction. Therefore, this study employed an experimental design to investigate the impact of using a discussion strategy with learning analytics on the level of cognitive presence and the development of cognitive learning ties in students.

Literature Review

Cognitive Presence and Online Discussion

The community of inquiry model (CoI) was developed by Garrison, Anderson, and Archer (2001) in response to the increased focus on enhancing the quality of critical discussion in online learning environments. This model was used to evaluate the quality of interaction as well as to enhance online engagement to reach higher-level learning. CoI concentrated the development process of deep learning and the role of students in the process of knowledge building through different types of presence: cognitive, teaching, and social (Garrison & Anderson, 2003). Cognitive presence can be defined as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse" (Garrison & Arbaugh, 2007, p. 161). One of the key elements of CoI is cognitive presence, which focuses on students' engagement in the knowledge-building process through discussion and interaction in an online learning environment. Cognitive presence is categorised into four phases:

1. The triggering event phase involves contributions that question or identify the problem.
2. The exploration phase focuses on searching for and sharing information.
3. The integration phase focuses on constructing meaning from the information developed in the exploration phase.
4. The resolution phase focuses on examining and evaluating the solution or idea. (Garrison et al, 2000)

Studies of online learning have found some contributory factors related to discussion design that plays a role in enhancing the level of cognitive presence in an online environment. Gašević et al. (2015) found that discussion and course design affect the level of cognitive presence. For example, discussion strategies can enhance the quality of the discussion and student participation (Lee & Recker, 2021). Ertmer et al. (2011) investigated the influence of different kinds of questions on student engagement and found that open-ended questions increased participation in an online learning environment. Another factor that may affect the level of cognitive presence is the role of teachers. An et al. (2009) found that instructor facilitation affects student participation. Also, Zhu (2018) found that teacher facilitation in an online discussion can increase the level of cognitive presence and lead to higher-order thinking. Studies have also found that teacher feedback has an influence on cognitive presence. Van Der Kleij et al. (2015) found that elaborated feedback had a positive impact on student learning and engagement. Therefore, this study suggests that using open-ended questions and elaborated feedback may contribute to a positive learning experience.

Cognitive Presence and Social Interaction

Studies about online learning argue that engagement in an online discussion should not only focus on the quality of posts and level of cognitive presence but also on the students' social structures, interactions, networking, and the distribution of students' ties in the network (Alwafi et al., 2020). Developing cognitive presence requires students to establish interactive relationships with others. Social network analysis can be used as a method to understand students' interaction and process of building knowledge in an online environment (Rienties et al., 2012). Although social presence can provide indicators about how the learner recognizes the presence of other learners in the interaction, the social network can provide insight on the structure. Network approach can provide insight about the impact of instructional strategy on students' cognitive presence in an online learning environment (Rolim et al., 2019). The main elements of SNA are node and link. The node represents social entities such as individuals or organisations while the link represents the relations between the social entities. SNA has been used to examine the dynamics of knowledge building, cognitive presence processes, and group interaction (Alwafi et al., 2020). SNA can identify active participants in online discussion and examine the density of their interactions. Studies on social interaction recommend examining the process and structure of knowledge building in an online learning environment (Shea et al., 2010; Alwafi et al., 2020).

Learning Analytics and Student Participation in an Online Learning Activity

Learning analytics can be described as gathering, analysing, and reporting data related to learners' activities in an online learning environment (Siemens & Gašević, 2012). Learning analytics can be used as feedback to enhance the student learning process (Koh et al, 2019). Studies have found that learning analytics encourage student reflection, increase understanding and recognition of the learning process, and improve academic outcomes and achievements (Arnold et al, 2012). Designing an online discussion with learning analytics feedback can create an effective learning environment that enhances the quality of the discussion. Several studies recommend incorporating learning feedback to increase students' awareness of knowledge building, cognitive presence, and learning behavior (Kovanović, 2017). However, previous studies on the use of learning analytics do not investigate the use of discussion strategy with learning analytics, or, more specifically, the use of learning analytics with elaborated feedback to enhance the quality of the online discussion and social structure of the knowledge building process.

Hence, whether the use of discussion strategies with learning analytics impacts the level of cognitive presence and social interaction in students was the question at the centre of this study. It employed an experimental design to investigate the impact of open-ended questions and elaborated feedback with learning analytics on the level of cognitive presence and the development of cognitive learning ties.

Research Hypothesis and Questions

Based on a literature review, this study expected that the use of discussion strategies with learning analytics feedback would enhance the level of student cognitive presence and social interaction. Therefore, the following research questions were formulated:

RQ1: What is the impact of a discussion strategy with learning analytics feedback on the level of cognitive presence?

RQ2: What is the impact of a discussion strategy with learning analytics feedback on social interaction?

RQ3: What are students' perceptions of the use of learning analytics as a method of feedback on their cognitive learning process?

Methodology

Participants

In Spring 2020, the 41 participants in this study were enrolled in an online course focused on the issues related to e-learning tools as part of a master's programme in e-learning at a university in Saudi Arabia. All participants in this study were female and their average age was 29.

Research Design

This study used a pre-test/post-test control and experimental group design. This design allowed for the exploration of the differences between the open-ended discussion supported by elaborated feedback-based learning analytics and the learning environment without the learning analytics feedback.

Participants were randomly allocated to either an experimental or control group. Twenty-one students were allocated to the experimental group and twenty students were assigned to the control group. This study had two iterations: one before the intervention and one after the intervention. In the first iteration, students were engaged in an online learning activity that involved open-ended discussion supported by elaborated feedback without applying feedback-based learning analytics in both groups to measure the level of cognitive presence and pattern of interaction. In the second iteration, students in the experimental group were engaged in an online learning environment supported by feedback-based learning analytics. The open-ended and elaborated feedback focused on asking students to offer some clarification, justification, or evidence for their answer such as "What is your evidence?" and "Can you explain to us how you reached this conclusion?" In terms of learning analytics, tracked data included number of posts, word count submitted, number of students interacted with and number of reciprocal ties, and duration of participation in the online learning environment. This feedback was sent to students via weekly email.

The control group did not have learning analytics feedback. After the second iteration, students measured their cognitive presence and patterns of interaction. At the end of the experiment, the experimental group was interviewed to explore their perception of, and experience with, an online learning environment supported by feedback-based learning analytics.

Online Learning Activities

This study focused on a two-credit e-learning course that lasted for 16 weeks. The course focused on current problems in e-learning design and solutions for design implementation. Students were involved in several learning activities through the discussion forum that concentrated on solutions to current issues in e-learning environments and the effective design of e-learning environments. Study activities had no relationship to, or bearing on, student course grade.

The experimental group in the second iteration received feedback-based learning analytics every week. Feedback included information related to the number of posts, word count submitted, number of students interacted with and number of reciprocal ties, and duration of participation in the online learning environment. Instructors provided elaborated feedback with learning analytics in weekly emails.

Content Analysis of Students' Posts

To examine the level of cognitive presence in an online learning activity (RQ1), the study analysed students' posts. This study used the cognitive presence coding schema proposed by Garrison et al. (2001). The coding schema consist of four categories: Triggering, Explanation, Exploration, and Resolution. Content analysis was performed manually.

To test the reliability of content analysis, inter-rater reliability was applied. Two coders experienced in content analysis analysed the coding sample independently. The inter-rater reliability between coder 1 and 2 was 0.78, between coder 1 and 3 it was 0.80, and between coder 2 and 3 it was 0.82. The value of inter-rater reliability represents excellent agreement (Krippendorff, 1980).

Student Interaction with Others Using Social Network Analysis

SNA was applied to examine the form of social communication among students (RQ2). A social network consists of nodes (actors) and ties among actors. In this study, the interaction in an online learning community was translated into a social network by observing who replied to others posts. The social network data collected in this present study for the SNA involved all student interaction (posts) in online discussion forms. The social network data centered on the flow of interactions, in terms of sent and received posts.

In this study, both whole network analysis and ego network analysis were used. Two measures of SNA were applied to determine the level of students' interaction in developing cognitive learning ties: whole network density and ego network density (size). The whole network density measured the overall level of interaction among students in an online learning activity. The network density can be calculated as the number of all actual links divided by the number of all possible links. The ego network density was measured for each student to examine the number of actors connected by the ego network (Reinties et al., 2012).

Interview

Semi-structured interviews were conducted at the end of study to explore students' perceptions of open-ended questions supported by learning analytics feedback. Interviews were conducted with six students individually. Interview questions were designed to understand their experiences in engaging in this learning environment. Specifically, students were asked about their perceptions of the use of learning analytics as a method of feedback on their cognitive learning process. Sample questions included: "How did the feedback that you received help you in the course?"; "How did the feedback that you received affect your engagement and contribution in the discussion form?"; "How did the feedback that you received affect your social interaction with your peers?" All interviews were conducted online synchronously and took around 15-20 minutes. Thematic analysis was applied to the interview transcripts using the six steps of thematic analysis developed by Clarke and Braun (2006). These steps begin with an overview of the gathered data, followed by the coding process, creation, and revision of themes, and providing name to the themes (Clarke & Braun, 2006). Two experts studied the interview questions to assess the trustworthiness of the interview process. Also, a member check was done by sending the interview transcript to the interviewees to check the clarity and accuracy of the interview.

Statistical Analysis

Data normality was examined by visually reviewing the curve of normal distribution and by analysing the skewness and kurtosis value of the dependent variables. The data fell within acceptable limits ± 1.96 (Hair, Black, Babin & Anderson, 2010). An independent t-test was used to measure differences between the groups for cognitive presence and ego network size, and a paired sample t-test was applied to measure differences within the groups. The UCINET v6.658 and NetDraw v2.163 software tool was used to analysed social network data.

Results

Research Question 1: Change in Cognitive Presence

In terms of the volume of student posts, as seen in Table 1, both groups made a similar level of posts in all categories in the first iteration. The highest percentage of posts were in the explanation category, followed by exploration, trigger, and resolution. Table 1 shows that there was an increment increase in all categories of cognitive posts for the experimental group in the second iteration. However, the control group only saw an increase in explanation and trigger posts. Table 2 examines changes in cognitive presence before and after the intervention for both the control and experimental groups. The results of a paired-sample t-test show a significant increase between the first and second iteration in the mean of all categories of posts in the experimental group, while in the control group there was only a significant change in the mean of explanation and trigger. In terms of group differences, the independent t-test shows that there was a significant increase in all categories of cognitive posts between the control and experimental groups in the second iteration, with the experimental group posting more (see Table 1).

Table 1

The Differences Between Control and Experimental Group in Cognitive Presence

		Experimental group		Control group		
		M	**S.D**	**M**	**S.D**	**T-test**
Before the intervention	Triggering event	0.95	0.66	0.98	0.56	0.25
	Exploration	3.23	1.30	3.10	1.07	-0.37
	Integration	2.33	1.54	2.20	1.15	-0.37
	Resolution	0.67	0.57	0.65	0.59	-0.09
During the intervention	Triggering event	1.55	0.70	1.38	0.69	0.70*
	Exploration	5.05	1.32	4.45	1.85	-1.19*
	Integration	8.14	1.90	2.65	1.66	-9.85**
	Resolution	1.86	0.96	0.95	0.76	-3.33**

Table 2
Within-group Differences in Cognitive Presence

		Mean differences	T-test
Control group	Triggering event	-0.60	-2.97*
	Exploration	-1.35	-3.77*
	Integration	-0.45	-1.50
	Resolution	-0.95	-1.67
Experimental group	Triggering event	-0.40	-2.08*
	Exploration	-1.81	-5.58**
	Integration	-5.81	-18.54**
	Resolution	-1.19	-6.25**

Research Question 2: Change in Pattern of Interaction

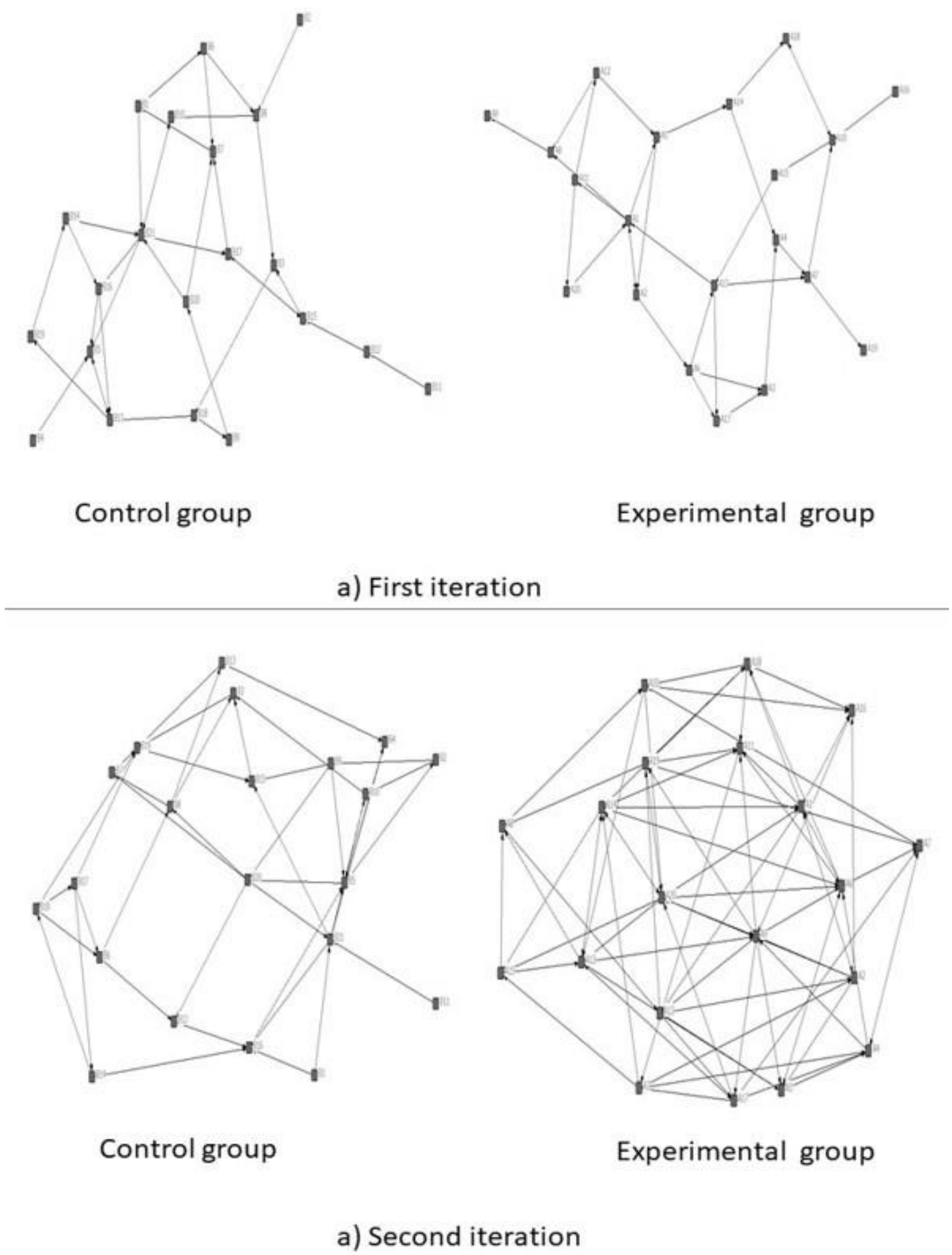
The second research question examined the effect of using learning analytics as feedback on patterns of interaction in online learning environments. Table 3 shows no obvious change between the density of the whole network for the control and experimental groups in the first iteration. In the second iteration, the experimental group saw an increase in the value of the density but only a slight increase in the density of the network for the control group.

Table 3
T-test of Network Density

Group	Density for iteration 1	Density for iteration 2	T-test
Experimental Group	0.086	0.25	-5.29*
Control Group	0.08	0.10	-1.4

Figure 1 shows the experimental and control group networks in different iterations. It appears that the cognitive network of the experimental group became denser over time as the number of links among students increased. However, the number of links among students in the control group did not show an obvious change from the first to the second iteration. To examine the difference between the networks within the groups, the study used a permutation test called a paired sample t-test, which was appropriate for examining the whole network data. As seen in Table 3, results showed that the density of the whole network changed significantly from the first to second iteration, while the control group did not change in the value of the density over time**.**

Figure 1
Visualisation of the Experimental and Control Group Networks



In terms of the ego network size, results showed significant differences between the control and experimental groups in the first iteration (See Table 5). However, in the second iteration, the experimental group showed more significant growth in the mean of the network size than control group. This means that students in the experimental group engaged more with their peers in developing cognitive presence than in the control group in the second iteration.

Table 4
The Differences Between the Control and Experimental Group in the Ego Network Size

	Experimental group		**Control group**		
	M	S.D	M	S.D	T-test
Iteration 1	2.90	1.34	2.84	1.46	-0.24
Iteration 2	7.01	1.65	3.75	1.71	0.89**

Research Question 3: Students' Perceptions of Their Learning Environment Supported by Learning Analytics Feedback

In response to RQ3 that focused on examining students' perceptions of their learning environment through learning analytics feedback, an interview was conducted with students in the experimental group. Interview data were coded, and two main themes were developed: an increase in motivation and raising awareness of engagement.

Throughout the interview, all students claimed a positive experience when using learning analytics as feedback in the online learning environment. One of the main themes that emerged from the interview was that learning analytics feedback increased students' motivation to participate in the online discussion. Students acknowledged that the learning analytics feedback encouraged them to participate in the online discussion. For example, one student said that "the statistical data showed me my participation in the discussion and encouraged me to participate in each online activity." The second theme that emerged from the interview was raising awareness of engagement. Students found learning analytics feedback enhanced their engagement in an online learning environment. For example, one student said that "the descriptive data about the number of my posts let me think and evaluate my level of participation and reinforce me to post more." Also, students found that learning analytics increased their awareness of the number of peers they connected with directly. For example, one student said that "the numbers of my contacts in the discussion forms promote me to develop my connection and not focus on small number of peers."

Discussion

This study attempted to respond to gaps in the literature related to teachers' uses of discussion strategies with learning analytics and how they impact the level of cognitive presence and interaction in students. The first research question was open-ended and focused on examining the impact of elaboration feedback with learning analytics on the level of cognitive presence. This study found that using learning analytics-based elaboration feedback increased the level of cognitive presence. Moreover, it allowed students to engage in higher-order thinking. Students in the experimental group saw increases in the exploration and resolution categories more than the control group. Students in the experimental group also engaged in exploration more than explanation. One possible explanation for this result is that learning analytics data may make students aware of their contribution in the discussion forum and allow them to evaluate themselves. Koh, Jonathan, and Tan (2019) found that learning analytics can increase critical thinking. This implies that students may find that learning analytics feedback helps them to reflect on their participation and improve the quality of their contribution in the discussion forum.

The second research question examined the impact of learning analytics feedback on patterns of interaction. Findings indicated that the whole density of the network increased over time and the network size of students in the experimental group increased after the intervention. Qualitative data provided an explanation for this development. As shown in the interview, students found that learning analytics made them aware of their connections. Recent studies show that teachers' awareness of their networking and connections with others can play a crucial role in improving and developing their network (Van Waes et al., 2019). Verbert, Duval, Klerkx, Govaerts, and Santos (2016) argue that learning analytics can help students become aware of their learning behaviour which consequently leads them to improve it. The findings of this study suggest that learning analytics enhance students' social learning and networks.

The third research question focused on understanding students' perceptions of their learning environment supported by learning analytics feedback. Students found that the discussion strategy with learning analytics feedback made them aware of their level and quality of interaction and their role in building knowledge in an online learning community. In addition, they felt that the environment increased their motivation to participate in the discussion. This finding is consistent with studies (e.g., Wise, Zhao, & Hausknecht, 2014) on learning analytics which found that students value learning analytics as they make students aware of their progress and motivate them to participate. This implies that designing online discussions with learning analytics feedback can create interactive learning environments that maximise student engagement and motivation.

Limitations and Future Direction

This study has several limitations that need to be considered. First, the number of participants was relatively small. Future research should be replicated with a larger number of participants. Second, this study only examined students' perceptions. Future research should interview teachers to understand the benefits of using learning analytics feedback in online discussions from different perspectives. Another limitation is related to the study sample itself, since most participants were teachers and therefore may have prior experience with the discussion forum with their own students. Thus, replicating this study with non-teacher undergraduates who might not face the experience of using online discussion might provide different results. Therefore, future study can replicate this study to other populations of online learners. Finally, this study only focused on the impact of learning analytics feedback on students' cognitive presence and their cognitive learning ties. The relationship between students' network positions, centrality, and the types of cognitive presence posted were not investigated. Future research should examine the centrality of the individual network and the depth of the discussion.

Conclusion

This study examined the impact of teachers using a discussion strategy with learning analytics on the level of cognitive presence and interaction in students. The study found that the learning environment supported by learning analytics increased the level of cognitive presence in online discussions as well as the density and cognitive learning ties among students. The study also found that the discussion strategy with learning analytics increased students' awareness of their level and quality of interaction, their role in building knowledge in an online learning community, and their motivation to participate in the discussion. Findings from this research have practical implications for enhancing the design of online discussions. Learning analytics can incorporate teachers' feedback during participation in an online learning environment. The learning analytics feedback should include different kinds of learning analytics data such as level of participation, quality and type of contribution, and social network data. This information can be used to guide students' learning behaviour and make students aware of their cognitive and social learning development in an online learning environment.

Declarations

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The author(s) assert that approval from an ethics review board (IRB) was obtained but declined to include the name of the board that reviewed study.

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References

Alwafi, E. M., Downey, C., & Kinchin, G. (2020). Promoting pre-service teachers' engagement in an online professional learning community: Support from practitioners. *Journal of Professional Capital and Community. 5*(2), 129-146

An, H., Shin, S., & Lim, K. (2009). The effects of different instructor facilitation approaches on students' interactions during asynchronous online discussions. *Computers & Education, 53(*3), 749-760.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education, 10*(3), 157-172.

Garrison, D., & Anderson, T. (2003*). E-learning in the 21st century: A framework for research and practice*. Routledge.

Garrison, D., Anderson, T. and Archer, W. (2001). Critical thinking, cognitive presence and computer conferencing in distance education, *American Journal of Distance Education, 15*, 7-23.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education model. *The Internet and Higher Education, 2*(2-3), 87-105.

Gašević, D., Adesope, O., Joksimović, S., & Kovanović, V. (2015). Externally-facilitated regulation scaffolding and role assignment to develop cognitive presence in asynchronous online discussions. *The Internet and Higher Education, 24*, 53-65.

Hair Jr., J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). *Multivariate Data Analysis: A Global Perspective*. (7th ed.). Pearson Education, Upper Saddle River.

Koh, E., Jonathan, C., & Tan, J. P. L. (2019). Exploring conditions for enhancing critical thinking in networked learning: Findings from a secondary school learning analytics environment. *Education Sciences*, *9*(4). https://doi.org/10.3390/educsci9040287

Krippendorff, K. (1980). *Content Analysis: An Introduction to its Methodology*. Sage.

Lee, J. E., & Recker, M. (2021). The effects of instructors' use of online discussions strategies on student participation and performance in university online introductory mathematics courses. *Computers & Education, 162*, 104084.

Shea, P., Hayes, S., Vickers, J., Gozza-Cohen, M., Uzuner, S., Mehta, R., ... & Rangan, P. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *The Internet and Higher Education*, 13(1-2), 10-21.

Van der Kleij, F. M., Feskens, R. C. W., and Eggen, T. J. H. M. (2015). Effects of Feedback in a Computer-Based Learning Environment on Students' Learning Outcomes. *Review of Educational Research. 85* (4), 475–511. doi:10.3102/0034654314564881

Van Waes, S., De Maeyer, S., Moolenaar, N. M., Van Petegem, P., & Van den Bossche, P. (2019). Strengthening networks: A social network intervention among higher education teachers. *Learning and Instruction, 53*, 34-49.

Verbert, K., Duval, E., Klerkx, J., Govaerts, S., & Santos, J. L. (2013). Learning analytics dashboard applications. *American Behavioral Scientist, 57*(10), 1500-1509.

Rienties, B., Giesbers, B., Tempelaar, D., Lygo-Baker, S., Segers, M., & Gijselaers, W. (2012). The role of scaffolding and motivation in CSCL. *Computers & Education*, *59*(3), 893-906.

Rolim, V., Ferreira, R., Lins, R. D., & Găsević, D. (2019). A network-based analytic approach to uncovering the relationship between social and cognitive presences in communities of inquiry. *The Internet and Higher Education, 42*, 53-65.

Wise, A. F., Zhao, Y., & Hausknecht, S. N. (2014). Learning analytics for online discussions: Embedded and extracted approaches. *Journal of Learning Analytics, 1*(2), 48-71.

Evaluating a Structured Online Peer Evaluation System Among Graduate-Level Communication Capstone Students Through Action Research

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Abstract
Although enrollment in online courses continues to accelerate, challenges exist in online learning. A failure to experience collaboration and interaction can impact student retention and success. While peer review activity promotes student interaction, a collaborative community of learners, and critical thinking skills, higher education environments have failed to equip students with the knowledge and tools to ensure adept participation. As students offered limited participation and low-quality engagement in routine online peer review activities, the purpose of this action research was to implement and evaluate the impact of a structured online peer evaluation system for Graduate Communication Capstone students at the University of North Coast Muscari (UNCM). This study incorporated a structured peer evaluation system, including an interactive educational technology peer review tool kit innovation. The theoretical framework of the innovation was aligned to learning theory and grounded in Vygotsky's zone of proximal development, cognitive and mind tools, and Constructivist theory of cognitive apprenticeship. Data collection offered seven methods and data analysis included quantitative and qualitative approaches as part of a triangulation mixed methods design. Community of Inquiry (CoI) deductive analysis was performed to denote social and cognitive presences, while further validating the themes that had emerged through qualitative data analysis. As an impact of this research study, students used the structured peer evaluation system to transform anxiety into social and cognitive freedom, producing a focused, responsible approach to peer learning.

Keywords: Constructivism, cognitive apprenticeship, community of inquiry, ed tech, peer review

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Enrollment in online courses continues to accelerate (Hart et al., 2021; Picciano, 2019) as the use of web-based technology continues to extend “the boundaries and pedagogies of teaching and learning” (Cheng & Chau, 2016, p. 257). In the tenth annual report of *Changing Course: Ten Years of Tracking Online Education in the United States*, the rate of online enrollments far exceeded those across higher education overall (Allen & Seaman, 2013). In 2016, 72% of public universities and 50% of private, non-profit educational institutions offered completely online programs (Xu & Xu, 2019). In research conducted in January and February 2020, more than half of online college students noted that if their online programs became unavailable, they would seek a comparable online program as on-campus enrollment was not an option (Magda et al., 2020). Of those students surveyed, one-third expressed a desire to take additional online courses following their degree completion (Magda et al., 2020).

However, there are challenges to success in the online learning environment. Engaging students in online learning is not an easy endeavor. Regular participation frequently involves a small number of students while others wait and engage very little or not at all (Barría et al., 2014). This difference in interaction relative to face-to-face courses can lead to feelings of isolation for learners (Negash, 2008; Yuan & Kim, 2014). The failure to experience collaboration and a lack of interaction are among the factors impacting student retention and success in the online environment (Conrad & Donaldson, 2004; Heyman, 2010; Lee & Choi, 2011, Willging & Johnson, 2009).

Despite the various merits of online learning, the lack of physical presence and face-to-face interaction can offer the absence of spoken and visual cues (Alman et al., 2012) and cause students to suffer from feelings of loneliness and inadequate social engagement (Purarjomandlangrudi et al., 2016). As participation is an inherent factor of learning (Wenger, 1998), its importance is paramount. In a study that examined the correlation between online participation and grades, those students who failed one or more of the learning modules interacted less often than peers who attained passing grades (Davies & Graff, 2005). In turn, an elevated level of student participation and activity has the potential to offer a positive impact on academic achievement and deliver a stronger e-learning experience (Cheng & Chau, 2016; Huang et al., 2012; Michinov et al., 2011).

The peer review process has many benefits and is an important tool in online higher education learning environments. During peer review, students employ critical thinking skills (Demirbilek, 2015; McMahon, 2010), gain insight into different perspectives (Hogg, 2018), and engage writing and organizational skills (Man et al., 2018). Most important, peer review provides the opportunity for student interaction and collaboration within the online environment and encourages the development of a community of learners (Moneypenny et al., 2018).

Even so, to reap the benefits of peer review, students must choose to actively take part. Although peer review is lauded as an effective, collaborative online tool that allows students to experience analysis, synthesis, and evaluation processes (Demirbilek, 2015; Li et al., 2010; Lynch et al., 2012), higher education environments fail to equip students with the knowledge and tools related to peer review assessment (Nicol et al., 2014). Specifically, students do not receive sufficient preparation and training to formulate and deliver feedback to their peers, nor do they receive guidance on how to interpret the feedback received (Nicol et al., 2014). For peer review to be a successful learning opportunity, online students must receive strong guidance on how to fully participate and become actively engaged in the process.

Literature Review

The review of literature includes conceptualizing peer review through theoretical alignment, advantages and disadvantages of peer review, and an examination of peer review tools and methods.

Theoretical Alignment to Peer Review

Peer review offers an interactive experience through which knowledge is constructed collaboratively. In turn, peer review aligns to the learning theory of constructivism as per John Dewey (1916, 1938): Constructivism is not the act of telling or being told, but a constructive process. As opposed to knowledge that is passed from instructor to learner through rote memory, constructivism provides for the creation of knowledge through experience (Dewey, 1938; Ertmer & Newby, 2013; Jaramillo, 1996) and through contexts that have the capacity to enhance student learning (Biggs, 2011).

In alignment with the social constructivist theory of learning, peer review provides a collaborative culture of learning. Vygotsky’s (1962) social constructivist theory of learning claims that students’ skills and knowledge are shaped through cultural interaction. Learning becomes a social activity where learners interact and cognitive growth is stimulated (Schunk, 2008).

During peer review activities, participants experience the attributes of the constructivist theory of cognitive apprenticeship. Students are able to learn through observation, imitation, and modeling (Collins, 1988; Collins et al., 1987). Correspondingly, the methods dimension of cognitive apprenticeship seeks to adapt student behaviors into genuine practices through activities and social engagement opportunities (Brown et al., 1989).

Advantages and Disadvantages of Peer Review

Although peer review is often heralded for the benefits it provides, research findings indicate that there are perceived advantages and disadvantages to its implementation.

Benefits

Through participation in peer review, higher education students relay experiences in critical reflection and deeper learning (Demirbilek, 2015; McMahon, 2010). During this period of higher order thinking, students become more intently probative and delve deeper into cognitive processes (Ching & Hsu, 2013, 2016). Furthermore, skills developed during peer review, such as research, writing, teamwork, problem solving, and organization, can be highly transferrable to professional practice and leadership roles (Chittum & Bryant, 2014; Gikandi & Morrow, 2016; Hogg, 2018, Llado et al., 2014; Man et al., 2018).

Through meaningful and active engagement in peer review, students offer inquiries, deliver positive commentary, and identify areas for improvement (Ching & Hsu, 2016; Gikandi & Morrow, 2016). By way of shared perspectives and offers of feedback and guidance, students move from hesitation to active engagement within a robust learning community (Dar et al., 2014; Gikandi & Morrow, 2016; Kearney, 2013). In addition, the exchange of information during peer-to-peer feedback allows students to increase comprehension and learn new approaches through exposure to different perspectives (Demirbilek, 2015; Gikandi & Morrow, 2016; Hogg, 2018).

When learners are aware of an upcoming peer review task, they can offer increased motivation and care in the preparation of their work (Dar et al., 2014; Llado et al., 2014). In interdisciplinary research by Llado et al. (2014), university students reported that peer assessment prompted them to take additional time to prepare stronger work. Therefore, peer review serves as an effective strategy to prompt students to plan ahead, engage in formative feedback, and revise work prior to final submission (Baker, 2016).

Persistent Issues and Concerns

While research findings indicate numerous advantages to peer review, issues and concerns remain. Frequently, students admit that it can be difficult to critically assess the work of peers (Demirbilek, 2015; Llado et al., 2014; Mulder et al., 2014) due to friendships and the potential for damaged relationships (Hogg, 2018; McMahon, 2010). For example, undergraduate students at a New Zealand university reported concerns over the fairness of peers' assessment, stating that established relationships made it harder to critique than to deliver praise (Hogg, 2018).

When students associate limitations, distaste, or low value with peer review, their motivation to participate may diminish, and they may resist engagement (Brill, 2016; Wang, 2016; Zong et al., 2022). Even when students receive proper peer review training, some students may not take peer review seriously and consider it to be unrealistic and a waste of time (Dar et al., 2014).

Students can experience anxiety and intimidation as they consider the level of responsibility and the amount of time required to mark the work of their peers (Llado, et al., 2014; Moneypenny et al., 2018). In research by Nagori and Cooper (2014), postgraduate students acknowledged questioning both their peer review abilities and those of their classmates, reporting that it had been an unsettling experience. Furthermore, students share their concern about peers reviewing their work and observing their weaknesses (Dar et al., 2014; Llado et al., 2014).

Peer Review Tools and Methods

Research indicates that there are opportunities to utilize peer review tools in support of the processing and management of peer review activities (Caddy, 2014; Mulder et al., 2014; O'Connor & McGuigge, 2013; Sridharan et al., 2018). PRAZE, an electronic peer review management tool, was reported to be useful in distributing articles to ensure that each article received multiple reviews (Mulder et al., 2014). Similarly, in undergraduate research by Caddy (2014), the online tool SPARKPLUS recorded a high level of group peer review engagement and delivered a reduction in social loafing.

The use of forms serves to clarify expectations and standardize feedback within a structured peer review environment (Baker, 2008, 2016; Dijks et al., 2018; Gielen & De Wever, 2015; McMahon, 2010; Mulder et al., 2014; Tricio et al., 2018). A highly structured feedback form can provide students with the competencies and main criteria that need to be assessed and marked by assessors (Baker, 2008, 2016; Dijks et al., 2018). Additionally, rubrics can be utilized to guide proper evaluation and to assist students in creating constructive feedback (Baker, 2016; De Grez et al., 2012; Elshami & Abdalla, 2017; Gikandi & Morrow, 2016; Kelly, 2015; Llado et al., 2014; Ng, 2018; Ratminingsih et al., 2017). Sridharan et al. (2018) asserted that by infusing criterion-based rubrics into the peer assessment process, a common understanding of anticipated standards could be achieved.

The integration of scripts and prompts can assist students in creating feedback and serve as a framework for analysis (Ching & Hsu, 2013, 2016; Nicol et al., 2014). In addition, exemplars and guides, such as instructional procedures for peer assessment, can prove beneficial for leading and directing students in their review of peer work and in the creation of feedback (Brill, 2016; Dar et al., 2014; Nagori & Cooper, 2014; Wang, 2016). In research by Reinholz (2018), the use of reflective questions, checkboxes, and hints was reported to offer guidance for students. Furthermore, research involving graduate instructional design students suggested the need to support peer review efforts through scaffolding and ample resources, such as checklists and models (Brill, 2016).

Numerous opportunities exist for peer review activities within the online course design, software, and Learning Management System (LMS) of higher education institutions (Gikandi & Morrow, 2016; Hampel & Pleines, 2013; Nicol et al., 2014). By creatively utilizing the asynchronous discussion forums, students can post and share their work for active conversation and collaboration (Gikandi & Morrow, 2016). Furthermore, institutions may choose to select external peer review environments to entice users with well-known, popular settings. Research asserts that wiki sites, Facebook, and Twitter are compelling platforms for social and collaborative peer learning (Demirbilek, 2015; Evans, 2015).

Research Purpose and Direction

The existing Graduate Communication (GRAD COM) Capstone environment at the University of North Coast Muscari (UNCM) (a pseudonym) lacked a structured online peer evaluation system with effective peer evaluation tools to prepare students for peer assessment, promote peer review participation, and ensure that students received the benefits associated with peer review, whether giving or receiving feedback. Students offered limited participation and low-quality engagement in routine online peer review activities and until the dilemma was fully addressed and rectified, it was assumed that peer review participation would remain low. Therefore, two primary research questions guided this action research study.

Research Questions

1. How does using a structured peer evaluation system impact the peer review process in an online Graduate Communication Capstone classroom at UNCM?

2. What are the perceptions of students regarding a structured peer evaluation system in support of online asynchronous peer review activity in a Graduate Communication Capstone classroom at UNCM?

Method

This action research study was conducted at the College of Online and Continuing Education (COCE) at UNCM. The private nonprofit university, which currently enrolls over 135,000 students, hosts over 200 programs. The research took place in the GRAD COM Capstone classroom via the online Brightspace Desire to Learn (D2L) LMS. Study participants included a convenience sample of students participating in their final course in support of an MA in Communication degree.

Of the 14 Capstone students who received the UNCM IRB Consent Form as an invitation to participate in the study, seven students signed the IRB Consent Form and consented to study participation. All seven study participants participated in the preterm and post-term questionnaires with six of the seven students participating in one-on-one interviews. Additional demographic information about participants was not able to be gathered and reported due to UNCM IRB restrictions.

Innovation

An interactive peer review tool kit was created as part of the structured peer evaluation system for this study. The innovation offered foundational alignment to learning theory and was designed to promote participation and empower students to engage and provide feedback at a higher-quality level. As students can feel detached from dialogue and direction in the online classroom, the tool kit allowed the instructor to provide access to helpful resources so that students could determine which ones worked best for them (Schrenk et al., 2021).

In alignment with Vygotsky's (1978) work with students of similar mental development and their ability to handle problems independently up to a certain level of difficulty, all GRAD COM students were positioned to enter the Capstone course with similar course and credit hour profiles. In turn, the Capstone innovation was positioned to elevate students of similar standing from independent problem-solving levels at the lower end of the zone of proximal development to a higher level of knowledge (Vygotsky, 1978). This was accomplished through the provision of scaffolding, guidance, and support provided through the expertise of a more knowledgeable other (Vygotsky, 1978).

The use of cognitive and mind tools in education is represented through computer programs, applications, and technology that allow users to participate in higher-order learning and enable critical thinking skills (Kirschner & Erkens, 2006). In turn, the innovation for this research study provided access to a collection of computer-based cognitive tools which could be used to create and facilitate technology-enhanced dialogue, extend learning, and further enhance collaboration (Kirschner & Erkens, 2006).

In alignment with the Constructivist theory of cognitive apprenticeship, the innovation design was further influenced by the concepts of modeling, coaching, scaffolding, articulation, reflection, and exploration (Collins et al., 1987). The interactive elements of the innovation were grounded in research and aligned with the cognitive apprenticeship components (see Table 1).

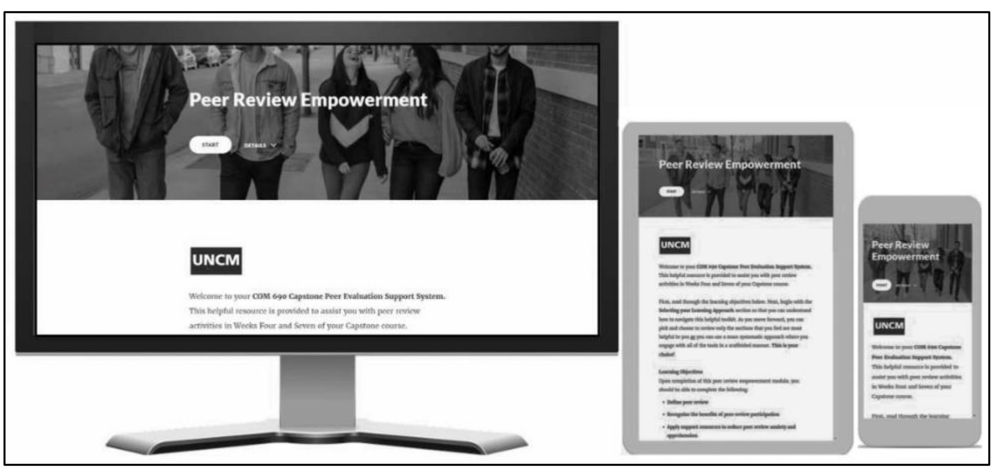
Table 1
Cognitive Apprenticeship to Research Grounded Peer Review Elements

Cognitive Apprenticeship Components	**Elements of Peer Review (in general)**
Modeling	Feedback Examples (Alnasser, 2018; Brill, 2016; Nagori & Cooper, 2014)
Coaching	Student Peer Review Training (Alnasser, 2018; Baker, 2016; Barnard et al., 2015; Dar et al., 2014; Llado et al., 2014; McMahon, 2010; Tricio et al., 2018)
Scaffolding	Prompts (Ching & Hsu, 2013, 2016; Nicol et al., 2014) Guiding Statements and Questions (Baker, 2016; Ching & Hsu, 2013; Dar et al., 2014; McMahon, 2010; Nicol et al., 2014; Reinholz, 2018; Wang, 2016) Feedback Templates and Forms (Baker, 2008, 2016; Dijks et al., 2018; Geilen & De Wever, 2015; Hogg, 2018, McMahan, 2010; Mulder et al., 2014; Tricio et al., 2018)

Cognitive Apprenticeship Components	Elements of Peer Review (in general)
Articulation	Prompts (Ching & Hsu, 2013, 2016; Nicol et al., 2014). Guiding Statements and Questions (Baker, 2016; Ching & Hsu, 2013; McMahon, 2010; Dar et al., 2014; Nicol et al., 2014; Reinholz, 2018; Wang, 2016) Rubrics (Baker, 2016; De Grez et al., 2012; Elshami & Abdalla, 2017; Gikandi & Morrow, 2016; Kelly, 2015; Llado et al., 2014; Ng, 2018; Ratminingsih et al., 2017; Sridharan et al., 2018)
Reflection	Practice and Reflection (Dar et al., 2014; Hamer et al., 2015; McMahon, 2010; Nagori & Cooper, 2014)
Exploration	Independent Problem-Solving (Collins et al., 1987)

The innovation, designed and housed in an external e-learning environment, was linked within the course announcements. The link provided access to the external peer review tool kit which, when launched, offered a responsive design with access via computers, laptops, mobile devices, and tablets (see Figure 1).

Figure 1
Responsive Design of the Innovation in the Structured Peer Evaluation System



The innovation served as a repository for eight learning modules and their supporting cognitive tools. The modules included (1) Learning Module Options, (2) Sixty Seconds of Knowledge: Video Clips, (3) Navigating the Peer Review Process: Support Tools, (4) Interactive Learning Activities, (5) Getting Started: Questions & Prompts, (6) Final Project Rubric Reminder, (7) Reflection: Practice & Self-Check, and (8) Exploration: Independent Learning.

Data Collection Methods

To fully examine the proposed research questions, seven data collection methods were utilized (see Table 2). The data sources included a preterm questionnaire, a post-term questionnaire, post-term questionnaire open-ended questions, observational field notes, one-on-one interviews, researcher's handwritten interview notations, and student post artifacts.

Table 2

Research Questions and Data Sources

Research Questions	Data Sources
RQ1: How does using a structured peer evaluation system impact the peer review process in an online Graduate Communication Capstone classroom at UNCM?	• Student Post Artifacts • Observational Field Notes
RQ2: What are the perceptions of students regarding a structured peer evaluation system in support of online asynchronous peer review activity in a Graduate Communication Capstone classroom at UNCM?	• Preterm and Post-term Questionnaires (Parts One, Two, and Three) • One-on-One Interviews • Researcher's Handwritten Interview Notations • Post-term Questionnaire (Part Four)

Preterm Questionnaire

The preterm and post-term questionnaires for this study were constructed from two published survey instruments. Questions 1-10 of the instrument (Part One) were based on Kaufman and Shunn's (2011) research survey and were positioned to evaluate students' perceptions regarding online peer assessment. The remaining 20 questions (Parts Two and Three) of the instrument were created based on research by Moneypenny et al. (2018) that aligned specifically with Wen and Tsai's (2006) four subscales of peer review. The subscales within the questionnaires were referenced as (1) Positive Attitude Subscale (POS), (2) Online Attitude Subscale (OAS), (3) Understanding-and-Action Subscale (UAS), and (4) Negative Attitude Subscale (NAS).

The purpose of the preterm questionnaire was to gauge students' perceptions of the existing peer review process at UNCM or their former participation in peer review activity (see Appendix A). During the two-week period prior to the term kick-off and following UNCM Institutional Review Board (IRB) approval, the Capstone students received a UNCM email with the Capstone Peer Review IRB Consent Form as an invitation to participate in the study. Students who signed and submitted the consent form prior to the beginning of the Capstone term were eligible for study participation and received a follow-up email with a link to the quantitative questionnaire, housed in SurveyMonkey. Due for completion before the start of the term, the questionnaire offered 30 questions based on a five-point Likert scale.

Post-term Questionnaire

A final quantitative questionnaire, positioned to measure the usefulness of the research intervention (Creswell, 2014), mirrored the three sections outlined in the preterm questionnaire. Immediately following the conclusion of the term, study participants received a UNCM email with a link to the post-term questionnaire, located in SurveyMonkey (see Appendix D). The study participants received three weeks to complete the post-term questionnaire.

Post-term Questionnaire Open-ended Questions

A fourth section was added to the post-term questionnaire and focused specifically on the structured peer review innovation. Thus, Part Four offered a qualitative component of the post-term questionnaire, consisting of six open-ended questions that students completed as part of their response to the post-term questionnaire (see Appendix D).

Observational Field Notes

Following the term conclusion, the researcher recorded observational field notes to describe the interactivity of the peer review participants (see Appendix B). The notations included posting patterns and additional collaborative activity deemed to be significant. As the Capstone class size was small, the observations provided an opportunity to gather data on actual student behaviors instead of relying solely on students' self-reported feelings and perceptions (Schmuck, 1997).

One-on-One Interviews

In alignment with UNCM IRB requirements, qualitative one-on-one interviews were conducted following the term conclusion. The purpose of the 20–25-minute semi-structured interviews was to question participants about their experiences with the structured peer evaluation system and the peer review tool kit (see Appendix C). The interviews yielded direct quotes from participants and offered insight into their opinions and experiences (Patton, 2014).

Researcher's Handwritten Interview Notations

During each of the one-on-one interviews, the researcher recorded handwritten notes of impressions and interesting aspects as they surfaced (see Appendix C). Interviews were approached through in-depth inquiry to ensure that the research topic was fully discussed and documented in support of potential changes to current systems (Patton, 2014).

Student Post Artifacts

Student post artifacts were created within the discussion board forum of D2L Brightspace by way of student interaction during the term. As study participants provided original and response posts during the peer review activities, conversational threads developed. These student post artifacts remained within the Capstone course environment during and after the study term and were later collected for CoI assessment (Garrison & Arbaugh, 2007).

Data Analysis

The data analysis process for this study embodied methodological techniques to analyze the data and to ensure that the information provided alignment to the study's research questions (Mertler, 2017).

Quantitative Data Analysis

The use of preterm and post-term questionnaires provided the opportunity to measure and produce numeric data.

Cronbach's Alpha. Prior to calculating the descriptive statistics for the preterm and post-term questionnaires, the reliability, or internal consistency, of the two instruments was assessed by calculating Cronbach's alpha for each part of each questionnaire (Cronbach, 1951; Tavakol & Dennick, 2011). Through this interpretation of reliability, Cronbach's alpha offered insight into the inter-item relationship of the questionnaire parts and how well the items correlated and measured the same characteristics (Tavalok & Dennick, 2011; Roever & Phakiti, 2018).

Descriptive Statistics Analysis. To evaluate the quantitative results from the two questionnaires, descriptive statistics analysis was utilized to "summarize, organize, and simplify" (Mertler, 2017, p. 178) the data.

Shapiro-Wilk Test and the Wilcoxon Signed Rank Test. To test the normality of the data and to determine if the data were normally distributed for the population, the researcher conducted a Shapiro-Wilk test in JASP (Version 0.11.0; 2020), an open-source statistical software program supported by the University of Amsterdam. Although a deviation from normal was not indicated by the Shapiro-Wilk test (Shapiro & Wilk, 1965), the Wilcoxon signed rank test, a non-parametric test, (Wilcoxon, 1945) was run, due to limited data for the seven study participants. The Wilcoxon signed rank test was conducted for each part (Part One, Part Two, and Part Three) of the questionnaires to assess whether the mean scores from preterm questionnaire to post-term questionnaire differed significantly (Wilcoxon, 1945). The utilization of an alpha value of .05 allowed the researcher to ensure with reasonable certainty that only 5% of the time would the differences attained actually be because of chance or sampling error (Johnson, 2008; Mertler, 2017). Results with a p value of less than .05 were statistically significant.

Bonferroni Adjustment Test. As more than one questionnaire part was aligned to one research question, the Bonferroni adjustment (Streiner & Norman, 2011) test was run to verify if each questionnaire part was independent of each other. To produce a significant result, it was necessary for the Bonferroni adjustment test to produce a p value of less than .017 (Streiner & Norman, 2011).

Qualitative Data Analysis

The qualitative data for this study yielded vast amounts of unstructured data; however, through qualitative analysis, the masses of text were brought into a more meaningful form and framework (Yee, Wong, & Turner, 2017). To reduce the amount of qualitative data collected, the researcher used inductive analysis (Mertler, 2017), as well as CoI analysis with *a priori* categories for social and cognitive presence (Garrison & Arbaugh, 2007; Van der Merwe, 2012).

Inductive Analysis. To make sense of the qualitative data compiled from the observational field notes, the one-on-one interviews, the researcher's handwritten interview notations, and the post-term questionnaire open-ended questions, the data were segmented, taken apart, and put back together (Creswell, 2014; Flick, 2009). The ultimate goal was to reduce the qualitative information into patterns and themes for a representation of the research discoveries (Johnson, 2008). Once all data sets were organized and prepared, inductive analysis proceeded on two levels. First, a handwritten memoing process was conducted, followed by computer-aided analysis.

Computer-aided Analysis. Digital content from the four data sources was uploaded into Delve, an online digital tool for creating projects and coding digital transcripts ("Delve," n.d.). Coding began with *Structural Coding* to align the segments of data with the study's research questions (Saldaña, 2016). Thereafter, a second round of *Descriptive Coding* and a third round of *Process Coding* (Saldaña, 2016) were conducted. As a fourth and final round of first cycle coding, *In Vivo Coding* was conducted on all data sources except for the observational field notes as they did not represent the voices of study participants (Saldaña, 2016). Supporting analytic memos were created to offer a description of each code.

Next, in seeking to discover categories, the researcher moved from the Delve coding environment back into Microsoft Word and organized and assembled the first cycle codes through a code mapping process. During code mapping, codes were organized and visually displayed (Saldaña, 2016). During a second iteration of code mapping, the researcher reviewed the codes and began to assess, organize, and group the codes (Saldaña, 2016) until ten categories emerged.

Identification of Themes and Presentation. Upon completion of code mapping, a second cycle approach was utilized to reduce data into smaller units (Saldaña, 2016). The researcher transitioned from Microsoft Word into the physical environment where foam core boards were used to pin, move, and rearrange the codes by category. The researcher utilized the categories that had been created in a second iteration of code mapping and through pattern coding to group the original codes by pattern. Analytic memos were created for each of the ten categories. The analysis proceedings continued to evolve as the researcher sought to link categories and identify emerging themes and patterns (Clark & Vealé, 2018; Esterberg, 2002). Ultimately, three themes were identified to communicate study participants' experiences and behaviors (Saldaña, 2016).

Community of Inquiry Analysis. A fifth qualitative data set was generated through student peer review posts and responses provided during the active term. For qualitative analysis purposes, student posts were treated as course artifacts as they were the tools "to get work done" (Saldaña & Omasta, 2017, p. 74) during peer review. Once again, data analysis began with a general approach followed by a computer-aided approach. Printed copies received initial memoing and highlighting based on the seven established *a priori* category codes for social and cognitive presence (Garrison & Arbaugh, 2007; Van der Merwe, 2012).

Next, the researcher returned to Delve and created a separate project distinct from the previous inductive analysis project. Student post artifacts were uploaded into Delve as separate transcripts for Week Four and Week Seven, after which seven codes were created in Delve to align with Garrison and Arbaugh's (2007) *a priori* category codes for social and cognitive presence. Finally, supporting analytic memos were created and aligned.

Based on Garrison and Arbaugh's (2007) CoI categories and presence indicators, a sentence-by-sentence analysis was utilized with social presence coded first, followed by cognitive presence. Moving forward, the researcher tallied CoI categories and indicators in Delve, entering totals and percentages into an Excel spreadsheet.

Integration

Through a triangulation mixed methods approach, both quantitative and qualitative data were evaluated. The findings of the two analyses were integrated via a convergent process to provide a more comprehensive review of the research topic (Mertler, 2017).

Results

For this study, quantitative and qualitative data were collected in a mixed methods approach and analyzed through triangulation to corroborate the findings (Lincoln & Guba, 1985). Through confirmation of multiple processes, the certainty assigned to data interpretation was increased (Webb, et al., 1966). Triangulation ensured that the flaws of one process were "cancelled out by the strengths of another" (Lincoln & Guba, 1985, p. 306).

Summary of Quantitative Findings

Quantitative data collected in this study included study participants' feedback from a preterm questionnaire and a post-term questionnaire. During quantitative data analysis, Cronbach's alpha was calculated for each part of the preterm and post-term questionnaires, offering low and varied internal consistency. Descriptive statistics were calculated for each part of each questionnaire. Although a deviation from normality was not detected in the Shapiro-Wilk test (Shapiro & Wilk, 1965), the Wilcoxon signed rank test was run due to the limited number of study participants. Results from the Wilcoxon signed rank test and the Bonferroni adjustment test produced no statistically significant results.

Summary of Qualitative Methods and Findings

In this study, qualitative data was collected from five data sources including six post-term questionnaire open-ended questions, observational field notes, one-on-one interviews, researcher's handwritten interview notations, and student post artifacts.

Inductive Analysis Results

First cycle and second cycle coding of the first four data sources produced ten categories and three qualitative themes. The themes included Theme I: Comprehensive peer review tool kit promoted student confidence and empowerment, Theme II: Peer review engagement fostered appreciative, collaborative community of learners, and Theme III: The structured peer review system transformed student anticipation and anxiety into a focused approach to learning.

Community of Inquiry Findings

CoI coding of the fifth data set, student post artifacts, was conducted separately. During CoI coding, a total of 598 codes were applied across 24 student threads. Using the seven *a priori* CoI categories and performance indicators (Garrison & Arbaugh, 2007), 349 occurrences of social presence and 249 occurrences of cognitive presence were recorded (see Table 3).

Table 3

Community of Inquiry Presences Coded Across Student Post Artifacts

Components and Categories	Sample Presence Indicators	Code Tally
• Social Presence		
○ Open communication	○ Risk-free expression	123
○ Group cohesion	○ Encourage collaboration	210
○ Affective expressions	○ Emoticons	16
• Cognitive Presence		
○ Triggering event	○ Sense of puzzlement	69
○ Exploration	○ Information exchange	94
○ Integration	○ Connecting ideas	41
○ Resolution	○ Applying new ideas	45
	Total Number of Codes	598

Note: Categories and presence indicators from Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and directions. *Internet and Higher Education*, *10*(3), 157-172.

Through triangulation, the researcher corroborated the qualitative themes and the CoI findings to test for rigor (Lincoln & Guba, 1985) and to provide an increased assurance for the meaning of the data (Webb et al., 1966). The results were further valdidated through alignment to study participant (referenced by pseudonym) examples and existing research (see Table 4).

Table 4

Community of Inquiry Findings to Themes with Examples and Prior Research

Qualitative Themes	Community of Inquiry Findings & Alignment	Study Participant Examples	Prior Research
Theme I: Comprehensive peer review tool kit promoted student confidence and empowerment	• Of the three social presences observed 349 times in the Week Four and Week Seven student post artifacts, open communication was observed and coded a total of 123 times. • During open communication with peers, the study participants demonstrated confidence and a sense of ownership for their comments. • Empowered by the structured peer evaluation system and more specifically, by the resources and tools shared within the peer review tool kit, study participants displayed a freedom to engage with peers. • Students displayed a sense of comfort and self-confidence	• Salem explained, "The …School sounds like a wonderful opportunity for students in Rhode Island! I am a huge proponent of educational choice and love the idea of alternative learning environments to suit the needs of different students." • Justice explained, "I enjoyed reading what you have so far and seeing the progress, gave me more to think about of structure for my own actually." • Eastyn disclosed, "I really struggled with my strategies/tactics section as well, and for some reason, I was drawing a blank on the differences between a strategy and a tactic. I've overthought everything in this course, so I'm right there with you!"	Instructors can implement unique methods and tools to motivate and encourage student participation in peer review activities (Baker, 2008; Ghadirian et al., 2016; Hamer et al., 2015; Jin, 2017; Wang, 2016). Prior research findings confirm the opportunity to utilize peer review training to support student needs (Baker, 2016; Barnard et al., 2015; McMahon, 2010; Sridharan et al., 2018; Tricio et al., 2018). Llado et al. (2014) endorse the application of unique strategies and training to clarify tasks and to

Qualitative Themes	Community of Inquiry Findings & Alignment	Study Participant Examples	Prior Research
	in disclosing aspects about themselves.		deliver supportive tools.
Theme II: Peer review engagement fostered appreciative, collaborative community of learners	• Of the 349 occurrences of social presence recorded across the 24 threads from Weeks Four and Seven, group cohesion was the most highly coded category with a total of 210 occurrences. • The social presence category of group cohesion, exhibited through encouraging support, agreement, and compliments, aligns with the second qualitative theme. These social interactions, exhibited during peer review engagement, fostered a collaborative community of learners.	• Oakley stated, "First and foremost, thank you for your service and from one army family to you, may you stay safe along with your unit for the duration of your deployment. Also, kudos to you for sticking with the class and finding the spare minutes to work on this class. FINISH STRONG! You got this." • Salem shared, "Overall, your campaign is strong and presents the school in a very positive light. I think it is an exciting concept and you highlight the advantages of the program."	During peer review participation, students can experience high levels of interaction and collaborative exchange with their peers. Through meaningful and active engagement, students offer inquiries, deliver positive commentary, and identify areas of concern with suggestions for improvement (Ching & Hsu, 2016; Gikandi & Morrow, 2016). As students interact and share their experiences with one another, a community of learners emerges (Moneypenny et al., 2018).
Theme III: The structured peer review system transformed student anticipation and anxiety into a focused	• In review of the 24 Week Four and Week Seven student threads, cognitive presences were observed and coded 249 times.	• Justice offered, "I enjoyed the images you included for the comparison. My only critique would be making sure that the images hold value to be in the document. Your last image speaks to	Through a structured approach to peer review and repeated exposure to a standardized peer evaluation system, students can gain comfort

Qualitative Themes	Community of Inquiry Findings & Alignment	Study Participant Examples	Prior Research
approach to learning	• Cognitive presence was observed through occurrences of a triggering event brought on by a sense of puzzlement, exploration through information exchange, integration by connecting ideas, and resolution by applying new ideas (Garrison & Arbaugh, 2007). • Of the 249 occurrences of cognitive presence across the 24 student threads, exploration through information exchange was the most highly coded cognitive presence with a total of 94 incidents. • Students were able to utilize the structured approach to peer review to move past feelings of excitement or trepidation and engage fully and purposefully with peers through a focused approach to learning.	your campaign but the other two seem to just be placed there with no lead up or explanation other than the caption." • Marlo explained, "I don't see examples yet on your work about the ways to combat apathy and engage those involved on the use of social media, but I assume you are considering stories (use of emotions to gain followers), creative content, video, and pictures." • Campbell stated, "I would also consider in-person events to promote sales. Things like wine pairings with meals or on site cooking shows with different beer and/or alcohol in the recipes."	with the process and become more effective as peer assessors (Brutus et al., 2013). A structured peer evaluation system can be utilized to "promote, facilitate, and standardize" (Brutus et al., 2013, p. 18) Vygotsky (1962) proclaims that students' skills and knowledge are shaped through cultural interaction. Learning becomes a social activity in an environment where learners interact and where cognitive growth is stimulated (Schunk, 2008).

Discussion

To fully understand the results from this study, it is important to situate and interpret the findings within the research questions and in alignment with the voices of the study participants (referenced by pseudonyms).

Research Question 1: How Does Using a Structured Peer Evaluation System Impact the Peer Review Process in an Online Graduate Communication Capstone Classroom at UNCM?

The findings from the converged observational field notes and the student post artifacts revealed that students assumed a responsible role in the construction of collaborative learning. The student post artifacts, displaying student peer review engagement in Week Four and Week Seven, reflected the study participants' use of the structured peer evaluation system to trigger their active participation. Moreover, students were prompted to express themselves both socially and responsibly and to openly share cognitive knowledge with peers.

Students Assumed a Responsible Role in the Construction of Collaborative Learning

The structured peer evaluation system was designed to empower students to take on a responsible role during peer assessment as they constructed new meaning during the evaluation of peers' work and produced an interpretation and feedback based on their individual experiences, beliefs, and thought patterns (Jaramillo, 1996; Jonassen, 1991; Powell & Kalina, 2009). The goal was to empower students through training, resources, and tools. As opposed to rote learning during which knowledge is simply passed from instructor to student, the learning theory of constructivism (Dewey, 1916, 1938) asserts that knowledge is actively constructed through student experiences (Dewey, 1938; Ertmer & Newby, 2013; Jaramillo, 1996). Likewise, during peer review, knowledge is constructed collaboratively through a shared learning experience with peers (Moneypenny et al., 2018).

In the Week Four and Seven scheduled peer review activities, each of the study participants took part in peer review conscientiously by posting their original work for review, reviewing their peers' work, and responding with feedback. Furthermore, in both weeks, every initial peer review response post provided a depth of more than 100 words. These findings support research conclusions by Dar et al. (2014) which claimed that when students are taught how and what to assess, the process can be simplified, and students' interest and motivation can be enhanced.

During the scheduled peer review activities, students assumed a responsible role through active engagement in first-hand, participatory learning. As emphasized in research by Clark (2018), during constructivism, a student is in control of his or her own learning. During the observation of the study participants' peer review engagement and the coding of the student post artifacts, it was evident to the researcher that students had utilized the structured peer evaluation system to prompt their active involvement. These findings support earlier research by Jaramillo (1996) which asserted that the constructivist learner is not a docile vessel waiting to receive knowledge but one who is strongly involved in the pursuit of his or her learning.

Structured System Prompted Social and Cognitive Liberation

During this research study, students demonstrated a strong degree of social expression and cognitive freedom via their peer review participation.

Social Presence

In support of Garrison and Arbaugh's (2007) established CoI categories and presence indicators, social presence was coded 349 times across the 24 student threads in the student post artifacts. Of the 598 coded occurrences of social and cognitive presence, social presence was more prevalent and coded 58% of the time.

The social presence of group cohesion was exhibited within the student post artifacts through agreements, compliments, and the use of encouraging conversation. Often, group cohesion included references to another student's work as the conversation became representative of several students working together to produce a resolution. Of the three categories of social presence coded within the student artifacts, group cohesion was coded for 210 of the 349 occurrences, representing 60% of all social presence. In the observational field notes, the researcher recorded a strong level of motivational support placed at the onset of the participants' peer review feedback. Coded as group cohesion, this initial delivery of affirmation and positivity aligned with the feedback sandwich example provided in the peer review tool kit:

> Eastyn — I have thoroughly enjoyed watching your campaign unfold this term! I absolutely love the integrated strategy you've detailed in your report.

Furthermore, open communication through risk-free expression was coded a total of 123 times across the student post artifacts and took place in an open, uninhibited, and guilt-free manner:

> Marlo — I struggled a bit with my organization of those three sections because you have so many ideas in your head it's hard to classify each one under the "right" section.

Lastly, affective expression was coded 16 times across the student post artifacts and was demonstrated through the use of emoticons in support of emotion, agreement, suggestion, and humor. These findings align with the social constructivist theory of learning as through dialogue, a collaborative culture of learning and student knowledge can be created and shaped through social interaction (Vygotsky, 1962).

Cognitive Presence

The design of the study's peer review tool kit was influenced by the constructivist theory of cognitive apprenticeship and its six dimensions (Brown & Stefaniak, 2016). During cognitive apprenticeship, implied processes are openly shared with students, as they visualize, participate in, and practice these processes with the instructor and their classmates (Collins et al., 1987). Based on Garrison and Arbaugh's (2007) established CoI categories and presence indicators, the student post artifacts were coded for 249 occurrences of cognitive presence.

The most highly coded cognitive presence was the category of exploration, offering 94 occurrences. Exploration was exhibited through suggestions to peers, brainstorming ideas, and the infusion of possible conclusions:

> Skyler — And this may seem like a minor or silly thing or distinction to be making but I would consider not just targeting woman as your audience?

Although not as highly represented as the category of exploration, a triggering event was coded 69 times across the student post artifacts and was demonstrated through puzzlement or a sense of curiosity:

Salem — As I was reading your draft, I found that I was searching through the first few paragraphs trying to determine what type of school this campaign would be promoting.

Furthermore, the cognitive presences of integration and resolution were coded 41 and 45 times, respectively. Based on the established CoI categories and indicators (Garrison & Arbaugh, 2007), participants in this study presented a strong level of cognitive presence throughout peer review activities. Further sustaining these findings were the noted observations, as the researcher recorded a strong tendency for students to fully review the work of peers and deliver well-reasoned, well-researched responses. In addition, the researcher observed that students went above and beyond brief affirmative responses by providing links to outside resources, offering referrals back to prior instructor guidance, and citing and referencing valid sources to justify their claims. These findings support Boud's (2000, 2013) research assertions, which claimed that although peer review is utilized for assessment purposes, it fulfills an essential classroom component as students not only learn alongside each other but from one another as well.

Research Question 2: What are the Perceptions of Students Regarding a Structured Peer Evaluation System in Support of Online Asynchronous Peer Review Activity in a Graduate Communication Capstone classroom at UNCM?

Following their engagement with the structured peer evaluation system, participants in this research study offered positive perceptions of the structured approach. Students reported an elevated degree of confidence and empowerment through their use of the peer review tool kit and openly acknowledged the collaborative community of learners that emerged.

Heightened Confidence and Empowerment Through Tool Kit Innovation

In feedback received through post-term questionnaire open-ended questions and one-on-one interviews, students relayed an elevated level of self-confidence and empowerment due to the tool kit intervention:

Justice — In earlier peer review, there was no structure, but this gave you something to fall back on. It gave me more faith.

Eastyn — It's incredibly easy to feel underqualified, so I appreciated the reminders throughout the toolkit that showed me I was more than capable of helping my peers through a thoughtful review.

These findings support research that encourages the use of proactive training and support to help students understand how to give and receive peer review feedback prior to their participation (Alnasser, 2018; Baker, 2016; Dar et al., 2014; McMahon, 2010).

Furthermore, study participants acknowledged their peers' use of the tool kit:

Salem — I think they were a little more emboldened to give constructive criticism as opposed to platitudes.

Marlo — Yes! I could read between the lines when I received criticism that my peers had read guidelines to provide constructive criticism.

This feedback aligns with prior research by Barnard et al. (2015) which asserted that training can be provided to teach students how to deliver constructive feedback and to provide guidance for overly critical students (McMahon, 2010). Furthermore, study participants confirmed that specific peer review resources and tools helped to empower and support them:

Skyler	So, you have … what is a peer review and examples…I think that was helpful…It made me more knowledgeable.
Eastyn	I really enjoyed the handout that had the diagram of the sandwich to remind us to preface the review with something positive, then offer constructive criticism, and then end on a high note.

These findings sustain research by Llado et al. (2014) which endorsed the use of unique approaches and training to clarify peer review tasks and deliver helpful tools and techniques.

Although this study offered a small number of study participants and the Cronbach's alpha score of the three parts of the preterm and post-term questionnaires offered low and varied consistency, there were some positive takeaways in support of students' perceptions with respect to peer review. In support of confidence in peers' ability to provide useful feedback, study participants provided a Likert scale response to the following statement in Part One of both questionnaires: The feedback my peers give me on my writing for this class will be useful. The mean score of the preterm questionnaire for Q5 (M=4.14) and the mean score of the post-term questionnaire for Q5 (M=4.43) offer positive implications. Following the intervention of the structured peer evaluation and the peer review tool kit innovation, students' perception of the usefulness of peers' feedback elevated slightly.

Collaborative Community of Learners Realized Through Peer Review Participation

Study participants perceived that their peer review interactions evolved into a collaborative community of learners who were invested in supporting one another. During the one-on-one interview, Oakley noted a peer review team approach and stated, "This week we're going to look at these things as a group and help each other get better."

In response to the post-term questionnaire open-ended questions, Skyler stated, "Most explained their reasoning and thinking behind why they were making the suggestions they did…this made me more confident in accepting…what they had to say." Furthermore, in response to the one-on-one interview, Eastyn explained, "I know that through giving others peer review, it really did help me reflect on my own work and say…this is something that I should actually do in my project." By mirroring and practicing the skills they observe during peer review, students improve their work (Llado et al., 2014; Mulder et al., 2014).

During the one-on-one interview, Salem discussed the tool kit and the revelation that peers would be reviewing each other's work. Salem stated, "The section that talks about making me mindful of an initial draft, knowing someone is going to be reading it was probably my biggest takeaway…So, I feel like peer review helped me."

Although interpretations of the preterm and post-term questionnaires should be tentatively considered, based on a limited number of students and low and varied internal consistency outcomes (DeVellis, 2016), an increase in the mean scores across relative questions from preterm to post-term was observed. In support of study participants' perception of increased interaction between peers during peer review activities, Likert scale responses were provided to this statement by students in Part Two of both the preterm and post-term questionnaires: Peer review activities increase the interaction between my classmates and me. The mean score of the preterm questionnaire for Q18 (*M*=4.57) and the mean score of the post-term questionnaire for Q18 (*M*=4.71) offer encouraging connotations. Following the intervention of the structured peer evaluation, the mean score for this statement elevated slightly, indicating the study participants' acknowledgment for the increased interaction that occurred during the Capstone term. Furthermore, students provided Likert scale responses to Q19, in Part Two of both the preterm and post-term questionnaires, which stated: Having a peer's feedback on a draft allows me to create a better final product. The mean score of the preterm questionnaire for Q19 (*M*=4.71) and the mean score of the post-term questionnaire for Q19 (*M*=4.86) produced a slight elevation from preterm to post-term. This slight growth denotes an increased appreciation for the collaborative feedback that study participants received across the community of learners within the Capstone classroom. Finally, one of the statements in Part Two of the preterm and post-term questionnaire was positioned to gauge students' feelings regarding the ability for peer review to foster community in an online learning environment. Study participants provided a Likert scale response to the following statement, entitled Q25: Peer review increases the sense of community in an online course. The mean score of the preterm questionnaire for Q25 (*M*=4.00) and the mean score of the post-term questionnaire for Q25 (*M*=4.57) produced an increase from preterm to post-term. This increase denotes the study participants' strong comprehension of the increase in community building that was experienced through the structured peer evaluation system.

Furthermore, in a review of the researcher's interview notations, a positive perception of peer engagement surfaced as a common theme. The researcher noted that Skyler shared a sense of enjoyment and proclaimed engagement to be the best part of peer review. Similar to research findings by Moneypenney et al. (2018), when students connect and share their understandings and experiences during peer review, a community of learners develops and grows.

Limitations, Implications, and Next Steps

The limitations of this research include a small sample size, lack of internal access to the externally located educational technology innovation, and potential researcher bias. However, this research offers implications and opportunities. Due to the study outcomes, a heightened expectation for student peer review participation should be realized, encouraged, and supported moving forward. The findings of this research study assert that students were empowered to move from hesitant bystander to one who was enthusiastically involved in a robust community of learners (Dar et al., 2014; Gikandi & Morrow, 2016; Kearney, 2013). Through a structured approach, scaffolded learning, and supportive tools and resources, students can obtain understanding and aptitude and become empowered to actively engage in peer review (Brown & Stefaniak, 2016).

As an additional implication, the vital role of learning theory in designing educational technology cannot be overstated. During this study, it was vital to design the tool kit innovation so that students of similar status could rise from independent problem-solving at the lower end of the zone of proximal development to a more advanced knowledge level and higher achievement (Vygotsky, 1978). By undergirding the tool kit innovation with theory, a learning pathway was created for students to construct knowledge through experience (Dewey, 1938; Ertmer & Newby, 2013; Jaramillo, 1996).

Recommendations for future research include the opportunity to place a tool kit intervention earlier in the learning pathway as an introductory training to teach students to collaborate, assess peers, and deliver proficient feedback (Sridharan et al., 2018). Furthermore, based on the outcomes of this study and the abundant existing literature, future researchers may consider the integration of additional resources to support students in overcoming peer review anxiety.

Declarations

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. The author/researcher declared completion of the Collaborative Institutional Training Initiative (CITI Program) for Human Research (Social & Behavioral Researchers) and the receipt of UNCM IRB approval prior to conducting the research study.

References

Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States.* Sloan Consortium. https://www.onlinelearningsurvey.com/reports/changingcourse.pdf

Alman, S. W., Frey, B. A., & Tomer, C. (2012). Social and cognitive presence as factors in learning and student retention: An investigation of the cohort model in an iSchool setting. *Journal of Education for Library and Information Science*, *53*(4), 290-302. https://www.jstor.org/stable/43686922?seq=1#page_scan_tab_contents

Alnasser, S. M. (2018). Exploring student-writers' views on replacing teacher feedback with peer feedback and computer-based feedback. *Arab World English Journal*, *9*(3), 345-366. https://doi.org/10.24093/awej/vol9no3.23

Baker, D. (2008). Peer assessment in small groups: A comparison of methods. *Journal of Management Education*, *32*(2), 183-209. https://doi.org/10.1177/1052562907310489

Baker, K. M. (2016). Peer review as a strategy for improving students' writing process. *Active Learning in Higher Education*, *17*(3), 179-192. https://doi.org/10.1177/1469787416654794

Barnard, R., de Luca, R., & Li, J. (2015). First-year undergraduate students' perceptions of lecturer and peer feedback: A New Zealand action research project. *Studies in Higher Education*, *40*(5), 933-944. http://dx.doi.org/10.1080/03075079.2014.881343

Barría, J., Scheihing, E., & Parra, D. (2014). Visualizing student participation in a collaborative learning environment. In F. Cena, A. S. da Silva, & C. Trattner (Eds.), *Hypertet HT (Doctoral Consortium/Late-breaking Results/Workshops), CEUR Workshop Proceedings (Vol. 1210).* Santiago, Chile: CEUR-WS.org.

Biggs, J. B., & Tang, C. S. (2011). *Teaching for quality learning at university: What the student does* (4th ed.) New York, NY: McGraw-Hill Education. https://books.google.com/books?id=XhjRBrDAESkC&printsec=frontcover&dq=teaching+for+quality+learning+at+university&hl=en&sa=X&ved=0ahUKEwj3kqKVo9bhAhWPmeAKHVV6ClQQ6AEIKjAA#v=onepage&q=teaching%20for%20quality%20learning%20at%20university&f=false

Boud, D. (2000). Sustainable assessment: Rethinking assessment for the learning society. *Studies in Continuing Education*, *22*(2), 151-167. https://doi.org/10.1080/713695728

Boud, D. (2013). Introduction: Making the move to peer learning. In D. Boud, R. Cohen, & J. Sampson (Eds.), *Peer learning in higher education: Learning from and with each other.* Routledge.

Brill, J. (2016). Investigating peer review as a systemic pedagogy for developing the design knowledge, skills, and dispositions of novice instructional design students. *Educational Technology Research & Development*, *64*(4), 681-705. https://doi.org/10.1007/s11423-015-9421-6

Brown, J. A., & Stefaniak, J. E. (2016). The design of a cognitive apprenticeship to facilitate storytime programming for librarians. *Contemporary Educational Technology*, *7*(4), 331-351. https://files.eric.ed.gov/fulltext/EJ1117606.pdf

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42. https://doi.org/10.3102/0013189X018001032

Brutus, S., Donia, M. B., & Ronen, S. (2013). Can Business students learn to evaluate better? Evidence from repeated exposure to a peer-evaluation system. *Academy of Management Learning & Education*, *12*(1), 18-31. https://doi.org/10.5465/amle.2010.0204

Caddy, I. (2014). Using an online peer review and assessment tool in a large undergraduate business subject: Analysing student behaviour and performance. *Employment Relations Record*, *14*(1), 55-80. https://search.informit.com.au/documentSummary;dn=552924605721692;res=IELBUS

Cheng, G., & Chau, J. (2016). Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course. *British Journal of Educational Technology*, *47*(2), 257-278. https://doi.org/10.1111/bjet.12243

Ching, Y.-H., & Hsu, Y.-C. (2013). Peer feedback to facilitate project-based learning in an online environment. *The International Review of Research in Open and Distributed Learning, 14*(5), 258-276. doi:10.19173/irrodl.v14i5.1524

Ching, Y.-H., & Hsu, Y.-C. (2016). Learners' interpersonal beliefs and generated feedback in an online role-playing peer-feedback activity: An exploratory study. *International Review of Research in Open and Distributed Learning*, *17*(2), 105-122. https://eric.ed.gov/?id=EJ1093774

Chittum, J. R., & Bryant, L. H. (2014). Reviewing to learn: Graduate student participation in the professional peer-review process to improve academic writing skills. *International Journal of Teaching and Learning in Higher Education*, *26*(3), 473-484. https://eric.ed.gov/?id=EJ1060832

Choi, J. (2014). Online peer discourse in a writing classroom. *International Journal of Teaching and Learning in Higher Education, 26*(2), 217-231. http://www.isetl.org/ijtlhe/pdf/IJTLHE1730.pdf

Clark, K. R. (2018). Learning theories: Constructivism. *Radiologic Technology, 90*(2), 180-182. http://www.radiologictechnology.org/content/90/2/180.extract#

Clark, K. R., & Vealé, B. L. (2018). Strategies to enhance data collection and analysis in qualitative research. *Radiologic Technology, 89*(5), 482-485. http://www.radiologictechnology.org/content/89/5/482CT.extract

Collins, A. (1988). Cognitive apprenticeship and instructional technology (Technical Report No. 6899). BBN Laboratories, Cambridge, MA. https://apps.dtic.mil/dtic/tr/fulltext/u2/a203609.pdf

Collins, A., Brown, J. S., & Newman, S. E. (1987). Cognitive apprenticeship: Teaching the craft of reading, writing and mathematics (Technical Report No. 403). BBN Laboratories, Cambridge, MA. Centre for the Study of Reading, University of Illinois. January, 1987. https://www.ideals.illinois.edu/bitstream/handle/2142/17958/ctrstreadtechrepv01987i00403_opt.pdf?sequence=1

Conrad, R., & Donaldson, J. (2004). *Engaging the online learner: Activities and resources for creative instruction*. San Francisco, CA: John Wiley & Sons, Inc.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297-334.

Dar, M. F., Zaki, S., & Kazmi, H. H. (2014). Peer assessment in EAP writing: An effective strategy for large classes. *Journal of Educational Research*, *17*(1), 50-59. https://search.proquest.com/openview/b45d19a21ac8ab9137cb4281ed3a04c8/1?pq-origsite=gscholar&cbl=1616349

Davies, J., & Graff, M. O. (2005). Performance in e-learning: Online participation and student grades. *British Journal of Educational Technology, 36*(4), 657-663. http://www.elsinnet.org.uk/research/mgg_files/BJET2005.pdf

De Grez, L., Valcke, M., & Roozen, I. (2012). How effective are self- and peer assessment of oral presentation skills compared with teachers' assessments? *Active Learning in Higher Education*, *13*(2), 129-142. https://doi.org/10.1177/1469787412441284

Delve. (n.d.) https://delvetool.com/getstarted

Demirbilek, M. (2015). Social media and peer feedback: What do students really think about using wiki and Facebook as platforms for peer feedback? *Active Learning in Higher Education*, *16*(3), 211-224. doi:10.1177/1469787415589530

DeVellis, R. F. (2016). *Scale development: Theory and applications* (2nd ed.). Sage Publications, Inc.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education.* Macmillan. https://archive.org/stream/democracyandedu00dewegoog#page/n6/mode/2up

Dewey, J. (1938). *Experience & education*. Kappa Delta Pi. https://archive.org/details/ExperienceAndEducation

Dijks, M. A., Brummer, L., & Kostons, D. (2018). The anonymous reviewer: The relationship between perceived expertise and the perceptions of peer feedback in higher education. *Assessment & Evaluation in Higher Education*, *43*(8), 1258-1271. https://doi.org/10.1080/02602938.2018.1447645

Elshami, W., & Abdalla, M. E. (2017). Diagnostic radiography students' perceptions of formative peer assessment within a radiographic technique module. *Radiography*, *23,* 8-13. http://dx.doi.org/10.1016/j.radi.2016.06.001

Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 26*(2), 43-71. doi:10.1002/piq.21143

Esterberg, K. G. (2002). *Qualitative methods in social research*. McGraw-Hill.

Evans, P. (2015). Open online spaces of professional learning: Context, personalisation and facilitation. *TechTrends: Linking Research & Practice to Improve Learning*, *59*, 31-36. https://doi.org/10.1007/s11528-014-0817-7

Flick, U. (2009). *An introduction to qualitative research* (4th ed.). http://books.google.com

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: review, issues, and future directions. *Internet and Higher Education*, *10*(3), 157-172. https://doi.org/10.1016/j.iheduc.2007.04.001

Ghadirian, H., Ayub, A. F., Bakar, K. B., & Hassanzadeh, M. (2016). Growth patterns and e-moderating supports in asynchronous online discussions in an undergraduate blended course. *International Review of Research in Open & Distance Learning*, *17*(23), 189-208. http://www.irrodl.org/index.php/irrodl/article/view/2397

Gielen, M., & De Wever, B. (2015). Scripting the role of assessor and assessee in peer assessment in a wiki environment: Impact on peer feedback quality and product improvement. *Computers & Education*, *88*, 370-386. http://dx.doi.org/10.1016/j.compedu.2015.07.012

Gikandi, J. W., & Morrow, D. (2016). Designing and implementing peer formative feedback within online learning environments. *Technology, Pedagogy & Education*, *25*(2), 153-170. https://doi.org/10.1080/1475939X.2015.1058853

Hamer, J., Purchase, H., Luxton-Reilly, A., & Denny, P. (2015). A comparison of peer and tutor feedback. *Assessment & Evaluation in Higher Education*, *40*(1), 151-164. https://doi.org/10.1080/02602938.2014.893418

Hampel, R., & Pleines, C. (2013). Fostering student interaction and engagement in a virtual learning environment: An investigation into activity design and implementation. *CALICO Journal*, *30*(3), 342-370. https://doi.org/10.11139/cj.30.3.342-370

Hart, C.M.D., Xu, D., Hill, M., & Alonso, E. (2021). COVID-19 and community college instructional responses. *Online Learning*, *25*(1), 41-69. https://doi.org/10.24059/olj.v25i1.2568

Heyman, E. (2010). *Overcoming student retention issues in higher education online programs: A Delphi study* (Doctoral dissertation). ProQuest Dissertations & Theses Global. (748309429)

Hogg, L. M. (2018). Empowering students through peer assessment: Interrogating complexities and challenges. *Reflective Practice*, *19*(3), 308-321. https://doi.org/10.1080/14623943.2018.1437404

Huang, E. Y., Lin, S. W., & Huang, T. K. (2012). What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. *Computers & Education, 58*(1), 338-349. https://doi.org/10.1016/j.compedu.2011.08.003

Jaramillo, J. A. (1996). Vygotsky's sociocultural theory and contributions to the development of constructivist curricula. *Education*, *117*(1), 133. https://met512.weebly.com/uploads/4/2/2/5/42253875/anas_article_re-_vygotsky___constructivism.pdf

Jin, S.-H. (2017). Using visualization to motivate student participation in collaborative online learning environments. *Journal of Educational Technology & Society, 20*(2), 51-62. http://www.jstor.org/stable/90002163

Johnson, A. P. (2008). *A short guide to action research* (3rd ed.). Allyn & Bacon.

Jonassen, D. H. (1991). Evaluating constructivistic learning. *Educational Technology, 31*(9), 28-33. https://eric.ed.gov/?id=EJ433315

Kaufman, J. H., & Schunn, C. D. (2011). Students' perceptions about peer assessment for writing: Their origin and impact on revision work. *Instructional Science, 39*(3), 387-406. http://www.lrdc.pitt.edu/schunn/research/papers/KaufmanSchunn-StudentPerceptions-.pdf

Kearney, S. (2013). Improving engagement: The use of "Authentic self-and peer-assessment for learning" to enhance the student learning experience. *Assessment & Evaluation in Higher Education*, *38*(7), 875-891. https://doi.org/10.1080/02602938.2012.751963

Kelly, L. (2015). Effectiveness of guided peer review of student essays in a large undergraduate biology course. *International Journal of Teaching & Learning in Higher Education*, *27*(1), 56-68. https://eric.ed.gov/?id=EJ1069821

Kirschner, P. A., & Erkens, G. (2006). Cognitive tools and mindtools for collaborative learning. *Journal of Educational Computing Research, 35*(2), 199-209. https://doi.org/10.2190/R783-230M-0052-G843

Lee, Y. & Choi, J. (2011). A review of online course dropout research: Implications for practice and future research. *Educational Technology Research and Development, 59*, 593-618. https://doi.org/10.1007/s11423-010-9177-y

Li, L., Liu, X., & Steckelberg, A. L. (2010). Assessor or assessee: How student learning improves by giving and receiving peer feedback. *British Journal of Educational Technology*, *41*(3), 525-536. https://doi.org/10.1111/j.1467-8535.2009.00968.x

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Sage Publications, Inc.

Llado, A. P., Soley, L. F., Fraguell Sansbello, R. M., Pujolras, G. A., Planella, J. P., Roura-Pascual, N., … Moreno, L. M. (2014). Student perceptions of peer assessment: An interdisciplinary study. *Assessment & Evaluation in Higher Education*, *39*(5), 592-610. https://doi.org/10.1080/02602938.2013.860077

Lynch, R., McNamara, P. M., & Seery, N. (2012). Promoting deep learning in a teacher education programme through self-and peer-assessment and feedback. *European Journal of Teacher Education*, *35*(2), 179-197. https://doi.org/10.1080/02619768.2011.643396

Magda, A. J., Capranos, D., & Aslanian, C. B., (2020). *Online college students 2020: Comprehensive data on demands and preferences*. Wiley Education Services.

Man, D., Xu, Y., & O'Toole, J. M. (2018). Understanding autonomous peer feedback practices among postgraduate students: A case study in a Chinese university. *Assessment & Evaluation in Higher Education, 43*(4), 527-536. https://doi.org/10.1080/02602938.2017.1376310

McMahon, T. (2010). Peer feedback in an undergraduate programme: Using action research to overcome students' reluctance to criticise. *Educational Action Research*, *18*(2), 273-287. https://doi.org/10.1080/09650791003741814

Mertler, C. A. (2017). *Action research: Improving schools and empowering educators* (5th ed.). Sage Publications, Inc.

Michinov, N., Brunot, S., Le Bohec, O., Juhel, J., & Delaval, M. (2011). Procrastination, participation, and performance in online learning environments. *Computers & Education*, *56*(1), 243-252. https://doi.org/10.1016/j.compedu.2010.07.025

Moneypenny, D. B., Evans, M., & Kraha, A. (2018). Student perceptions of and attitudes toward peer review. *American Journal of Distance Education*, *32*(4), 236-247. https://doi.org/10.1080/08923647.2018.1509425

Mulder, R., Baik, C., Naylor, R., & Pearce, J. (2014). How does student peer review influence perceptions, engagement and academic outcomes? A case study. *Assessment & Evaluation in Higher Education*, *39*(6), 657-677. doi:10.1080/02602938.2013.860421

Nagori, R., & Cooper, M. (2014). Key principles of peer assessments: A feedback strategy to engage the postgraduate international learner. *IAFOR Journal of Education*, *2*(2), 211-237. https://eric.ed.gov/?id=EJ1080371

Negash, S. (2008). *Handbook of distance learning for real-time and asynchronous information technology education.* http://books.google.com

Ng, E. M. (2018). Are students receptive to formative assessment when authoring wiki projects? *Ubiquitous Learning: An International Journal*, *11*(3), 1-15. http://doi.org/10.18848/1835-9795/CGP/v11i03/1-15

Nicol, D., Thomson, A., & Breslin, C. (2014). Rethinking feedback practices in higher education: A peer review perspective. *Assessment & Evaluation in Higher Education, 39*(1), 102-122. https://doi.org/10.1080/02602938.2013.795518

O'Connor, E. A., & McQuigge, A. (2013). Exploring badging for peer review, extended learning and evaluation, and reflective/critical feedback within an online graduate course. *Journal of Educational Technology Systems, 42*(2), 87-105. https://doi.org/10.2190/ET.42.2.b

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). Sage Publications, Inc.

Picciano, A. G. (2019). Artificial intelligence and the academy's loss of purpose. *Online Learning, 23*(3), 270–284. http://doi.org/10.24059/olj.v23i3.2023

Powell, K. C., & Kalina, C. J. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, *130*(2), 241-250. https://link.gale.com/apps/doc/A216181184/AONE?u=anon~e1bf3c00&sid=googleScholar&xid=b3237160

Purarjomandlangrudi, A., Chen, D., & Nguyen, A. (2016). Investigating the drivers of student interaction and engagement in online courses: A study of state-of-the-art. *Informatics in Education, 15*(2), 269-286. https://doi.org/10.15388/infedu.2016.14

Ratminingsih, N. M., Artini, L. P., & Padmadewi, N. N. (2017). Incorporating self and peer assessment in reflective teaching practices. *International Journal of Instruction, 10*(4), 165-184. https://doi.org/10.12973/iji.2017.10410a

Reinholz, D. L. (2018). Three approaches to focusing peer feedback. *International Journal for the Scholarship of Teaching & Learning*, *12*(2), 1-8. https://doi.org/10.20429/ijsotl.2018.120210

Roever, C., & Phakiti, A. (2018). *Quantitative methods for second language research: A problem-solving approach.* http://books.google.com

Saldaña, J. (2016). *The coding manual for qualitative researchers* (3rd ed.). Sage Publications, Inc.

Saldaña, J., & Omasta, M. (2017). *Qualitative research: Analyzing life.* Sage Publications, Inc.

Schrenk, N., Alves, K., Van Dam, D., & Schrenk, B. (2021). Reflecting on best practices for online learning in a post-COVID-19 world. *Online Learning, 25*(4), 486-504. https://doi.org/10.24059/olj.v25i4.2460

Schmuck, R.A. (1997). *Practical action research for change*. Skylight Professional Development.

Schunk, D. H. (2008). *Learning theories: An educational perspective* (5th ed.). Pearson.

Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, *52*(3/4), 591-611.

Sridharan, B., Muttakin, M. B., & Mihret, D. G. (2018). Students' perceptions of peer assessment effectiveness: An explorative study. *Accounting Education*, *27*(3), 259-285. https://doi.org/10.1080/09639284.2018.1476894

Streiner, D. L., & Norman, G. R. (2011). Correction for multiple testing: Is there a resolution? *Chest, 140*(1), 16-18.

Tavalok, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53-55. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4205511/

Tricio, J., Woolford, M., & Escudier, M. (2018). Analysis of dental students' written peer feedback from a prospective peer assessment protocol. *European Journal of Dental Education*, *20*, 241-247. https://doi.org/10.1111/eje.12187

Van der Merwe, M. D. (2012). Applying the community of inquiry framework: A novel tool for systematic and economic coding and analysis of forum discourse in situ and in context. *International Journal of Learning Technology, 7*(3), 246-260. https://pdfs.semanticscholar.org/9b82/f6890ee5a1a05f643dd7d2f597182e2f31cb.pdf?_ga=2.202346834.2132451076.1564110631-1017552094.1564110631

Vygotsky, L. S. (1962). *Thought and language.* MIT Press. (Original work published in 1934).

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wang, W. (2016). Peer feedback in Chinese College English Writing class: Using action research to promote students' English writing. *Journal of Language Teaching and Research*, *7*(5), 958-966. http://dx.doi.org/10.17507/jltr.0705.17

Webb, E. J., Campbell, D. T., Schwartz, R., & Sechrest, L. (1966). *Unobtrusive measures: Nonreactive research in the social sciences.* Rand McNally.

Wen, L. M., & Tsai, C. C. (2006). University students' perceptions of and attitudes toward (online) peer assessment. *Higher Education, 51*(1), 27-44. doi:10.1007/s10734-004-6375-8.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge University Press.

Wilcoxon, F. (1945). Individual comparisons by ranking methods. *Biometrics Bulletin, 1*(6), 80-83.

Willging, P. A., & Johnson, S. D. (2009). Factors that influence students' decision to dropout of online courses. *Journal of Asynchronous Learning Networks, 13*(3), 115-127.

Xu, D., & Xu, Y. (2019). *The promises and limits of online higher education: Understanding how distance education affects access, cost, and quality.* Washington, DC: American Enterprise Institute. https://www.aei.org/wp-content/uploads/2019/03/The-Promises-and-Limits-of-Online-Higher-Education.pdf

Yee, K. C., Wong, M. C., & Turner, P. (2017). Qualitative research for patient safety using ICTs: Methodological considerations in the Technological Age. *Studies in Health Technology and Informatics*, *241*, 36-42. https://pdfs.semanticscholar.org/5b54/1b7a07fe11c6653db4954554856d5e84a4a7.pdf

Yuan, J., & Kim, C. (2014). Guidelines for facilitating the development of learning communities in online courses. *Learning, Design, and Technology*, *30*(3), 220-232. https://doi.10.1111/jcal.12042

Zong, Z., Schunn, C. D., & Wang, Y. (2022). Do experiences of interactional inequality predict lower depth of future student participation in peer review? *Computers in Human Behavior*, *127*. https://doi.org/10.1016/j.chb.2021.107056

Appendix A

Capstone Peer Review Pre-Term Questions

Please rate your level of agreement with each of the following statements by using the key outlined below:

- Strongly Agree (SA)
- Agree (A)
- Neither Agree nor Disagree (N)
- Disagree (D)
- Strongly Disagree (SD)

Part One: Feedback - 10 Questions

Usefulness of own feedback

1. The feedback I give my peers on their work for this class will be useful. SA A N D SD

Positive nature of own feedback

2. The feedback I give my peers on their work will likely be too negative or critical [Agreement reverse coded for this item]. SA A N D SD

Validity of own feedback

3. The feedback I give a peer on his/her paper probably will be similar to the feedback that other peers give on the same work. SA A N D SD

Reliability of own feedback

4. If I had to give feedback several months from now on the same papers for which I will give feedback in this class, I would probably give similar feedback. SA A N D SD

Usefulness of peers' feedback

5. The feedback my peers give me on my writing for this class will be useful. SA A N D SD

Positive nature of peers' feedback

6. The feedback peers give me on my writing will likely be too negative or critical [Agreement reverse coded for this item]. SA A N D SD

Validity of peers' feedback

7. The feedback I get from one peer will be similar to the feedback I get from other peers on the same paper. SA A N D SD

Reliability of peers' feedback

8. If my peers gave me feedback several months from now on the same work, they will examine for this class, they would probably give me similar feedback. SA A N D SD

Fairness of peers' feedback

9. Peers will give me a fair grade on my writing. SA A N D SD

10. I will receive a fair assessment of my work through the peer review given to me by multiple peers. SA A N D SD

Part Two: Attitudes - 17 Questions

11. Peer review is helpful to my learning. (POS) SA A N D SD

12. Peer review makes me better understand an assignment's requirements. (POS) SA A N D SD

13. Peer review activities can improve my skills in verbal communication. (POS) SA A N D SD

14. Peer review activities can improve my skills in written communication. (POS) SA A N D SD

15. Peer review activities motivate me to learn. (POS) SA A N D SD

16. Peer review activities increase the interaction between my teacher and me. (POS) SA A N D SD

17. Peer review helps me develop a sense of participation in a course. (POS) SA A N D SD

18. Peer review activities increase the interaction between my classmates and me. (POS) SA A N D SD

19. Having a peer's feedback on a draft allows me to create a better final product. (POS) SA A N D SD

20. Receiving feedback from my peers can be just as valuable as receiving feedback from my professor. (POS) SA A N D SD

21. Submitting a project to my peers can be intimidating. (NAS) SA A N D SD

22. I think students should not be responsible for making assessments. (NAS) SA A N D SD

23. Peer review is time-consuming. (NAS)	SA A N D SD
24. My comments given to other classmates are affected by comments given to me. (NAS)	SA A N D SD
25. Peer review increases the sense of community in an online course. (OAS)	SA A N D SD
26. Online peer review activities can be time-saving. (OAS)	SA A N D SD
27. Online course peer review can be as effective as face-to-face course peer review. (OAS)	SA A N D SD

Part Three: Understanding and Action - 3 Questions

28. Peer review activities help me understand what other classmates think. (UAS)	SA A N D SD
29. The teacher should develop criteria (such as a rubric or guide) for students completing peer review. (UAS)	SA A N D SD
30. Students should participate in the development of criteria (such as a guide or a rubric) for peer review. (UAS)	SA A N D SD

Appendix B

Observational Field Note Document

Capstone Course Number: ______________ Course Section: ______________
Instructor: ____
Date of Observation: _______________ Day: _________ Term Week: _____________
Beginning Time of Observation: __________ Ending Time of Observation: __________

Observational Field Note Protocol for Research Question 1

- Observation of individual student participation
- Conversation patterns (Do students gravitate toward original posts where response posts are recorded, and conversational activity is already underway or do students gravitate toward original posts where there is no conversation yet recorded?)
- Student interaction (Do students respond to original posts as they are shared [within 24 hours] or is there a lag in the recorded peer review response time?)
- Average number of posts per student
- Depth of reviewer posts (length), based on a 100-word cut-off measuring parameter
- Number of peer works reviewed and commented on by each reviewer
- Unique observances

Researcher Observations and Field Notes:

Appendix C

Interview Questions and Handwritten Notation Document

1) **Initial Perceptions and Design**

What are your initial perceptions regarding the structured peer evaluation system that was provided to assist with peer review activities this term?
Researcher Notations:

a. Was the design of the structured peer evaluation system conducive to your participation in peer review activities this term? If so, how? If not, why not?
Researcher Notations:

b. Was there anything missing from the structured peer evaluation system design that you would like to see added? If so, what would you like added and why?
Researcher Notations:

c. How did you decide whether or not to use the resources and tools that were provided in the structured peer evaluation system?
Researcher Notations:

d. Were there any resources or tools provided in the structured peer evaluation system that you found to be particularly helpful? If so, which ones were they and why were they helpful?
Researcher Notations:

e. Were there any resources or tools in the structured peer evaluation system that you found to be confusing or not helpful? If so, which ones were they and why?
Researcher Notations:

2) Impact on Participation

What was the overall impact on your peer review participation if you chose to use the structured peer evaluation system?
Researcher Notations:

a. Did the use of the structured peer evaluation system impact your ability to give feedback in any way? Please explain how it did or did not impact your ability to provide feedback for your peers.
Researcher Notations:

b. Did the use of the structured peer evaluation system offer an impact on your ability to receive and accept feedback posted to your work by peers? Please explain how it did or did not impact your ability to receive and accept feedback.
Researcher Notations:

3) Confidence Building

What was the impact of the structured peer evaluation system in building your confidence level in support of peer review participation?
Researcher Notations:

> a. If you utilized the resources and tools in the structured peer evaluation system, did you feel more confident in your role as the reviewer when reviewing the work of your peers?
> *Researcher Notations:*
>
> b. As the reviewee who received peer feedback, did you feel more confident in your peers' assessment based on their potential use of the resources and tools found within the structured peer evaluation system? Why or why not?
> *Researcher Notations:*

4) Additional Perceptions

Do you have any additional feedback or perceptions that you would like to share regarding the structured peer evaluation system that was provided in support of the online asynchronous peer review activity in the Capstone experience this term? If so, please feel free to share your thoughts and views.
Researcher Notations:

Appendix D

Capstone Peer Review Post-Term Questions

Please rate your level of agreement with each of the following statements by using the key outlined below:

· Strongly Agree (SA)
· Agree (A)
· Neither Agree nor Disagree (N)
· Disagree (D)
· Strongly Disagree (SD)

Part One: Feedback - 10 Questions

Usefulness of own feedback					
1. The feedback I gave my peers on their work for this class was useful.	SA	A	N	D	SD
Positive nature of own feedback					
2. The feedback I gave my peers on their work was too negative or critical [Agreement reverse coded for this item].	SA	A	N	D	SD
Validity of own feedback					
3. The feedback I gave a peer on his/her paper probably was similar to the feedback that other peers gave on the same work.	SA	A	N	D	SD
Reliability of own feedback					
4. If I had to give feedback several months from now on the same papers for which I gave feedback in this class, I would probably give similar feedback.	SA	A	N	D	SD
Usefulness of peers' feedback					
5. The feedback my peers gave me on my writing for this class was useful.	SA	A	N	D	SD
Positive nature of peers' feedback					
6. The feedback peers gave me on my writing was too negative or critical [Agreement reverse coded for this item].	SA	A	N	D	SD
Validity of peers' feedback					
7. The feedback I got from one peer was similar to the feedback I got from other peers on the same paper.	SA	A	N	D	SD
Reliability of peers' feedback					
8. If my peers gave me feedback several months from now on the same work they examined for this class, they would probably give me similar feedback.	SA	A	N	D	SD

Fairness of peers' feedback

9. Peers gave me a fair grade on my writing.	SA A N D SD
10. I received a fair assessment of my work through the peer review given to me by multiple peers.	SA A N D SD

Part Two: Attitudes – 17 Questions

11. Peer review is helpful to my learning. (POS)	SA A N D SD
12. Peer review makes me better understand an assignment's requirements. (POS)	SA A N D SD
13. Peer review activities can improve my skills in verbal communication. (POS)	SA A N D SD
14. Peer review activities can improve my skills in written communication. (POS)	SA A N D SD
15. Peer review activities motivate me to learn. (POS)	SA A N D SD
16. Peer review activities increase the interaction between my teacher and me. (POS)	SA A N D SD
17. Peer review helps me develop a sense of participation in a course. (POS)	SA A N D SD
18. Peer review activities increase the interaction between my classmates and me. (POS)	SA A N D SD
19. Having a peer's feedback on a draft allows me to create a better final product. (POS)	SA A N D SD
20. Receiving feedback from my peers can be just as valuable as receiving feedback from my professor. (POS)	SA A N D SD
21. Submitting a project to my peers can be intimidating. (NAS)	SA A N D SD
22. I think students should not be responsible for making assessments. (NAS)	SA A N D SD
23. Peer review is time-consuming. (NAS)	SA A N D SD
24. My comments given to other classmates are affected by comments given to me. (NAS)	SA A N D SD

25. Peer review increases the sense of community in an online course. (OAS)	SA	A	N	D	SD
26. Online peer review activities can be time-saving. (OAS)	SA	A	N	D	SD
27. Online course peer review can be as effective as face-to-face course peer review. (OAS)	SA	A	N	D	SD

Part Three: Understanding and Action - 3 Questions

28. Peer review activities help me understand what other classmates think. (UAS)	SA	A	N	D	SD
29. The teacher should develop criteria (such as a rubric or guide) for students completing peer review. (UAS)	SA	A	N	D	SD
30. Students should participate in the development of criteria (such as a guide or a rubric) for peer review. (UAS)	SA	A	N	D	SD

Part Four: Open-ended Response Opportunities – 6 Questions

1. What are your perceptions of the structured peer evaluation system that was provided to assist with peer review activities this term?
2. Did you access or use any of the resources or tools provided in the structured peer evaluation system in support of peer review activities? Why or why not?
3. Do you feel that the resources and tools in the structured peer revaluation system empowered you to offer serious and objective peer review feedback for your classmates? Why or why not?
4. Do you feel that the resources and tools in the structured peer evaluation system allowed you to feel more confident in accepting feedback received from your peers? Why or why not?
5. Do you feel that the use of the resources and tools in the structured peer evaluation system promoted a sense of community among peers during peer review activities? Why or why not?
6. What other comments would you like to add about the structured peer evaluation system?

Fostering Cognitive Presence in Online Courses: A Systematic Review (2008-2020)

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Abstract
Within the Community of Inquiry (CoI) framework, cognitive presence has been central to success in higher education settings. This systematic review examined 24 articles published between 2008-2020 that empirically analyzed cognitive presence in online courses. We share the patterns that emerged regarding the interplay between teaching and cognitive presence and social and cognitive presence. We also explore how the four phases of cognitive presence—triggering event, exploration, integration, and resolution—were evident within specific instructional activities. We conclude with implications for practice that will be helpful for course instructors and designers seeking to foster greater cognitive presence within their online courses.

Keywords: Cognitive presence, community of inquiry, online courses, practical inquiry model

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There is a clear relationship between motivation, satisfaction, and learning within the context of online education (Brooker et al., 2018; Hsu et al., 2019). These relationships have gained particular relevance amidst the shift to online learning during the COVID-19 pandemic (Baber, 2020; Moore, 2020). The dramatic shift to emergency remote teaching (ERT) in 2020 (Hodges et al., 2020) highlighted the critical need to continually reflect on how online learning environments are being constructed. As we continue through this global pandemic, we have an opportunity to closely examine how we can more effectively integrate technology into learning environments in an equitable and just way (Adedoyin & Soykan, 2020; Hodges et al., 2020; Masonbrink & Hurley, 2020; Moore, 2020; Roitsch et al., 2021; Schuck & Lambert, 2020). Moreover, through this introspection, we can create more equitable online learning environments.

In this paper, we examine online learning environments through the Community of Inquiry (CoI) model (Garrison et al., 1999). CoI was developed to address unique barriers in developing higher-order learning in online learning environments. Three interconnected presences make up the CoI model: social presence, teaching presence, and cognitive presence. For our paper, we focus on the third presence, cognitive presence, which has been linked to success within higher education settings (Abe, 2020). This model suggests that the most successful online learning environments emphasize self-regulated learning and self-reflection. They also involve linkages between past understanding and newly acquired knowledge, social interactions and coordinated efforts between peers, and direct application of knowledge to learners' daily lives (Cercone, 2008; Garrison, 2007; Ke, 2010; Kilis & Yıldırım, 2018).

While CoI creates a valuable framework for examining online educational experiences, other factors can further enhance online learning. Kozan and Caskurlu (2018) posited that CoI could expand to include additional presences, including autonomy presence, distributed teaching presence, emotional presence, instructor presence, instructor social presence, teacher engagement, and learning presence. Within these presences, different categories point to the importance of characteristics such as intrinsic motivation (autonomy presence), outcome and activity emotions (emotional presence), open communication and emotional expression (instructor social presence), and motivating and supporting learners (teacher engagement); all of which share common threads of motivation and satisfaction within communities of inquiry and online learning (Kozan & Caskurlu, 2018).

The purpose of this systematic review was to examine the empirical research of cognitive presence in online courses and understand the contexts and implications for practice that emerged from these studies. The review focuses on articles from 2008–2020, as 2008 was when the validated CoI instrument was developed (Arbaugh et al., 2008). To guide our review, we used the following research questions:

1. How has cognitive presence been examined in online courses?
2. How can instructors foster cognitive presence within online courses?

In the literature review section, we provide an overview of the three presences that make up the CoI model and cover the components that comprise cognitive presence, the focus of this paper. Also, in the literature review, we discuss the phases of the Practical Inquiry Model (PIM; Garrison et al., 2001), which guides the learner through the phases of cognitive presence. We conclude that section with a brief overview of how the three presences intersect and a discussion about the ways that instructors might consider fostering cognitive presence in their classrooms.

Our methods section documents the process we used to systematically consider articles for inclusion in this study. Finally, in the results and discussion section, we synthesize our findings around context, the PIM, and implications for practice.

Literature Review

Community of Inquiry Model

The Community of Inquiry (CoI) framework, introduced by Garrison et al. (1999), examines the critical elements of a community of inquiry and how these elements overlap to create an educational experience. Garrison et al. (1999) sought to establish key indicators of cognitive presence, social presence, and teaching presence and how these elements contribute to student success (Fiock, 2020; Garrison, 2016). As can be gleaned from the name itself, CoI emphasizes the importance of community and collaboration within an educational context, especially online learning. It emphasizes the interactions among students, instructors, and peers within the higher education context and how these interactions contribute meaningfully to an educational experience. In initial studies of CoI, the transcript coding method was utilized to analyze transcripts and code them within the categories and elements within the CoI framework (Arbaugh et al., 2008). The CoI instrument was developed to study online communities of inquiry with a more descriptive approach. The COI instrument is 34-questions that collects data on both the categories and elements of CoI within the context of various courses and universities (Arbaugh et al., 2008; Stenbom, 2018; Stenbom et al., 2016). The CoI survey was validated (Swan et al., 2008) and applied in a multitude of studies across the educational landscape to further understand the dynamics of online and blended learning environments. Sadaf et al. (2021) found in their recent systematic review of cognitive presence and the CoI that most research on CoI is either using the survey instrument or a coding of discussion forum transcripts.

The first presence in CoI is teaching presence, which describes the role of instructors in course design, organization, and delivery and the instructions that guide social and cognitive presences to desired learning outcomes (Anderson et al., 2001). Garrison (2007) further defines teaching presence as a significant factor for students' satisfaction, perceptions of learning, and sense of community. Examples of teaching presence include direct instruction, course/instructional design, and facilitating discussion and collaboration throughout a course. Teaching presence rests primarily on the role of the instructor and includes their ability to design, facilitate, and encourage learning through a variety of methods (Fiock, 2020).

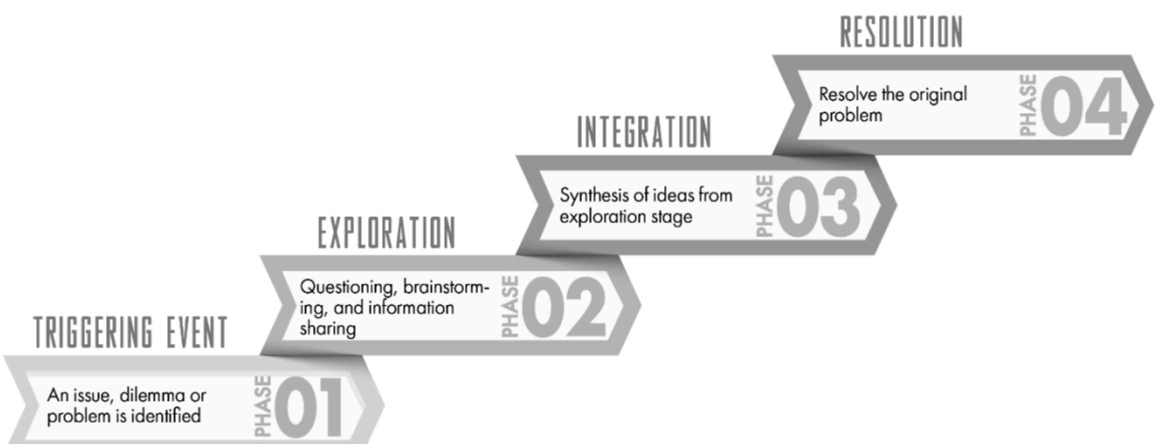
The second presence, social presence, is an important aspect of online learning and is particularly essential for high-quality asynchronous discussion forums (Akcaoglu & Lee, 2016). In addition to discussion forums, video-based platforms have been explored for their ability to develop social presence in online courses (Clark et al., 2015; Gurjar, 2020; Lowenthal et al., 2020; Lowenthal & Moore, 2020). This presence focuses on the fundamental social relationships among members of a learning community and the social climate that contributes to mastery of learning objectives (Moore, 2016; Rourke et al., 1999). Social presence is the ability to present oneself (in this case, through digital mediums) and establish personal and purposeful relationships (Garrison, 2007). The three most important aspects of social presence are effective communication, open communication, and group cohesion (Garrison, 2007). Without the interaction created through social presence, the resultant collaboration and knowledge construction needed for cognitive presence cannot exist within a course (Kreijns et al., 2014). Key categories of social presence include students' ability to express emotion, work together as a group, and freely express themselves within the context of the community (Garrison et al., 1999).

The third presence (and focus of this paper) is cognitive presence, which is defined as the exploration, construction, resolution, and confirmation of understanding through collaboration and reflection in a community of inquiry (Garrison, 2007). Cognitive presence is grounded in critical thinking literature (Garrison et al., 1999; 2001) and operationalized through the cycle of practical inquiry, in which participants move deliberately from understanding the issue to exploration, integration, and application (Garrison, 2007; Gibson et al., 2012). Cognitive presence is of particular interest in online courses, in which the community established within the virtual arena is paramount (Abe, 2020; Fiock, 2020). Whereas cognitive presence in in-person classes can be communicated via facial expressions, body language, and other live indicators of understanding, it can be more challenging to ensure that students are engaged virtually (Moore, 2016). Online and blended learning offer a variety of tools to help foster cognitive presence, such as asynchronous online discussion (Galikyan & Admiraal, 2019), video communication (Seckman, 2018), and other activities that guide the learner through the four phases of the Practical Inquiry Model (PIM) (Fiock, 2020; Sadaf & Olesova, 2017). Schrire (2004) suggests the PIM as an effective way to analyze the cognitive dimension within a discussion forum. Cognitive presence is a central dimension of the PIM that describes the learning phases from the initial practical inquiry to eventual knowledge construction and problem solving (Garrison et al., 2001).

Practical Inquiry Model

The four phases of the Practical Inquiry Model are: a triggering event, exploration, integration, and resolution (Figure 1; Garrison et al., 2001; Garrison, 2007; Gibson et al., 2012; Moore et al., 2019).

Figure 1
Four Phases of Practical Inquiry Model (adapted from Garrison et al. [2001])



In the initial "triggering event" phase, the learning cycle is initiated by a problem or dilemma, which, in the course context, is typically introduced by the instructor. In a discussion forum, this would be the initial prompt the instructor has posed to learners, and students are first tasked with scoping and understanding the prompt (Chen et al., 2019). At the second phase of exploration, students move on to brainstorming and other activities in which they gather information relevant to the problem or task at hand. In many discussion forums, this is the phase in which students spend the most time. One example of this in practice would be asking students to brainstorm a solution to a problem of practice (Chen et al., 2019). At the integration phase, after gathering an appropriate body of information, students selectively synthesize and integrate different components while filtering out irrelevant information. It is at this stage where higher levels of cognitive presence are demonstrated. An example of this could be a discussion forum activity in which a designated student must summarize other students' posts over the past week and share their synthesis. Another example might be asking students to post replies that specifically call out areas of agreement or disagreement. In the final stage, resolution, cognitive presence is typically the most difficult to reach, in part due to the educational context (Kovanović et al., 2015; Moore, 2016; Moore et al., 2019). In this phase, the desired outcome is for students to reach a resolution to the original problem. However, if this is a new subject domain for learners, it may not be possible to attain this outcome within the relatively short duration of the discussion forum. It is also common to see the resolution of the original problem launch a new learning cycle, with an accompanying new triggering event (Kovanović et al., 2015).

Interaction of Teaching, Social and Cognitive Presences

To achieve an optimal educational experience, all three presences must be accounted for within a course. It is at the intersection of the presences that specific learning outcomes can be observed, as the presences are interconnected. The intersection of social presence and cognitive presence is important, as students are not online simply for purely social reasons (Garrison, 2007). In further exploring the relationship between the three presences, studies have found that social presence is a mediator between teaching presence and cognitive presence, and teaching presence causally influences both social and cognitive presence (Garrison et al., 2010; Kreijns et al., 2014; Shea & Bidjerano, 2009).The connection between social and cognitive presence can lead to an environment that facilitates interaction between learners, content, and instructors (Song & Yuan, 2015). Additionally, Garrison et al. (2010) suggest that the central role of teaching presence is establishing and maintaining social and cognitive presence. The learner navigates the learning environment (created through teaching presence) and engages with peers and content (social presence) to develop higher-order thinking skills (cognitive presence) (Gibson et al., 2012). Teaching presence brings the social and cognitive presences together and accounts for learners' needs and capabilities (Garrison & Anderson, 2003; Kreijns et al., 2014).

Instructional Approaches

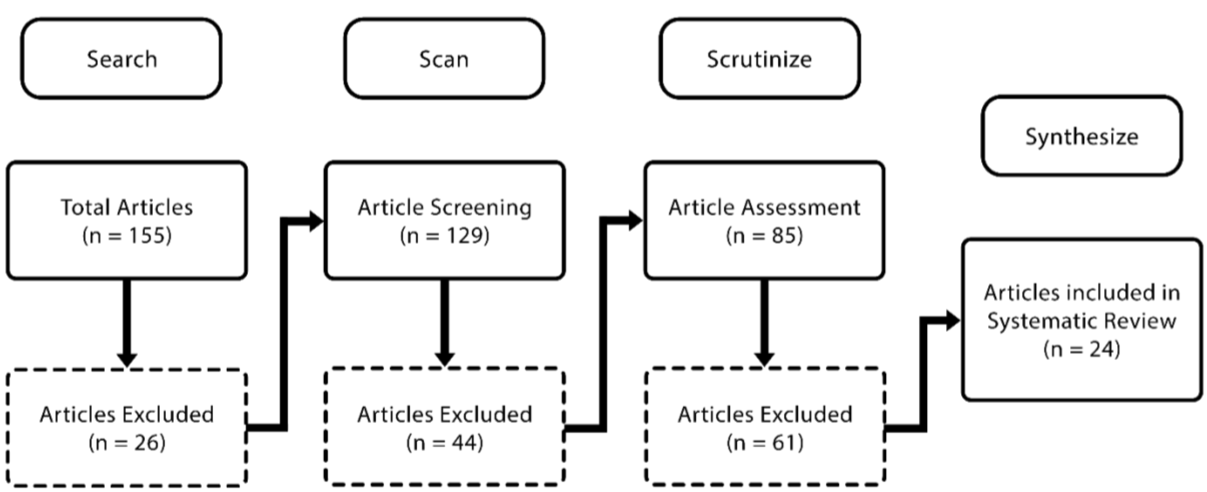
Different strategies have been used to encourage cognitive presence, one of which is using discussion forums (Abe, 2020; Brooker et al., 2018; Chen et al., 2019; Fiock, 2020; Galikyan & Admiraal, 2019; Junus et al., 2019; Moore, 2016; Sadaf & Olesova, 2017). Sadaf and Olesova (2017) focused their study on the how the type of question posed by the instructor could influence the student's levels of cognitive presence. They found that framing the question around a case-based discussion resulted in students demonstrating higher levels of cognitive presence. In this scenario, the instructor is taking the lead in presenting a prompt that makes students think critically and more importantly, articulate their thought processses. The implementation of small group vs. whole-class dynamics has also been explored as an instructional approach to foster cognitive and social presence (Akcaoglu & Lee, 2016). In this approach, the students can delve deeper into a topic because they have focused their discussions within a smaller group. This can lead to a richer discussion and co-construction of knowledge. The role of facilitation has been explored, as knowledgeable facilitators providing appropriate prompting can engage learners in higher-level learning (Baber, 2020; Fiock, 2020). Additionally, researchers have compared the merit of synchronous and asynchronous interaction as a part of CoI (Clark & Grove, 2015; Molnar, 2017). Others have examined the use of video in both synchronous and asynchronous capacities to encourage participation (Clark & Grove, 2015; Guo & Chen, 2019; Gurjar, 2020; Lowenthal et al, 2020).

These various studies have demonstrated that context and instructional aims are key determining factors in how cognitive presence can be fostered within the online learning environment. The course objectives will vary but the goal of identifying ways to engage learners with both the content and each other is a universal objective for instruction. As instructors are considering how to best structure their course, they have a variety of options to consider. And as the studies mentioned above highlight, there are a lot of options to consider. Thus, we have synthesized the literature focusing on ways that cognitive presence has been fostered in online courses. We narrowed our review to include studies that provide insight on techniques that instructors can use to develop their learner's cognitive presence. We have distilled the literature into themes, which we discuss in the results section, that will be useful for instructors considering how they may approach the challenge of fostering cognitive presence within their online courses.

Methods

This systematic review was guided by the PRISMA principles (Liberati et al., 2009), and we adapted the principles to complete four phases of our selection and synthesis of the literature (Figure 2). In this section, we discuss the selection and filtering process that we used and thus create a level of transparency that adds trustworthiness to the study. To aid in that transparency, we used PRISMA as it allows for a clear and concise way to present our process so that others may replicate or update the review. This method aids in establishing the trustworthiness of the study (Page et al., 2021).

Figure 2
Article Selection Process (adapted from Liberati et al. [2009])



Search

In the first phase, we conducted our search using the Academic Search Premier and Education Source databases. Our search terms were combinations of "online engagement," "motivation," "satisfaction," "develop*," "foster*," and "cognitive presence." We restricted our search to peer-reviewed journal articles published in English between 2008-2020. The initial search returned 155 studies, and 26 duplicates were removed.

Scan

In the second phase, we reviewed abstracts and removed an additional 44 studies that were either irrelevant or unobtainable, leaving 85 articles for full-text screening.

Scrutinize

In the third phase, we read each of the 85 articles and determined if they fit the inclusion and exclusion criteria in Table 1. To be included in the study, an article needed to match all the inclusion criteria. These inclusions were based on the focus of our research study. This process left 24 articles.

Table 1

Inclusion and Exclusion Criteria

Inclusion Criteria	**Exclusion Criteria**
• Article was peer-reviewed	• Article was book chapter, conference proceeding, or not a peer-reviewed source
• Article was empirical	• Article was not empirical
• Article was published between 2008-2020 Article presented a strategy or technique for fostering cognitive presence	• Article did not focus on cognitive presence in an online course

Synthesize

In the following section, we synthesize the 24 articles included in this review. Where appropriate, we have added additional context through citations.

Results and Discussion

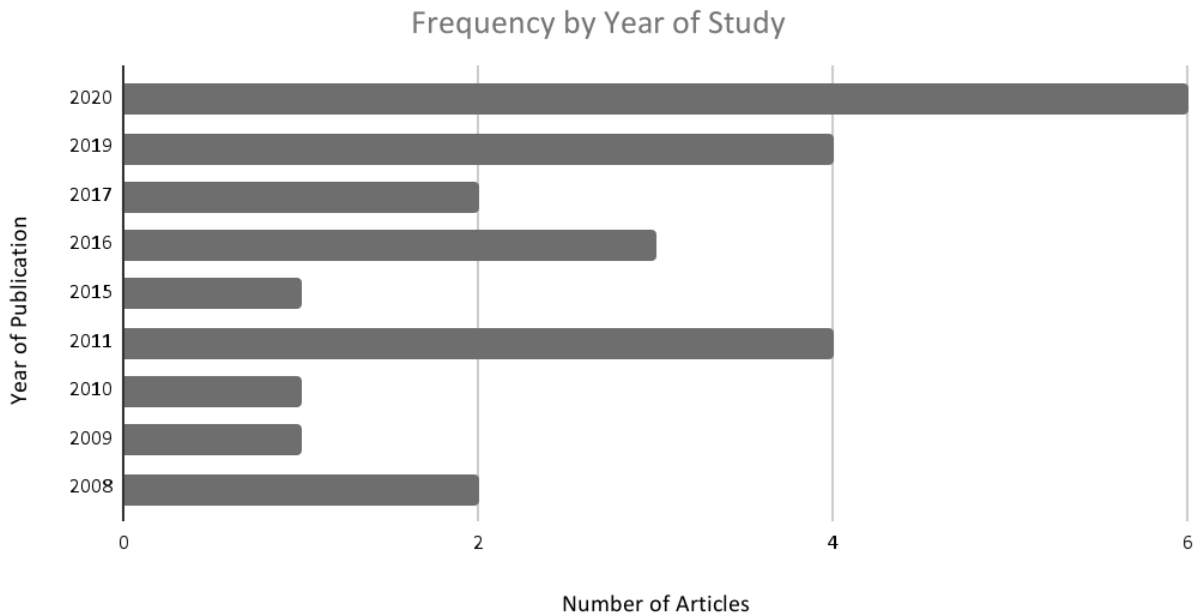
Research Question #1: How Has Cognitive Presence Been Examined in Online Courses?

For our first research question, we were interested in understanding the contexts in which cognitive presence has been examined. We were particularly curious to explore whether there were any patterns in the empirical research that may be helpful for contextualizing our understanding of cognitive presence. In this section, we look specifically at the publication dates, educational level of learners, instructional contexts, scope of study, methods, relationship between presences, and PIM.

Publication Date

We searched for articles between 2008-2020 and found that there were publications in each of those years, except for 2012-2014 and 2018 (Figure 3). Most years had three or fewer articles, with the most popular years being 2011, 2019 and 2020. Reviewing the year of publication and factors such as method of assessment, scope of study, or learner audience did not reveal any trends in terms of direction of research.

Figure 3
Frequency of Publications by Year



Educational Level of Learner Audience

Most studies focused on graduate-level students, followed by undergraduate students, and then adult learners (Table 2). Of the 24 studies, five (Joo et al., 2011; Morueta et al., 2016; Patwardhan et al., 2020; Shea et al., 2010; Shea & Bidjerano, 2008) did not specify audience by grade level, but by course type, content, or other criteria.

Table 2
Articles by Learner Audience

Learner Audience	Articles
Graduate students	(Akyol et al., 2011; Akyol & Garrison, 2008; Bissessar et al., 2020; Chen et al., 2019; Gašević et al., 2015; Ice et al., 2011; Kucuk & Richardson, 2019; Kumar et al., 2011; Leader-Janssen et al., 2016; Rolim et al., 2019)
Undergraduate students	(Cho & Tobias, 2016; Choo et al., 2020; Molnar & Kearney, 2017; Poluekhtova et al., 2020; Shea & Bidjerano, 2009)
Both graduate and undergraduate students	(Pillai & Sivathanu, 2019)
Teachers	(Sağlam & Dikilitaş, 2020)
Adult learners	(DuBois et al., 2019; Saadatmand et al., 2017)

Instructional context

We found that the articles were situated within one of four instructional contexts: university system, single course, multiple courses, and at the program level (Table 3).

Table 3
Articles by Instructional Context

Context	Studies
Online university system	(Ice et al., 2011)
Single course	(Akyol et al., 2011; Akyol & Garrison, 2008; Bissessar et al., 2020; Chen et al., 2019; DuBois et al., 2019; Gašević et al., 2015; Joo et al., 2011; Molnar & Kearney, 2017; Morueta et al., 2016; Rolim et al., 2019; Saadatmand et al., 2017; Sağlam & Dikilitaş, 2020)
Multiple courses	(Cho & Tobias, 2016; Patwardhan et al., 2020; Pillai & Sivathanu, 2019; Shea et al., 2010; Shea & Bidjerano, 2008, 2009)
Program level	(Choo et al., 2020; Kucuk & Richardson, 2019; Kumar et al., 2011; Leader-Janssen et al., 2016; Poluekhtova et al., 2020)

Scope of Study

Another theme worth mentioning that contributes to both of our research questions is the scope of the study. Most of the literature fell into two groups: studies to test the effectiveness of CoI strategies, and studies that sought to review CoI in general. We will discuss the studies on CoI strategies in the next section and will focus on the second group here.

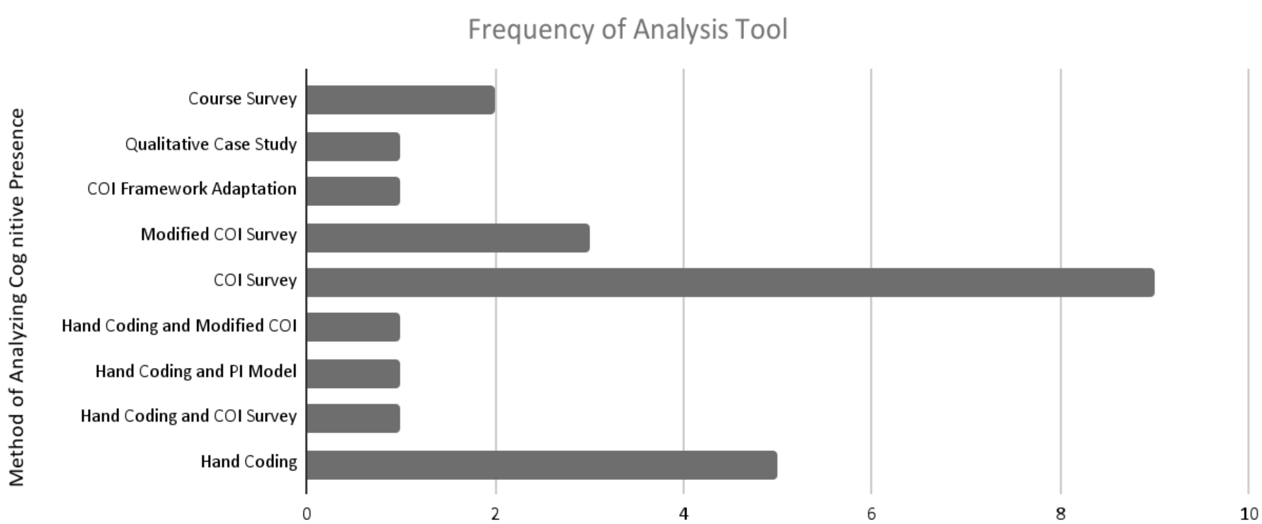
A large portion of the literature (Bissessar et al., 2020; Choo et al., 2020; Ice et al., 2011; Joo et al., 2011; Kucuk & Richardson, 2019; Leader-Janssen et al., 2016; Morueta et al., 2016; Patwardhan et al., 2020; Pillai & Sivathanu, 2020; Poluekhtova et al., 2020; Saadatmand et al., 2017; Sağlam & Dikilitaş, 2020; Shea et al., 2010; Shea & Bidjerano, 2008, 2009) looked at CoI in a holistic fashion, utilizing the CoI survey (and variations thereof) to measure cognitive presence in courses. While some studies viewed how students experienced and perceived CoI (Bissessar et al., 2020; Leader-Janssen et al., 2016; Poluekhtova et al., 2020; Saadatmand et al., 2017; Shea & Bidjerano, 2008;), other studies sought to determine the interplay between other various factors. Overarching themes included the study of CoI and course satisfaction (Choo et al., 2020; Ice et al., 2011; Kucuk & Richardson, 2019; Patwardhan et al., 2020; Sağlam & Dikilitaş, 2020), CoI and enrollment (Ice et al., 2011), the different presences within CoI (Joo et al., 2011; Kucuk & Richardson, 2019; Pillai & Sivathanu, 2020; Shea et al., 2010; Shea & Bidjerano, 2009), CoI and engagement (Kucuk & Richardson, 2019), CoI and course design (Patwardhan et al., 2020), and cognitive and social presence within higher cognitive tasks (Morueta et al., 2016).

Methods

A few notable themes related to methods of analysis emerged as the data was reviewed (Figure 4). Most studies used a quantitative approach, while Bissessar et al. (2020) utilized a qualitative case study approach. The CoI instrument was the most frequently used, either in its original form (Akyol et al., 2011; Cho & Tobias, 2016; Ice et al., 2011; Kucuk & Richardson, 2019; Leader-Janssen et al., 2016; Patwardhan et al., 2020; Sağlam & Dikilitaş, 2020; Shea & Bidjerano, 2008, 2009) or adapted (Joo et al., 2011; Kumar et al., 2011; Saadatmand et al., 2017). Choo et al. (2020) created their own survey built around the CoI framework but did not specifically indicate that the CoI instrument was used. In some cases, the CoI survey (or a modified form) was used in combination with other forms of measurement, such as hand coding (Akyol & Garrison, 2008; DuBois et al., 2019).

Hand coding was a common theme of measurement. While Chen et al. (2019) utilized both hand coding and the Practical Inquiry (PI) Model, more authors (Gašević et al., 2015; Molnar & Kearney, 2017; Morueta et al., 2016; Rolim et al., 2019; Shea et al., 2010) used hand coding on its own. Less commonly seen was the use of final course surveys (Pillai & Sivathanu, 2019; Poluekhtova et al., 2020).

Figure 4
Articles by Analysis Used



One final trend worth noting is that there is some commonality among the types of measurement tools being used based on scope of study. Studies that looked at multiple courses and the entire online university tended to use the CoI survey (Cho & Tobias, 2016; Ice et al., 2011; Patwardhan et al., 2020; Shea & Bidjerano, 2008, 2009). Studies that evaluated a single course used almost equal parts hand coding (Gašević et al., 2015; Molnar & Kearney, 2017; Morueta et al., 2016; Rolim et al., 2019) or some version of the CoI survey (Akyol et al., 2011; Joo et al., 2011; Saadatmand et al., 2017; Sağlam & Dikilitaş, 2020) At the program level, methods were split between using the CoI survey (Kucuk & Richardson, 2019; Leader-Janssen et al., 2016), adapted CoI (Kumar et al., 2011), survey adapted from the COI framework (Choo et al., 2020) and final course survey (Pillai & Sivathanu, 2019; Poluekhtova et al., 2020).

Community of Inquiry Presences

The CoI is about the interplay of three presences to create an educational experience. It is not surprising that the articles that highlight cognitive presence would also discuss the other presences of teaching and social presence. Several studies focused specifically on the relationship between cognitive presence and one other presence. The relationship between cognitive and social presence was the most common relationship (DuBois et al., 2019; Kucuk & Richardson, 2019; Morueta et al., 2016; Sağlam & Dikilitaş, 2020), while Akyol and Garrison (2008) explored the relationship between cognitive presence and teaching presence. Other articles focused more broadly on the relationships between the three presences. In the study conducted by Sağlam and Dikilitaş (2020), a positive correlation was found between all three presences. This finding builds off the work of prior researchers who found that teaching and social presence contributed to the observed levels of cognitive presence (Shea et al., 2010; Shea & Bidjerano, 2009). Kucuk and Richardson (2019) linked cognitive presence to engagement measures of emotional, cognitive, and behavioral.

Another theme that emerged from the studies was how the presences were linked to outcomes such as achievement or learner motivation and satisfaction. Specifically, cognitive presence and teaching presence were linked to student learning and satisfaction (Akyol & Garrison, 2008), and cognitive presence was found to be a predictor of student satisfaction (Joo et al., 2011). Bissessar et al. (2020) examined the relationship between the three presences and learner outcomes, and Sağlam and Dikilitaş (2020) looked at the three presences and learner satisfaction.

Practical Inquiry Model

As previously mentioned, cognitive presence is operationalized through four sub-phases including (a) a triggering event (defining and understanding the problem), (b) exploration (exploring the issue through discussion and critical reflection), (c) integration (constructing meaning from ideas developed through exploration), and (d) resolution (applying new knowledge in a real-world context) (Akyol et al., 2011; Bissessar et al., 2020; Hsu et al., 2019; Sadaf & Olesova, 2017; Sağlam & Dikilitaş, 2020).

The demonstration of the different phases varied across the studies. Bissessar et al. (2020), found that student feedback on facilitators showed more triggering events, whereas other studies found the exploration phase to be the most commonly coded (Chen et al., 2019; Molnar & Kearney, 2017). While two studies found more instances of integration and resolution phases (Akyol et al., 2011; Akyol & Garrison, 2008), Bissessar et al. (2020) found integration to be the least frequently observed phase. Chen et al. (2019) found that students were offering more solutions when they were actively engaged in their thinking and presentation of arguments. In a comparison of synchronous and asynchronous discussions, Molnar and Kearney (2017) found that more evidence of the resolution phase appeared in the synchronous version.

Research Question #2: How Have Instructors Fostered Cognitive Presence in Online Courses?

In our second research question, we examined how instructors fostered cognitive presence in online courses. The discussion forum was a common tool used to foster cognitive presence, and we found that the facilitation of these discussion forums reached different learning outcomes for the studies. We also saw that overall course structure was used to foster cognitive presence.

Discussion Forum Facilitation

A common theme among many of the studies was the use of discussion forums (Akyol et al., 2011; Akyol & Garrison, 2008; Chen & Chang, 2019; Cho & Tobias, 2016; DuBois et al., 2019; Gašević et al., 2015; Kumar et al., 2011; Molnar & Kearney, 2017; Rolim et al., 2019). How the discussion forum is integrated into the course influences the development of cognitive presence within the course. The instructor plays a critical role in this—whether it is by creating activities and designing the course to allow for peer facilitation or by being an active participant within the discussion forum (Shea et al., 2006; Shea & Bidjerano, 2008, 2009). Below, we discuss how the studies explored what role, if any, facilitation within the discussion forum can play in the demonstration of cognitive presence.

Peer Facilitation

Several studies highlighted how students were tasked with facilitating discussions (Akyol et al., 2011; Akyol & Garrison, 2008; Chen et al., 2019; Rolim et al., 2019). In these studies, the instructors provided support and a structure, but the responsibility for engaging with classmates within the discussion forum was tasked to specific students. In other words, the designated students served as moderators for the forum. In Rolim et al. (2019), students served as an expert on a topic and the rest of the class were in the role of researchers. Chen et al. (2019) found that when students were using facilitation techniques such as summarizing, social cues, and providing information to their peers, they were able to demonstrate the exploration stage.

Instructor Facilitation

Other studies focused on the role of the instructor in the facilitation of discussions (Bissessar et al., 2020; Cho & Tobias, 2016; Gašević et al., 2015; Leader-Janssen et al., 2016; Saadatmand et al., 2017). The role of the instructor varied and demonstrated different ways that cognitive presence can be fostered within a course. The instructor could serve in a more traditional role where they are posing discussion prompts and then facilitating the branching conversations and discussion (Bissessar et al., 2020; Cho & Tobias, 2016; Gašević et al., 2015; Rolim et al., 2019; Saadatmand et al., 2017). While this is a common approach to instructor facilitation, impact on student learning has been mixed. Cho and Tobias (2016) found that instructor participation within the discussions did not significantly increase student learning.

Another way that instructors facilitated discussions was through the coordination of synchronous sessions and/or activities (Kumar et al., 2011; Molnar & Kearney, 2017; Saadatmand et al., 2017). By bringing the learners together at the same time, the instructor sought to leverage learner-learner interaction techniques to foster cognitive presence. Additionally, studies provided examples of how instructors used social media interactions (DuBois et al., 2019; Saadatmand et al., 2017), peer and online mentoring (Sağlam & Dikilitaş, 2020), and groups/subgroups for collaboration (Kumar et al., 2011; Molnar & Kearney, 2017) to foster cognitive presence.

Design Considerations

One of the challenges that learners face in online environments is their need to self-regulate. The studies we examined addressed this challenge by providing suggestions for ways to design courses that can foster the development of cognitive presence. Gašević et al. (2015) suggest that providing detailed participation guidelines helps learners to demonstrate higher levels of cognitive presence. Additionally, Choo et al. (2020) suggest that assessments for peer-support learning can aid in students demonstrating cognitive presence. And Saadatmand et al. (2017) suggest that instructors take a holistic approach to how they integrate and use technology within their course. Instead of focusing on just one area, instructors should seek to provide multiple opportunities for students to engage with each other and the content. Saadatmand et al. (2017) further found that the integration of principles of problem-based learning helped to foster the learner-learner interaction and learner-context interaction that is critical for cognitive presence.

Implications for Practice

In our study, we found that several studies provided useful implications for practice, specifically around how to design course activities and create opportunities for student engagement, which can in turn foster cognitive presence. Discussion forums are a popular instructional tool within online learning environments, but the forum itself doesn't create cognitive presence (Moore et al., 2019; Sadaf & Olesova, 2017; Shea et al., 2010; Shea & Bidjerano, 2009). And while Shea et al. (2010) points out that reaching the final stages of integration and resolution are optimal, the research shows that it is not common to reach those final stages, particularly the resolution stage. But there are ways that instructors can get students to engage in higher levels of cognitive presence. One of those ways is by using the PIM to frame questions and using a case-based discussion approach (Sadaf & Olesova, 2017). Instructors need to be intentional in how they are designing and structuring their courses to ensure there is optimal engagement between learners and the content (Moore, 2016; Oyarzun et al., 2020). Simply creating discussion forum assignments will not be enough to have students reach the integration and resolution stages of cognitive presence. And failing to be strategic in the design of the discussion forum—including prompts, guidelines, and expectations for the forum – will be a missed opportunity to engage learners in rewarding online discussions. Specific approaches, such as providing scaffolded guidelines for student response (Rolim et al., 2020), can help raise the amount of engagement students may experience. In addition, studies that directly compare the effectiveness of instructional approaches (Cho & Tobias, 2016; Gašević et al., 2015) can futher guide practitioners in thoughtful and intentional design of activities that foster CoI.

The different presences overlap. For example, one approach to foster cognitive presence could be designing activities intended to increase social presence. A common issue in online courses is the sense of isolation or the sense of separation that learners might feel from being physically distant from other students. When efforts are made to cut down on the transactional distance, a greater sense of community is fostered, which can lead to more engagement and participation (Gurjar, 2020; Moore, 2014, 2016). Technology can offer a potential solution to addressing the transactional distance in online courses (Moore, 2016). Tools such as PollEverywhere, VoiceThread, and Flipgrid have all been shown to engage learners (Guo et al., 2019; Lowenthal & Moore, 2020; Moore et al., 2018; Oliver et al., 2017; Saçak & Kavun, 2020). Flipgrid, a free tool, integrates with many learning management systems and offers a robust tracking of student engagement, participation, and opportunities to allow the type of creativity that can be indicative of the latter stages of cognitive presence. Lowenthal and Moore (2020) explored student perceptions using Flipgrid for discussions and found that students enjoyed the activity and felt a deeper connection with their peers, despite being fully online.

In addition to tools for engagement, utilizing social platforms for interaction can contribute to the sense of community. The use of social media platforms such as Facebook (Dubois et al., 2019) and Twitter (Saadatmand et al., 2017) can take interaction out of the classroom and into a more "social" atmosphere. Because of this, learners may be able to embrace the aspects of communication and group cohesion that is not inherent in a more formalized classroom setting (Garrison, 2007).

A final note for practitioners to consider is how they might continue to contribute to the literature as they implement activities that foster CoI. This systematic review attempted to capture specific examples that were a part of the selected studies. However, many of the articles did not provide great specificity or examples of instructional approaches deployed. As more research is conducted around cognitive presence and CoI, practitioners can provide best practice recommendations to be adopted and applied to online courses.

Conclusion

We conducted a systematic review to examine the empirical research focused on cognitive presence in online courses. The distribution of publication years suggests that the Community of Inquiry model is still a relevant and oft-studied model in the context of online learning, and interest on the topic continues to grow. As we have seen a global shift to online learning resulting from a global pandemic, it is essential that we consider the needs of learners in technology-mediated environments (Moore, 2020; Roitsch et al., 2021). Suggestions for providing clear participation requirements, identifying multiple ways to integrate technology, and not simply relying on unstructured discussion forums were all useful considerations for course designers and instructors seeking to foster the development of cognitive presence. In addition, depending on the instructional context, students may not be that far developed in their thinking, as they may still be grappling with the initial exploration stages. Because of this, instructors should not be overly concerned if they are not able to see high levels of the integration and resolution stages within their course discussions. Instead, instructors should seek ways to align course objectives with an appropriate level of cognitive presence. We suggest that instructors review how they are leveraging their course management system, Web 2.0 technology tools such as PollEverywhere, Flipgrid and VoiceThread, and experiment with different approaches that can improve social presence which in turn will help foster cognitive presence in their online courses.

Declarations

The authors declare no conflicts of interest.

As a literature review, this work did not seek primary data collection from human subjects. Therefore, no ethics board approval was sought.

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References

Abe, J. A. A. (2020). Big five, linguistic styles, and successful online learning. *The Internet and Higher Education*, *45*. https://doi.org/10.1016/j.iheduc.2019.100724

Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. *Interactive Learning Environments*, 1–13. https://doi.org/10.1080/10494820.2020.1813180

Akcaoglu, M., & Lee, E. (2016). Increasing social presence in online learning through small group discussions. *The International Review of Research in Open and Distributed Learning, 17*(3), 1–17. https://doi.org/10.19173/irrodl.v17i3.2293

Akyol, Z., & Garrison, D. R. (2008). The development of a Community of Inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence. *Journal of Asynchronous Learning Networks*, *12*(3–4), 3–22.

Akyol, Z., Vaughan, N., & Garrison, D. R. (2011). The impact of course duration on the development of a community of inquiry. *Interactive Learning Environments*, *19*(3), 231–246. https://doi.org/10.1080/10494820902809147

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. (2008). Developing a community of inquiry instrument: Testing a measure of the Community of Inquiry framework using a multi-institutional sample. *Internet and Higher Education*, *11*(3–4), 133–136. https://doi.org/10.1016/j.iheduc.2008.06.003

Baber, H. (2020). Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of COVID-19. *Journal of Education and E-Learning Research*, *7*(3), 285–292.

Bissessar, C., Black, D., & Boolaky, M. (2020). International online graduate students' perceptions of CoI. *European Journal of Open, Distance and E-Learning*, *23*(1), 61–83. https://doi.org/10.2478/eurodl-2020-0005

Brooker, A., Corrin, L., de Barba, P. G., Lodge, J., & Kennedy, G. (2018). A tale of two MOOCs: How student motivation and participation predict learning outcomes in different MOOCs. *Australasian Journal of Educational Technology*, *34*(1), 73–87. https://doi.org/10.14742/ajet.3237

Cercone, K. (2008). Characteristics of adult learners with implications for online learning design. *AACE Journal*, *16*(2), 137–159.

Chen, Y., Lei, J., & Cheng, J. (2019). What if online students take on the responsibility: Students' cognitive presence and peer facilitation techniques. *Online Learning*, *23*(1), 37–61. https://doi.org/10.24059/olj.v23i1.1348

Cho, M.-H., & Tobias, S. (2016). Should instructors require discussion in online courses? Effects of online discussion on Community of Inquiry, learner time, satisfaction, and achievement. *The International Review of Research in Open and Distributed Learning*, *17*(2), 123–140. https://doi.org/10.19173/irrodl.v17i2.2342

Choo, J., Bakir, N., Scagnoli, N. I., Ju, B., & Tong, X. (2020). Using the Community of Inquiry framework to understand students' learning experience in online undergraduate business courses. *TechTrends*, *64*(1), 172–181. https://doi.org/10.1007/s11528-019-00444-9

Clark, C., Strudler, N., & Grove, K. (2015). Comparing asynchronous and synchronous video vs. text based discussions in an online teacher education course. *Online Learning*, *19*(3), 48–70. http://dx.doi.org/10.24059/olj.v19i3.668

DuBois, B., Krasny, M. E., & Russ, A. (2019). Online professional development for environmental educators: strategies to foster critical thinking and social interactions.

Environmental Education Research, *25*(10), 1479–1494. https://doi.org/10.1080/13504622.2018.1564247
Fiock, H. (2020). Designing a community of inquiry in online courses. *The International Review of Research in Open and Distributed Learning*, *21*(1), 134–152. https://doi.org/10.19173/irrodl.v20i5.3985
Galikyan, I., & Admiraal, W. (2019). Students' engagement in asynchronous online discussion: The relationship between cognitive presence, learner prominence, and academic performance. *The Internet and Higher Education*, *43*. https://doi.org/10.1016/j.iheduc.2019.100692
Garrison, D. R. (2003). *E-Learning in the 21st century: A framework for research and practice*. Routledge.
Garrison, D. R. (2007). Online community of inquiry review: social, cognitive, and teaching presence issues. *Journal of Asynchronous Learning Networks*, *11*(1), 61–72. https://doi.org/10.1128/JB.05513-11
Garrison, D. R. (2016). *Thinking Collaboratively: Learning in a Community of Inquiry*. Routledge/Taylor & Francis Group.
Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2–3), 87–105. https://doi.org/0.1016/S1096-7516(00)00016-6
Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education*, *15*(1), 7–23. https://doi.org/10.1080/08923640109527071
Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education*, *13*(1–2), 5–9. https://doi.org/10.1016/j.iheduc.2009.10.003
Garrison, D. R., Cleveland-Innes, M., & Fung, T. S. (2010). Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *Internet and Higher Education*, *13*(1–2), 31–36. https://doi.org/10.1016/j.iheduc.2009.10.002
Gašević, D., Adesope, O., Joksimović, S., & Kovanović, V. (2015). Externally-facilitated regulation scaffolding and role assignment to develop cognitive presence in asynchronous online discussions. *The Internet and Higher Education*, *24*, 53–65. https://doi.org/10.1016/j.iheduc.2014.09.006
Gibson, A. M., Ice, P., Mitchell, R., & Kupczynski, L. (2012). An inquiry into relationships between demographic factors and teaching, social, and cognitive presence. *Internet Learning*, *1*(1), 7–16.
Guo, C., Chen, X., & Hou, Y. (2019). A case study of students' participation and knowledge construction in two online discussion settings. *Proceedings of the 2019 4th International Conference on Distance Education and Learning - ICDEL 2019*, 45–49. https://doi.org/10.1145/3338147.3338177
Gurjar, N. (2020). Reducing transactional distance with synchronous and asynchronous video-based discussions in distance learning. *Proceedings of the SITE 2020 Annual Conference*, 268–272.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. EDUCAUSE Review Online. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Hsu, H.-C. K., Wang, C. V., & Levesque-Bristol, C. (2019). Reexamining the impact of self-determination theory on learning outcomes in the online learning environment. *Education and Information Technologies*, *24*(3), 2159–2174. https://doi.org/10.1007/s10639-019-09863-w

Ice, P., Gibson, A. M., Boston, W., & Becher, D. (2011). An exploration of differences between Community of Inquiry indicators in low and high disenrollment online courses. *Journal of Asynchronous Learning Networks*, *15*(2), 44–69.

Joo, Y. J., Lim, K. Y., & Kim, E. K. (2011). Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Computers & Education*, *57*(2), 1654–1664. https://doi.org/10.1016/j.compedu.2011.02.008

Junus, K., Suhartanto, H., R-Suradujono, B. S. H., Santoso, H. B., & Sadita, L. (2019). The community of inquiry model training using the cognitive apprenticeship approach to improve students' learning strategy in the asynchronous discussion forum. *The Journal of Educators Online*, *16*(1), 1–17. https://doi.org/10.9743/jeo.2019.16.1.7

Ke, F. (2010). Examining online teaching, cognitive, and social presence for adult students. *Computers & Education*, *55*(2), 808–820. https://doi.org/10.1016/j.compedu.2010.03.013

Kilis, S., & Yıldırım, Z. (2018). Investigation of community of inquiry framework in regard to self-regulation, metacognition and motivation. *Computers & Education*, *126*(June), 53–64. https://doi.org/10.1016/j.compedu.2018.06.032

Kozan, K., & Caskurlu, S. (2018). On the N th presence for the Community of Inquiry framework. *Computers & Education*, *122*(May 2017), 104–118. https://doi.org/10.1016/j.compedu.2018.03.010

Kreijns, K., Van Acker, F., Vermeulen, M., & Van Buuren, H. (2014). Community of Inquiry: Social presence revisited. *E-Learning and Digital Media*, *11*(1), 5–18. https://doi.org/10.2304/elea.2014.11.1.5

Kucuk, S., & Richardson, J. C. (2019). A structural equation model of predictors of online learners' engagement and satisfaction. *Online Learning*, *23*(2), 196–216. https://doi.org/10.24059/olj.v23i2.1455

Kumar, S., Dawson, K., Black, E. W., Cavanaugh, C., & Sessums, C. D. (2011). Applying the community of inquiry framework to an online professional practice doctoral program. *The International Review of Research in Open and Distributed Learning*, *12*(6), 126. https://doi.org/10.19173/irrodl.v12i6.978

Leader-Janssen, E. M., Nordness, P. D., Swain, K. D., & Hagaman, J. L. (2016). Students' perceptions of an online graduate program in special education for emotional and behavioral disorders. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *39*(4), 246–258. https://doi.org/10.1177/0888406416637411

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine*, *6*(7), 1–28. https://doi.org/10.1371/journal.pmed.1000100

Lowenthal, P., Borup, J., West, R. E., & Archambault, L. M. (2020). Thinking beyond Zoom: Using asynchronous video to maintain connection and engagement during the COVID-19 Pandemic. *Journal of Technology and Teacher Education*, *28*(2), 1–9.

Lowenthal, P., & Moore, R. L. (2020). Exploring student perceptions of Flipgrid in online courses. *Online Learning*, *24*(4), 28–41. https://doi.org/10.24059/olj.v24i4.2335

Masonbrink, A. R., & Hurley, E. (2020). Advocating for children during the COVID-19 school closures. *Pediatrics*, *146*(3), 1–4. https://doi.org/10.1542/peds.2020-1440

Molnar, A. L., & Kearney, R. C. (2017). A comparison of cognitive presence in asynchronous and synchronous discussions in an online dental hygiene course. *Journal of Dental Hygiene : JDH*, *91*(3), 14–21.

Moore, R. L. (2014). Importance of developing community in distance education courses. *TechTrends*, *58*(2), 20–24. https://doi.org/10.1007/s11528-014-0733-x

Moore, R. L. (2016). Interacting at a distance: Creating engagement in online learning environments. In L. Kyei-Blankson, J. Blankson, E. Ntuli, & C. Agyeman (Eds.), *Handbook of Research on Strategic Management of Interaction, Presence, and Participation in Online Courses* (pp. 401–425). IGI Global. https://doi.org/10.4018/978-1-4666-9582-5.ch016

Moore, R. L. (2019). Welcome to Normalton: Leveraging effective e-learning principles for adult learners. *International Journal of Designs for Learning*, *10*(1), 155–165. https://doi.org/10.14434/ijdl.v10i1.25610

Moore, R. L. (2020). Developing lifelong learning with heutagogy: contexts, critiques, and challenges. *Distance Education*, *41*(3), 381–401. https://doi.org/10.1080/01587919.2020.1766949

Moore, R. L., Blackmon, S. J., & Markham, J. (2018). Making the connection: Using mobile devices and poll everywhere for experiential learning for adult students. *Journal of Interactive Learning Research*, *29*(3), 397–421.

Moore, R. L., Oliver, K. M., & Wang, C. (2019). Setting the pace: examining cognitive processing in MOOC discussion forums with automatic text analysis. *Interactive Learning Environments*, *27*(5–6), 655–669. https://doi.org/10.1080/10494820.2019.1610453

Morueta, R. T., Maraver López, P., Hernando Gómez, Á., & Harris, V. W. (2016). Exploring social and cognitive presences in communities of inquiry to perform higher cognitive tasks. *The Internet and Higher Education*, *31*, 122–131. https://doi.org/10.1016/j.iheduc.2016.07.004

Oliver, K. M., Moore, R. L., & Evans, M. A. (2017). Establishing a virtual makerspace for an online graduate course: A design case. *International Journal of Designs for Learning*, *8*(1), 112–123. https://doi.org/10.14434/ijdl.v8i1.22573

Oyarzun, B., Martin, F., & Moore, R. L. (2020). Time management matters: Online faculty perceptions of helpfulness of time management strategies. *Distance Education*, *41*(1), 106–127. https://doi.org/10.1080/01587919.2020.1724773

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … McKenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ*, *10*(1), n160. https://doi.org/10.1136/bmj.n160

Patwardhan, V., Rao, S., Thirugnanasambantham, C., & Prabhu, N. (2020). Community of Inquiry (CoI) framework and course design as predictors of satisfaction in emergency remote teaching: Perspectives of hospitality management students. *Journal of E-Learning & Knowledge Society*, *16*(4), 94–103.

Pillai, R., & Sivathanu, B. (2019). An empirical study on the online learning experience of MOOCs: Indian students' perspective. *International Journal of Educational Management*, *34*(3), 586–609. https://doi.org/10.1108/IJEM-01-2019-0025

Poluekhtova, I. A., Vikhrova, O. Y., & Vartanova, E. L. (2020). Effectiveness of online education for the professional training of journalists: Students' distance learning during the COVID-19 pandemic. *Psychology in Russia. State of the Art*, *13*(4), 26–37.

Roitsch, J., Moore, R. L., & Horn, A. L. (2021). Lessons learned: What the COVID-19 global pandemic has taught us about teaching, technology, and students with autism spectrum disorder. *Journal of Enabling Technologies*, *15*(2), 108–116. https://doi.org/10.1108/JET-12-2020-0053

Rolim, V., Ferreira, R., Lins, R. D., & Gǎsević, D. (2019). A network-based analytic approach to uncovering the relationship between social and cognitive presences in communities of inquiry. *The Internet and Higher Education*, *42*, 53–65. https://doi.org/10.1016/j.iheduc.2019.05.001

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (1999). Assessing social presence in asynchronous text-based computer conferencing. *International Journal of E-Learning & Distance Education*, *14*(2), 50–71. http://www.ijede.ca/index.php/jde/article/viewArticle/153/341

Saadatmand, M., Uhlin, L., Hedberg, M., Åbjörnsson, L., & Kvarnström, M. (2017). Examining learners' interaction in an open online course through the community of inquiry framework. *European Journal of Open, Distance and E-Learning*, *20*(1), 61–79. https://doi.org/10.1515/eurodl-2017-0004

Saçak, B., & Kavun, N. (2020). Rethinking Flipgrid and VoiceThread in the context of online collaborative learning theory. In E. Alqurashi (Ed.), *Handbook of Research on Fostering Student Engagement With Instructional Technology in Higher Education* (pp. 211–228). IGI Global. https://doi.org/10.4018/978-1-7998-0119-1.ch012

Sadaf, A., & Olesova, L. (2017). Enhancing cognitive presence in online case discussions with questions based on the Practical Inquiry Model. *American Journal of Distance Education*, *31*(1), 56–69. https://doi.org/10.1080/08923647.2017.1267525

Sadaf, A., Wu, T., & Martin, F. (2021). Cognitive presence in online learning: A systematic review of empiricial research from 2000 to 2019. *Computers and Education Open*, *2*, Advance online publication. https://doi.org/10.1016/j.caeo.2021.100050

Sağlam, A. L. G., & Dikilitaş, K. (2020). Evaluating an online professional learning community as a context for professional development in classroom-based research. *The Electronic Journal for English as a Second Language*, *24*(3), 1–17.

Schrire, S. (2004). Interaction and cognition in asynchronous computer conferencing. *Instructional Science*, *32*(6), 475–502.

Schuck, R. K., & Lambert, R. (2020). “Am I doing enough?” Special educators’ experiences with emergency remote teaching in spring 2020. *Education Sciences*, *10*(11), 1–15. https://doi.org/10.3390/educsci10110320

Seckman, C. (2018). Impact of interactive video communication versus text-based feedback on teaching, social, and cognitive presence in online learning communities. *Nurse Educator*, *43*(1), 18–22. https://doi.org/10.1097/NNE.0000000000000448

Shea, P., & Bidjerano, T. (2008). Measures of quality in online education: An investigation of the community of inquiry model and the net generation. *Journal of Educational Computing Research*, *39*(4), 339–361. https://doi.org/10.2190/EC.39.4.b

Shea, P., & Bidjerano, T. (2009). Community of inquiry as a theoretical framework to foster “epistemic engagement” and “cognitive presence” in online education. *Computers & Education*, *52*(3), 543–553. https://doi.org/10.1016/j.compedu.2008.10.007

Shea, P., Hayes, S., Vickers, J., Gozza-Cohen, M., Uzuner, S., Mehta, R., Valchova, A., & Rangan, P. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *The Internet and Higher Education*, *13*(1–2), 10–21. https://doi.org/10.1016/j.iheduc.2009.11.002

Shea, P., Sau Li, C., & Pickett, A. (2006). A study of teaching presence and student sense of learning community in fully online and web-enhanced college courses. *Internet and Higher Education*, *9*(3), 175–190. https://doi.org/10.1016/j.iheduc.2006.06.005

Song, M., & Yuan, R. (2015). Beyond social presence: Increasing cognitive presence through meaningful interaction. *Global Learn 2015*, 731–736.

Stenbom, S. (2018). A systematic review of the Community of Inquiry survey. *The Internet and Higher Education*, *39*(June), 22–32. https://doi.org/10.1016/j.iheduc.2018.06.001

Stenbom, S., Jansson, M., & Hulkko, A. (2016). Revising the community of inquiry framework for the analysis of one-to-one online learning relationships. *International Review of Research in Open and Distance Learning*, *17*(3), 36–53. https://doi.org/10.19173/irrodl.v17i3.2068

Swan, K., Richardson, J. C., Ice, P., Garrison, D. R., Cleveland-Innes, M., & Arbaugh, J. B. (2008). Validating a measurement tool of presence in online communities of inquiry. *E-Mentor*, *2*(2), 1–12.

Introduction to Section II

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In addition to the special issue section on Advances in Cognitive Presence, this issue of *Online Learning* also contains a series of articles accepted through our regular submission process. These articles examine MOOCs, blended learning, online instruction, remote education, and the Community of Inquiry framework among other topics.

In "Fostering Self-Directed Learning in MOOCs: Motivation, Learning Strategies, and Instruction" Meina Zhu and Sarah Berri of Wayne State University join Curtis Bonk of Indiana University to provide insights into students' motivation, strategies and regulative behaviors in Massive Open Online Courses. It is important to note that MOOCs continue to provide students with lower cost and free opportunities for learning and that they remain very popular. In 2020, more than 950 universities provided over 16,000 MOOCs to 180 million registered MOOC users, the largest growth in MOOC registrants in a single year ever (Shah, 2020). Given all this activity, it is important to understand why and how learner participate effectively in MOOCs. Through in-depth, semi-structured interviews, this article provides much-needed data around the three themes noted in the title.

The next article in this section is "Implementing Blended First-year Chemistry in a Developing Country Using Online Resources" by Charisse Reyes of Monash University and University of the Philippines Open University, Sara Kyne and Christopher D. Thompson of Monash University, and Gwendolyn A. Lawrie University of Queensland. Educators in developing nations are increasingly implementing online and blended learning and novel approaches may be called for in these new contexts where resources may be limited. Through a mixed methods study employing a survey and focus groups, the authors of this paper aimed to understand student responses to the introduction of blended learning in an institution in the Philippines. Despite challenges associated with lack of infrastructure (electricity outages, limited access to computers), a majority of students favored blended learning for the flexibility, new pedagogy, and new forms of learning it enabled. However, a significant minority of students (40%) preferred the conventional face-to-face instruction with which they were familiar. These results suggest that progress in expanding access to higher education through more flexible modes of instruction will require institutions to identify resource challenges and address them.

The authors of "Simplicity is Key: Literacy Graduate Students' Perceptions of Online Learning", are Ann Van Wig and Shuling Yang of East Tennessee State University, Chelsey Bahlmann Bollinger of James Madison University, Xiufang Chen of Rowan University, Tala Karkar Esperat of Eastern New Mexico University, Kathryn Pole of University of Texas at Arlington and Nance Wilson of the State University of New York at Cortland. The purpose of this research was to determine literacy graduate students' perceptions of their experiences in completing literacy coursework when enrolled in online or blended formats. Using survey research, the authors examined 127 literacy master's degree candidates' perceptions before and after taking online classes, their confidence levels with technology, and about the technologies that impacted their learning. Results showed that initial perceptions of online learning changed positively after participating in online coursework and that course design influenced collaboration and engagement. This research identifies some important considerations for the development of online coursework for literacy graduate students.

In “Development and Validation of the Online Instructor Support Survey (OISS)” authors Swapna Kumar, Albert Ritzhaupt, of the University of Florida join Neuza Sofia Pedro of Lisbon University for a study documenting and analyzing an instrument to measure forms of institutional support for online faculty. The study identified seven domains of assistance for online instructors in higher education: technology infrastructure; technical support; online course development and teaching; online instructor incentives and rewards; administrative and academic support; institutional culture and policies; and program and legal support. The study focused on two questions related to the development of the instrument including faculty perceptions of available supports and establishing reliability and validity measures for the survey. Results from a survey using the instrument with 275 online faculty suggest that some supports are more prevalent whereas others require additional investment.

In “The Challenges of Remote K–12 Education During the COVID-19 Pandemic: Differences by Grade Level”, Nancy L. Leech, Sophie Gullett, and Miriam Howland Cummings of the University of Colorado Denver join Carolyn A. Haug of the Colorado Department of Education to explore a topic that is very relevant in the age of the pandemic. The study investigates obstacles experienced by teachers at various grade levels in implementing remote learning. Using both qualitative and quantitative methods with a sample of 604 teachers, the study found common challenges across levels and specific challenges within elementary and secondary levels. Common across levels were issues such as lack of student engagement, poor attendance and participation; a feeling of disconnect from students and colleagues; and a lack of knowledge as to how to transition online. For elementary teachers specifically there were even more struggles with adapting the curriculum to the remote/online format and gaining support from parents. This study provides insights as we continue to manage disruptions from toggling to remote instruction if there is another surge that requires a more aggressive social distancing.

In “Cheating on Unproctored Online Exams: Prevalence, Mitigation Measures, and Effects on Exam Performance” Jacob, John, and Barbara Pleasants of Iowa University investigate the issue of academic dishonesty in biology testing. As more faculty and students switched to remote instruction during the pandemic, concerns about cheating have become more urgent. There are multiple perspectives on student cheating and how best to prevent it, with some arguing for forms of teaching and learning that reduce or eliminate dishonesty by requiring students to demonstrate knowledge that is not easily captured on tests, e.g., through alternative forms of assessment. Others see testing as an inevitable consequence of the organization of higher education, with large numbers of students in introductory science courses—for example, which reduce the practicality of using more lengthy alternative assessments requiring customized feedback. The authors of this paper take the latter perspective and examine not only the existence of cheating in but also proportions of students engaging in academic dishonesty and ways to reduce these behaviors. An interesting result of this research is that despite finding evidence of cheating, the authors report that after implementing mitigation strategies and cheating declined, exam scores did not change significantly. It appears that cheating on these biology exams did not really help very much.

The next paper is “The Relationships of Connectedness, Performance Proficiency, Satisfaction, and Online Learning Continuance Intention in Online Learning” by Hungwei Tseng and Yingqi Tang of Jacksonville State University, with Yu-Chun Kuo of Rowan University, and Hsin-Te Yeh of Metropolitan State University of Denver. The authors of this study examined the relationships among online student sense of belonging and acceptance; how well they perform the tasks that required to master knowledge, their satisfaction, and their intent to continue with online learning. Multivariate correlational analysis of survey data indicated positive correlations between performance proficiency, satisfaction, and four subscales of online student connectedness. The authors provide some suggestions for supporting these variables through online course design.

The eighth paper in this section is "Identifying a Gap in the Project Management Approach of the Online Program Management and University Partnership Business Model" by Swati Ramani Southern California University of Health Sciences, George Bradford of Keck Graduate Institute, with Shamini Dias and Lorne Olfman of Claremont Graduate University. In this study, the authors analyzed the engagement of an online program management (OPM) firm with the University. OPMs are businesses that assist institutions of higher education to launch new online programs and offer a variety of services including marketing, recruitment and instructional design. Colleges usually pay a percentage of tuition revenue for new students in the online programs so the OPMs are motivated to move quickly, launch the programs successfully, and recruit relatively large cohorts of students. Contracts with OPMs are quite lengthy - typically, more than five years – and institutions are encouraged to innovate business practices, such as increasing the number of program-related start dates. These contracts can cause significant institutional and cultural change at colleges, and they can present challenges at institutions that employ faculty with multiple priorities, such as at the research university studied in this paper. Using Activity Theory to attempt to understand the complexities of the OPM partnership, the authors learned that faculty were surprised about the nature of the OPM contract, that their own opinions were not considered, and they did not understand the business relationship. The authors provide advice to various constituencies about OPM partnerships.

The final article in this section is "A Meta-Analysis on the Community of Inquiry Presences and Learning Outcomes in Online and Blended Learning Environments" by Florence Martin and Tong Wu of the University of North Carolina Charlotte with Liyong Wan of South-Central University for Nationalities, and Kui Xie of Ohio State University. This study presents research on two questions related to the CoI framework. The firsts asked about effects of teaching presence, social presence, and cognitive presence on actual learning, perceived learning and satisfaction as measured by the CoI survey. The second questions looked at the various elements of teaching presence, social presence, and cognitive presence described in the studies reviewed in the meta-analysis. The study defined actual learning as a change in knowledge identified by a rigorous measurement of learning. The authors report that while teaching presence and *actual* learning were moderately correlated, there was a weak correlation between both cognitive presence and social presence and actual learning. However, there were moderate to strong correlations between each of the presences and *perceived* learning as well as satisfaction. The authors indicated that the results have implications for designers and instructors of online and blended courses.

We hope that these new studies provide guidance for researchers and practitioners working to better understand how students and faculty learn, teach and assess in online environments. Please read, share, and cite this work and consider submitting your own rigorous original research to OLJ.

References

Shah, D. (2020). *The Second Year of the MOOC: A Review of MOOC Stats and Trends in 2020. The Report by Class Central*. https://www.classcentral.com/report/the-second-year-of-the-mooc/

Fostering Self-Directed Learning in MOOCs: Motivation, Learning Strategies, and Instruction

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Abstract
Given the increasing number of learners in massive open online courses (MOOCs), students' self-directed learning (SDL) skills are necessary for their success. The purpose of this study was to explore learners' motivation for enrolling in MOOCs and their SDL strategies, as well as instructional elements that support SDL from learners' perspectives. This qualitative study adopted a phenomenological research design. The data source was semi-structured interviews with 15 learners from three MOOCs. The data were analyzed using thematic analysis. The researchers found that the motivation for enrolling in MOOCs included intrinsic motivation (e.g., curiosity, improving personal knowledge, and personal interest) and extrinsic motivation (e.g., supporting formal education and career development). The learning strategies used by MOOC learners were task strategies, self-monitoring, and self-management strategies. The task strategies included taking notes, reading texts or subtitles, watching videos, and conducting further research. The self-monitoring strategies included self-assessment, self-reflection, progress indicators, final projects, and authentic tasks. Learners' self-management strategies (e.g., time management and resource management) varied depending on their diverse motivations. In addition, the instructional elements that support SDL were self-assessment and discussion forums, instructor feedback, flexibility, clearly stated learning goals, the authenticity of the content, and small learning units. The implications of the study are discussed in the paper.

Keywords: Self-directed learning, SDL, motivation, learning strategies, instruction, MOOCs

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Massive open online courses (MOOCs) are offering open-access learning materials in diverse subjects to learners (Zhu et al., 2018). More than 11,400 MOOCs were offered by the end of 2018 (Shah, 2019). The MOOCs differ from traditional online courses in several key ways, such as the number of learners in one course, open access to learning materials, the ratios of the instructor(s) to learners, how they are scheduled, the ability to contact and directly interact with the instructor, and so on. In one study, Chuang and Ho (2016) found that the average number of learners in a MOOC was 8,000 learners, though earlier research (Jordan, 2014) found that MOOCs enrollments initially averaged around 40,000 learners. During the COVID-19 pandemic time, the interest in MOOCs dramatically increased. One of the top providers, edX has over 24 million learners enrolled in over 2,600 courses, including nearly 300 micro-credentials and ten degree programs (edX, 2020; Shah, 2019). Those MOOC participants signing up for edX courses came from nearly 200 countries. At the start of the COVID-19 pandemic, another prominent MOOC vendor, Coursera, had the largest increase in newly registered learners, with 35 million new enrollments from mid-March to the end of July (Lohr, 2020). Udacity and FutureLearn also enrolled more than 10 million learners in 2019 (Shah, 2019); moreover, FutureLearn had established 49 micro-credentials and 23 degree programs (Shah, 2019).

Clearly, millions of learners have discovered a new way to learn and to keep up with the skill demands of their chosen fields, and many have also found a viable avenue in which to change careers without relying on full-time or part-time residential instruction. In addition to professional pursuits, others have learned valuable personal information related to health and fitness, financial management and investing, and learning to play a musical instrument (Businesswire, 2020).

As enrollments rise, it is becoming increasingly obvious that learning from MOOCs and other open educational resources (Kim et al., 2014) requires learners to have self-directed learning (SDL) skills (Kop & Fournier, 2010; Rohs & Ganz, 2015; Zhu, 2021; Zhu & Bonk, 2019a, b; Zhu et al., 2020), especially, for self-paced MOOCs and those MOOCs with limited presence from instructors or instructional support personnel. According to Brookfield (2013), “Self-directed learning is learning in which decisions around what to learn, how to learn it, and how to decide if one has learned something well enough are *all* in the hand of learners.” He further states that self-directed forms of learning are central to the educational pursuits of adults. The open education movement that has transpired over the past couple of decades (Bonk, 2009; Conole & Brown, 2018; MIT, 2001; Weller, 2014; Wiley & Hilton, 2009) has highlighted the need for research on SDL.

An in-depth investigation of MOOC students’ SDL when taking MOOCs is needed. The purpose of this study is to examine students’ self-directed learning (SDL) strategies and experience in MOOCs in order to provide insights to MOOC instructors and instructional designers on instructional strategies to support students’ SDL.

Theoretical Framework

This study adopted Garrison’s (1997) SDL model, which defined SDL with three closely related elements: (1) motivation, (2) self-monitoring, and (3) self-management. Motivation initiates and maintains learners’ effort toward learning to realize cognitive learning goals. It includes intrinsic motivation and extrinsic motivation. Self-monitoring refers to learners’ cognitive and metacognitive processes, which are related to learners’ ability to monitor learning strategies and think about their thinking. According to Garrison (1997), self-monitoring indicates that learners are responsible for personal knowledge construction. Learners not only need self-monitoring to promote cognitive improvement but also external feedback from the instructors. The third element, self-management, refers to task control. It involves the external activities that impact the learning process, such as the management of time and learning resources and support. These activities are constantly assessed and negotiated.

Prior research has indicated that SDL is essential to adult education (Brockett & Hiemstra, 1991; Candy, 1991; Garrison, 1997; Merriam, 2001). Furthermore, studies show that taking personal responsibility, willingness, self-direction, and self-discipline are critical factors that impact learners' success in online classes (Grow, 1991; Schrum & Hong, 2002). Given that most MOOC learners are adults, SDL is viewed as a necessary element in MOOCs (Bonk et al., 2015; Kop & Fournier, 2010; Terras & Ramsay, 2015). Stated another way, with SDL originating in the field of adult education (Brookfield, 2013), and MOOC learners typically being adults (Bonk et al., 2015, Chuang & Ho, 2016; Zhang et al., 2020) who heavily rely on self-directed learning skills (Bonk & Lee, 2017), this study adopted Garrison's (1997) model as the theoretical framework.

Prior researchers (e.g., Bonk et al., 2015; Loizzo et al., 2017) examined learners' SDL in MOOCs, including exploring the relations among the elements of SDL (e.g., Beaven et al., 2014; Kop & Fournier, 2010; Terras & Ramsay, 2015). For instance, a psychological perspective of SDL was explored by Terras and Ramsay (2015). They found that motivation and self-regulation are important attributes while designing and teaching MOOCs.

Motivations in MOOCs

Learners' motivation plays a key role in how they perceive their learning process (Bonk & Lee, 2017; Littlejohn et al., 2016). The main motives behind enrolling in MOOCs include intrinsic and extrinsic motivation (Glynn et al., 2011; Milligan & Littlejohn, 2017; Zheng et al., 2015). For example, Romero-Frías et al. (2020) found that MOOC learners showed a high level of intrinsic motivation, while at the same time, certain extrinsic motivations also played a role in their MOOC learning.

Barba et al. (2016) found a positive relationship between learner motivation, participation, and performance in MOOCs. Learners enroll in MOOCs to pursue different goals, and their core motives affect how they approach the courses and whether they complete them or not (Kizilcec & Schneider, 2015). Loizzo et al. (2017) found that motivations among students who enrolled in MOOCs varied; similarly, the criteria by which students measured their success also varied. Thus, learners' intentions should be considered when attempting to measure the success of a MOOC (Koller et al., 2013). Learners' intrinsic motivation affects their intentions of continuing in MOOCs (Abdullatif & Velázquez-Iturbide, 2020). Although the published dropout rates in MOOCs are high in comparison to traditional courses, they cannot be perceived as an indication of failure on the part of learners because not all learners enroll in MOOCs with the goal of completion (Alario-Hoyos et al., 2017; Clow, 2013; Reich & Ruipérez-Valiente, 2019; Walji et al., 2016).

Some enroll in MOOCs to learn or refresh their knowledge about a specific topic without having the end goal of earning any credentials (Hew & Cheung, 2014; Wang & Baker, 2015). Research indicates that learners often enroll in MOOCs with the motivation to continue until the end; however, certain factors, such as loss of interest, inadequate prior knowledge, and inability to manage time or self-direct their learning may hinder their initial intentions (Chang et al., 2015; Kop et al. 2011; Hew & Cheung, 2014; Rieber, 2017; Veletsianos, 2015). Therefore, having the motivation and the end goal of course completion does not always guarantee a successful result.

Internal factors such as autonomy and self-regulation are important for a successful learning experience (Durksen, 2016; Milligan & Littlejohn, 2016; Ossiannilsson, 2015). Other critical external factors, such as sound course design and effective pedagogies, are also important to prevent complicated course navigations and the loss of interest in learners (Liu, 2015).

Self-Directed Learning Strategies

Notetaking—the recording of vital information during the learning process—is a widely used learning strategy. Learners take notes while reading textbooks (Kiewra et al., 1991), listening to video or audio lectures (Titsworth & Kiewra, 2004), and learning online (Kauffman, 2004). In effect, notetaking is an important study skill for information recording and in-depth understanding (Kobayashi, 2005).

Earlier researchers identified two important functions of taking notes. First, taking notes help learners encode information from short-term memories into long-term memories. Researchers found that providing advance organizers improves learning outcomes (Titsworth & Kiewra, 2004). Second, notetaking serves an external storage purpose (Kauffman & Kiewra, 2010; Kiewra et al.,1991).

Researchers such as Makany et al. (2009) and Kauffman et al. (2011) explored different ways of taking notes for the external storage function. Kauffman et al. (2011) examined the advantages of using three different notetaking strategies: conventional, outline, and matrix notes. They found that the matrix notetaking strategy was most effective for learning. The matrix note is a two-dimensional, cross-classification table in which topics are listed on the top row, repeatable categories are listed down the left-most column, and then detailed information is generated in the intersecting cells (Kauffman et al., 2011). Matrix notes enable the learners to collect more information and then critically organize and analyze them.

Importantly, in MOOC-based learning environments, note-taking has been identified as one of the most effective strategies to support learning (Veletsianos et al., 2015). In this study, MOOC learners could take notes on hard notebooks or digital documents. Veletsianos et al. (2015) suggested integrating notetaking functions into MOOC platforms.

As a critical element of SDL, self-monitoring relates to skills of tracking and evaluating learning progress towards specific learning goals (Chang, 2007). It offers learners self-awareness of their understanding or learning performance (Butler & Winne, 1995; Lan, 1998; Pintrich et al., 2000; Winne, 1996), which helps keep learners on task and in control of their overall learning process. Researchers also note that self-monitoring skills can be trained to improve adaptive goal setting and learning. Prior research revealed that cultivating self-monitoring skills is beneficial to learners (e.g., Delclos & Harrington 1991; Maag et al., 1992; Malone & Mastropieri, 1991; Schunk, 1982). In a recent mixed methods study, we explored instructors' strategies to foster self-monitoring in MOOCs (Zhu & Bonk, 2019). In that study, we found that quizzes, tutorials, learning aids, reflection questions, learning communities, and progress indicators could support learners' self-monitoring process. In addition, external feedback from instructors, teaching assistants, and peers also supported learners' self-monitoring in MOOCs (Zhu & Bonk, 2019).

Self-management is one of the important elements of SDL. Self-management includes time management and resource management (Zhu & Bonk, 2019). Time management enables the learners to manage time to study and achieve learning goals in MOOCs. Prior research indicated that poor time management is one of the reasons that cause learners to drop out from MOOCs (Kizilcec & Halawa, 2015; Nawrot & Doucet, 2014; Zheng et al., 2015). In addition, researchers (e.g., Kizilcec et al., 2016) have explored time-management and its influence on learning in MOOCs. Through interviewing 17 learners, Kizilcec et al. (2016) discovered that time-management strategies were critical for effective self-directed learning. On the other hand, they found that it was challenging for learners to manage learning times based on their learning goals (Beaven et al., 2014; Loizzo et al., 2017; Milligan & Littlejohn, 2016). For example, the amount of time spent completing assignments failed to meet the learner's expectations (Chen & Chen, 2014).

Research Purpose and Questions

The purpose of this study was to explore learners' motivation for enrolling in MOOCs and their SDL strategies, as well as the instructional elements that support SDL from learners' perspectives. In effect, the prime research goal was to provide insights to MOOC instructors and instructional designers on instructional strategies to support students' SDL. Accordingly, the following three research questions guided this study:

1. What motivated individuals to enroll in MOOCs?
2. What were the learning strategies that helped learners' SDL in MOOCs?
3. What were the design and instructional elements of MOOCs that facilitated learners' SDL?

Methods

This qualitative study adopted a phenomenological research design. The researchers explored the MOOC phenomenon in-depth in a natural context (Yin, 2013). In effect, the reason for using qualitative methods is to have greater depth in the understanding of a phenomenon, in this case, MOOCs. The data source of this study was interviews with 15 MOOC learners. The semi-structured interviews gathered in-depth, rich information about learners' learning experiences in MOOCs. The interview protocol was developed based on the conceptual framework of Garrison (1997). The semi-structured interview protocol included four parts: (1) consent information, (2) two questions about interviewees' background, (3) four questions about SDL strategies, and (4) three questions about the design and instruction of the MOOCs that help their SDL (see Appendix).

Data Collection

The MOOC learners who participated in the authors' prior study (Zhu et al., 2020) volunteered to be interviewed. In the prior study, the authors asked the MOOC instructors to embed an online survey in three MOOCs (i.e., two Coursera courses and one FutureLearn course), which were delivered in English. The survey participants of the prior study indicated whether they wanted to volunteer to join a semi-structured interview and shared their email addresses with us. Among the 75 volunteers, the authors selected 15 volunteers that represented as many countries, ages, and educational backgrounds as possible. The semi-structured interview was conducted via Zoom, a popular and robust online meeting tool. Each interview lasted around 30-60 minutes. These interviews were audio or video recorded through Zoom. After the interview, the researchers transcribed the interview verbatim. To promote validity, the researchers conducted member checking with the interviewees to confirm the accuracy of the transcripts. Six of them provided detailed revision (e.g., misspellings), while nine replied without revisions but claimed that the transcript was accurate. To recruit study participants, a $25 Amazon gift card was provided to all the interviewees for the interview and member-checking.

Guest, Bunce, and Johnson (2006) found that saturation occurred within the first twelve interviews in non-probabilistic sampling interviews. The resulting interviewees (see Table 1) were MOOC learners in the United States (n=4), the UK (n= 2), Canada (n=1), Mexico (n = 1), Yemen (n=1), Turkey (n=1), Indonesia (n=1), Germany (n=1), the Netherlands (n=1), Albania (n=1), and Egypt (n=1). They have enrolled in or finished diverse MOOC topics. For privacy purposes, the interviewees were assigned pseudonyms.

Table 1
Fifteen Interviewees' Demographic Information

Pseudonyms	Gender	Countries	Occupations
Abdulrahman	M	Turkey	Teacher
Ali	M	Yemen	Student
Alina	F	The UK	Student
Betty	F	Albania	Engineer
Chang	M	Canada	Athlete
Dan	M	Mexico	Professor
Helen	F	Indonesia	Administrative assistant
Jacob	M	The US	Retired management consultant
Jane	F	The US	Educator
Joe	M	The UK	Retired engineer
Melena	F	Germany	Student
Mostapha	F	Egypt	Student
Sandy	F	The US	Student
Sarah	F	The US	Between jobs
Sophia	F	The Netherlands	Retired office manager

Data Analysis

To analyze the interview data, thematic analysis (Braun & Clarke, 2006; Braun et al., 2014) was used. Interview recordings were transcribed verbatim for coding after each interview. The recordings were stored in Kaltura for mechanical transcription. Next, the researchers reviewed the transcripts a second time to check their accuracy.

To perform thematic analysis, the researchers had the research questions in mind. Then, they read through the entire set of data. Afterward, the researchers chunked the data into smaller meaningful parts. Next, the researchers labeled each chunk with a code and compared each new chunk of data with previous descriptions. The similar chunks were labeled with the same code.

After all the data had been coded, the codes were grouped by similarity to identify themes. As recommended by Haney, Russell, Gulek, and Fierros (1998), the researcher read the transcripts and performed the open coding using Word documents. Once the individual coding was completed, two researchers debriefed the analysis results with each other to discuss the categories and themes. The inter-rater reliability was 92%. The final analysis resulted in three main categories and 11 sub-categories (see Table 2).

Table 2
Coding Themes

Themes	Sub-themes
1. Motivation	Intrinsic motivation
	Extrinsic motivation
2. Learning strategies	Task strategies
	Self-monitoring
	Self-management
3. Instructional elements that support SDL	Self-assessment
	The discussion boards and instructors' involvement
	The flexibility of the courses
	Clear learning goals
	The authenticity of the content
	Small learning units

Findings

Research Question 1 (RQ1). What Motivated Individuals to Enroll in MOOCs?

Different motives, intrinsic and extrinsic, drove the learners to enroll in MOOCs. This study found that intrinsic motivation included curiosity, improving personal knowledge, and personal interest, whereas extrinsic motivation included supporting formal education and career development.

Intrinsic Motivation

In the interviews, intrinsic motivation was the primary reported motive to decide to take a MOOC. Several participants described curiosity and personal knowledge as the reasons behind enrolling in MOOCs. Betty, an engineer from Albania, noted that "The reason why I chose this course is not that I want to learn something to use in life, but more something to use for my curiosity and additional knowledge that maybe I will never use."

Jacob, a retired management consultant from the US, expressed his motive behind enrolling in MOOCs as strictly intrinsic, "There's no reward. I'm retired. It's really just [that] I get very interested in topics. I realize holes in my knowledge and try to fill the holes."

Extrinsic Motivation

Besides intrinsic motivation, extrinsic motivation also plays an important role in MOOC enrollments. Some participants enrolled in MOOCs to aid in their current educational journeys. In the interview, Melena, a student from Germany, mentioned that "sometimes it is helpful to prepare for my exams; I listen to courses about physiology, and that was really helpful." Other participants have similar motives. For example, Ali, a second-year medical student, and Mostapha, a fifth-year medical student, both enrolled in MOOCs related to the field of medicine to aid in their formal education.

Besides educational purposes, some participants enrolled in MOOCs to help with their career development. For example, Sarah, who received her Ph.D. degree and was in between jobs at the time, selected topics such as anatomy, MatLab software, oncology, biology, and neuroscience. Sarah explained the purpose for taking these types of MOOCs was:

> To acquire and improve my knowledge as a medical physicist…I consider my resume when selecting MOOC. I choose courses related to my professional field to add them to my curriculum; otherwise, there would be a period without being in contact with my profession.

RQ2: What Were the Learning Strategies That Helped Learners' SDL in MOOCs?

Task Strategies

The recurring themes that emerged among the participants with respect to the task strategies included: taking notes, reading texts or subtitles, watching videos, conducting further research, and using learning strategies flexibly.

Notetaking was a common learning strategy used by the interviewees. Alina used notetaking as the core learning strategy to study for her courses. Similarly, Dan stated that his main learning strategy was notetaking: "I always have my little notebook for the MOOC that I'm working on or I'm studying. And whatever videos or whatever exercise that I was doing, I was always taking notes…" Likewise, Abdulrahman took notes during lectures, read the reading materials that were available to him, and visited the external links to prepare for the tests. He approached the courses with dedication and seriousness because he needed to obtain the certifications. In the interview, he observed: "Taking notes. Organizing my time, like most of the time, I did this in the evenings. I almost finished it before the deadline ahead."

Ali, a college student from Yemen, also explained how conducting further research on certain concepts helped him understand the materials more clearly. Similarly, Alina also conducted further research on topics that sparked interest in her. She described her approach as follows: "For the whole thing, I wrote down all the information alone on the notebook. If I am interested in something, I do research on that."

Some participants kept changing their learning strategies based on the courses and their needs. For instance, in the interview, Chang explained:

> I have been changing my strategies so I can learn more efficiently; in the beginning, sometimes I looked at videos and took notes, and then I found this is not efficient. (now) I just don't take notes and just look at the whole video and download the notes and go back to the parts that I don't understand. I have been changing my learning strategies.

Self-Monitoring Strategies

Self-monitoring is another critical element of SDL. In order to successfully lead their learning endeavors, it is crucial for learners to monitor and assess their learning throughout the process. MOOC learners in this study reported some strategies for self-monitoring; these included self-assessment, self-reflection, progress indicators, final projects, and authentic tasks.

To help her self-monitoring, Melena noted how enriching her knowledge and knowing new things that she did not know before, along with doing well on the quizzes and tests, were vital indications of her progress. She explained, "Usually, there is a test after each week. Performing it, I can see in which topic I have the biggest gaps, or I got it well. Moreover, if I apply it in other areas of my life and it can also be seen then."

Joe, on the other hand, assessed himself based on the courses and what they had to offer. If the course included quizzes and tests, then he relied on them for self-assessment; however, if the course did not include testing, then he relied on self-reflection and his own evaluation of his knowledge acquisition.

Dan considered the progress bar to be a good indication of his progress, and it also created a healthy competition among the learners. Seeing where he was at in the course compared to the other learners gave him a push. He stated,

> All the progress bar with milestones, with a small quiz that doesn't count for the evaluation, but they're good for you to check if I'm really learning. And, for example, I like when you have these kinds of nice competition[s], right. Everyone starts a MOOC at the same time, but you see that these weeks you progress faster than other members in the MOOC.

Abdulrahman relied on the final project to assess his general knowledge of the courses he had enrolled in. He stated,

> There is a kind of capstone project to show what you learn during all these four courses. So, you show them. You write. You design. You tape yourself. You teach. You send the information to see if you are progressing and what you are studying, what you learn.

However, Helen felt that proceeding from "not knowing" to "knowing" is how she monitored and assessed her learning. For instance, when she enrolled in a physiology class, she wanted to understand how the brain functions under Alzheimer's because her mother was diagnosed with this degenerative disease. To her, the course was a way of trying to find answers to what was happening with her mother. She explained:

> The reason I studied the brain because I have a mother who lost her mind. So, because the process is so slow over the years, like, why it started from her forgetting things, I need to get an answer to this "Why?" So, the more I studied, the more I know more. So, for me, the progress is, as I get the answer for all these things, that's how I progress. That's how I evaluate my progress. Before, it's just a big question mark. Why? But then I understand why.

Self-Management Strategies

MOOC learners reported self-management strategies from two perspectives: time management and resource management. Regarding time-management, the strategies varied based on their motivation to enroll in MOOCs. Learners who had an intention to get certificates or career development tended to rely on stricter strategies. Learners who enrolled in the MOOCs for personal interest learned with a more flexible schedule. In terms of resource management, some participants explained that they did further research to attempt to understand unclear content, whereas others were honest that they skipped complex content.

Regarding the time schedule, Ali found that studying in the mornings before attending medical school was what worked best for him. Similarly, Dan, the participant that enrolled in MOOCs as a learner and also taught MOOCs, described how he dedicated a certain time to work on MOOCs. For the most part, he allocated the mornings for reading and the afternoons for writing.

> For me, I'm a researcher. I'm better at writing papers in that afternoon and reading in the morning… Also, I try to schedule my time for the MOOC as everyone scheduled. This is time to go to the gym or whatever.

Some MOOC learners in this study were relatively flexible with time. Jacob believed that his learning strategy was dependent on the course and his end goal. For courses that he planned on finishing, he treated them like regular college classes and, hence, took notes, listened to lectures, took the quizzes, etc. However, in courses that he just wanted to get certain information out of, he only searched for that specific information. During the interview, he explained: “I'm after a specific piece of information, so really the strategies revolve around as I search to get answers, you know, being efficient in my search process.”

Regarding management with learning content and resources, Sophia, a retired office manager from the Netherlands, tackled the content with more flexibility. She read all the chapters, watched the videos, and made screenshots of interesting parts of the courses in order to further research them. But she did not stress over the parts that she could not understand because she was mainly taking the courses for personal knowledge and not necessarily to obtain a certificate. As she admitted, “When it was too complicated, I did not try to follow everything. I just picked out the nice things. And what I couldn’t understand well, I skipped it.”

RQ3: What Design and Instructional Elements of MOOCs Facilitate Learners’ SDL from the Student’s Perspective?

The MOOC learners in this study reported the design and instructional elements of MOOCs that facilitated their SDL. For instance, such SDL items included self-assessment and the use of discussion boards. It also can include the degree of involvement of MOOC instructors, the flexibility of the courses, having clearly stated learning goals, the authenticity of the content, and small learning units. Clearly, there is much that can be done to foster SDL in MOOCs.

Self-Assessment

Supplying learners with self-assessment outlets, such as exercises, quizzes, tests, and projects is critical in aiding their learning autonomy. One participant, Betty, from Albania, utilized all the free quizzes and tests that were available in the courses. She also took part in the discussion forums to write and answer questions about the content.

Besides tests, Alina believed that having worksheets or a set of questions after each module was the most helpful strategy to evaluate her learning step-by-step. Being able to answer the questions after each module gave her a sense of how much knowledge she retained before starting the next module. Similarly, Sandy elaborated upon how quizzes and tests were helpful, but she wished they were more advanced and included questions and answers rather than only multiple-choice questions. In the interview, she stated, “It might have been nice to have at least, you know, a bigger test that maybe involved a little more writing. Then you really have to understand the information in order to write something, rather than just answering multiple-choice questions.”

Discussion Board and Instructors’ Immediate Feedback

Most MOOCs have discussion boards available to the learners where they can have stimulating discussions and receive feedback and answers from one another. Most participants viewed the discussion boards as key in facilitating their SDL. Another feature that was also recurrent among the participants was the instructors’ involvement in the courses.

Jane believed that the discussion forums were crucial in keeping the learners accountable and creating a sense of community. She said, “I think the community is what’s really important.” Similarly, Jacob, a retired management consultant, reflected on the importance of the instructors’ presence. He claimed that it would have been more helpful if professors were more involved in the discussion boards and offered feedback from time to time. The extended time between posting a question and actually getting a reply back can discourage the learners. Jacob sadly acknowledged “I’ll ask [the professor] a question today. I’ll type in a question on my computer in the forum. It may be 2 to 3 weeks before I get a reply.” Ali expressed that “It would be great to communicate with professors." Similarly, Sarah explained that what affected her experience the most was the "lack of real-time interaction with the teacher."

Flexibility

The flexible nature of MOOCs can create a more relaxed learning experience for the learners to lead their own learning on their own time. Conversely, MOOCs might foster a more stressful experience if they do not employ the available resources correctly. Sandy, a former perfectionist, described her MOOC experience as life-changing. In this situation, the learner felt more comfortable directing her own learning rather than being pressured to follow a stricter schedule. When asked to describe her MOOCs experience, she explained,

> It helped me realize that I enjoy learning a lot more when I can just be a little more casual about it. I just find it a lot more enjoyable to learn. I think when I'm enjoying it more, I probably actually learn a lot more.

Clear Goals and Expectations

Dan suggested that instructors at the beginning of MOOCs offer the learners tips on how to manage their time, tell them what to expect from the courses, and provide them an idea of the anticipated course pace. Having a clear picture of what to expect is important for learners to plan their upcoming learning plans and schedules. As Dan explained the following tips at the beginning of the MOOC may be helpful: "Hey guys, this is a MOOC that requires you a certain amount of hours per week. And there is a strong deadline for delivering homework and during your quizzes."

Authentic Examples

The free nature of MOOCs can sometimes create an easy decision for learners to drop out of the courses whenever they lose concentration and interest. Therefore, the design of the content is crucial in maintaining the interest of the learners. One participant, Helen, believed that authentic examples, resources, and visuals that some instructors demonstrated in their courses helped maintain her curiosity. In our interview, she explained:

> When I studied the brain, the professor showed the real brain. Like, she took us to the laboratory and showed us how the brains, how they did it, they did things in the laboratory. So, I find it fascinating. I find it very interesting. Even though for the test I try to read, but for understanding and looking at the real thing, the visualization is very good.

Small Learning Units

Another important feature that helped the learners stay on track was the chunking of the content. Joe found the division of the content into small chunks highly effective in maintaining consistency and engagement while avoiding distractions. As Joe explained:

> I think what's really good is keeping it into small chunks. I'm going to say, roughly speaking, 3 to 7 minutes long because that makes it easy for you to put it down and pick it up again in small bits.

Discussion

The current study examined MOOC learners' motivation for enrolling in MOOCs as well as their SDL strategies and the instructional elements that can support SDL from a learner perspective. For this purpose, the researchers conducted semi-structured interviews with 15 MOOC learners in 11 different countries. We found that learners enrolled in MOOCs with intrinsic or extrinsic motivation or both. The intrinsic motivation included curiosity, improving personal knowledge, and personal interest, whereas the extrinsic motivation included supporting formal education and career development. This finding is in line with the data reported by previous researchers (e.g., Glynn et al., 2011; Milligan & Littlejohn, 2017; Zheng et al., 2015).

Naturally, the varied intrinsic and extrinsic motivational elements influence the learning behavior of MOOC learners. Littlejohn et al. (2016) stated that learners' motivation is critical in how they perceive their learning process. In this study, we found that learners with diverse motivations have diverse time-management strategies, which supports the prior studies from Barba et al. (2016) and Kizilcec and Schneider (2015). In the current study, we discovered that learners exhibiting motivations to obtain a certificate or finish the course to support their formal education and career development had relatively strict and fixed time-management strategies. In contrast, MOOC learners who only relied on personal interest to learn certain topics or parts of the course without having the goal of finishing the course had relatively more flexible time schedules. Thus, future MOOC instructors might provide diverse support based on MOOC learners' motivations and intentions.

The MOOC students in this study revealed that their SDL strategies included task strategies, self-monitoring, and self-management strategies. The task strategies involved notetaking, reading texts or subtitles, watching videos, and conducting further research. We found that notetaking is one of the most commonly used and effective learning strategies among MOOC learners. For instance, it was noted that MOOC learners like to record notes on hardcopy notebooks or take digital notes on their computers. This finding aligns with the finding of the research from Veletsianos et al. (2015), which indicated that notetaking is one of the more common and effective learning strategies for MOOC learners.

Prior research also indicates that notetaking supports deep comprehension while acting as an external storage function (Kobayashi, 2005). MOOC instructors and instructional designers might explore strategies to support notetaking in MOOCs. For instance, to promote digital notetaking, Veletsianos et al. (2015) suggested integrating notetaking plug-in tools into MOOC platforms to facilitate learners taking notes as well as collaborative notetaking. Further and more detailed functions and features could be explored regarding the tools and resources that can support digital notetaking. For learners who prefer taking notes by hand on paper notebooks, MOOC instructors could provide sufficient pauses and suggestions in the learning materials to give learners time and opportunities to take notes.

In a recent quantitative study of SDL in MOOCs employing a structural equation modeling approach (Zhu et al., 2020), we found that self-monitoring is a mediator element between motivation and self-management. Therefore, instructional strategies to facilitate learners' self-monitoring skills was deemed critical. In terms of self-monitoring strategies in the current study, MOOC learners reported that they used self-assessment, self-reflection, progress indicators, final projects, and authentic tasks to help their self-monitoring. This finding resonates with another one of our prior studies (Zhu & Bonk, 2019b) concerning the perspectives of MOOC instructors on learner SDL skills and the instructional techniques that these instructors engaged in to nurture and support such skills. Besides the internal monitoring from the learners themselves, external feedback from the MOOC instructors was a key extrinsic motivational element reported by the learners in that earlier study (Zhu & Bonk, 2019b). Leaders in the field of distance education—like Garrison (1997)—emphasized that external feedback from instructors is needed to support learners' self-monitoring. Therefore, MOOC instructors or other educators involved in the online course could possibly facilitate self-monitoring by providing immediate and constructive feedback to MOOC learners.

Limitations and Implications

This study provided in-depth insights into the MOOC learners' SDL experiences and strategies. Nevertheless, there were several key limitations in this study. First, the participants of this study were voluntary and as such, may indicate a particular bias. For example, the MOOC learners who have strong self-directed learning skills may have been more inclined to participate in our study. Second, this study only included learners' self-reported interview data . We are not sure to what extent the strategies mentioned by learners reflect their real learning experiences. In addition, we did not collect the learning outcomes in MOOCs. Consequently, we could not verify whether certain strategies were effective in improving the learning outcomes. We should also point out that while the MOOC learners we interviewed came from 11 different countries, no participants were from South America, Central America, or Africa, where access, bandwidth, and language issues may have more negatively impacted the motivation and SDL strategies of MOOC participants. Finally, all interviews were conducted in English, thereby limiting participants in this study.

Future research could include learners' MOOC log data and grades to triangulate the self-reported interview data. Such research could also explore how motivation for MOOC learning influences their self-monitoring and self-management strategies. Despite the various limitations stated above, the present study is an important contribution to the research on MOOC learners' motivation and SDL strategies. Follow-up research could extend to other countries and regions of the world. In the coming years, research might also explore how prior MOOC experience impacts one's motivation to take future MOOCs as well as how SDL skills and competencies can be extended and enhanced from completing numerous MOOCs.

Conclusion

This study provides insights regarding learners' motivations for enrolling in MOOCs and SDL strategies. In addition, the instructional elements that support SDL were also revealed. The findings of this study inform both instructors and instructional designers of learners' experiences and perceptions of the design elements in MOOCs that support SDL. Given that the authors' prior survey research (Zhu et al., 2020), as well as the current study, showed that different aspects of motivation influence learners' self-monitoring and self-management strategies in MOOCs, MOOC instructors and instructional designers might consider getting to know diverse; learner motivations for enrollment in MOOCs and how these motivations can be leveraged to facilitate SDL.

Notetaking is one of the most effective skills for task strategies in MOOCs. Future research could focus on different degrees of scaffolding regarding effective ways of taking notes digitally or on hardcopy notebooks to enhance SDL. Tools and resources could be developed to enable learners to take digital notes effectively on the platform or when using a mobile device. There also might be ways to share such notes across participants enrolled in a MOOC, as well as from participants of previous iterations of a MOOC with new enrollees. Given the importance of notetaking in this study as well as previous ones, the best notetaking practices and examples might be explored in future research.

Among the critical components of SDL for cognitive learning are self-monitoring strategies. As MOOC offerings and enrollments expand (Lohr, 2020; Shah, 2019, 2020), it is vital to explore cognitive and metacognitive strategies to enhance learners' self-monitoring skills in MOOCs in the future. At the same time, given the proliferation of learning from MOOCs during the past decade, enhanced understanding of the extrinsic or intrinsic motivational elements involved in MOOCs is critical.

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References

Abdullatif, H., & Velázquez-Iturbide, J. Á. (2020). Relationship between motivations, personality traits and intention to continue using MOOCs. *Education and Information Technologies*, *25*(5), 4417-4435. https://doi.org/10.1007/s10639-020-10161-z

Alario-Hoyos, C., Estévez-Ayres, I., Pérez-Sanagustín, M., Kloos, C. D., & Fernández-Panadero, C. (2017). Understanding learners' motivation and learning strategies in MOOCs. *The International Review of Research in Open and Distributed Learning*, *18*(3). https://doi.org/10.19173/irrodl.v18i3.2996

Barba, P., Kennedy, G., & Ainley, M. (2016). The role of students' motivation and participation in predicting performance in a MOOC. *Journal of Computer Assisted Learning*, *32*, 218–231. https://doi.org/10.1111/jcal.12130

Beaven, T., Hauck, M., Comas-Quinn, A., Lewis, T. & de los Arcos, B. (2014). MOOCs: striking the right balance between facilitation and self-determination. *MERLOT Journal of Online Learning and Teaching*, *10*, 1, 31–43.

Bonk, C. J. (July 2009). *The world is open: How Web technology is revolutionizing education.* Jossey-Bass

Bonk, C. J., & Lee, M. M. (2017). Motivations, achievements, and challenges of self-directed informal learners in open educational environments and MOOCs**.** *Journal of Learning for Development*, *4*(1), 36-57.

Bonk, C. J., Lee, M. M., Kou, X., Xu, S., & Sheu, F. R. (2015). Understanding the self-directed online learning preferences, goals, achievements, and challenges of MIT OpenCourseWare subscribers. *Journal of Educational Technology & Society, 18*(2), 349-368. http://www.ifets.info/journals/18_2/26.pdf

Bonk, C. J., Lee, M. M., Reeves, T. C., & Reynolds, T. H. (Eds.). (2015). *MOOCs and open education around the world.* Routledge.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., Clarke, V., & Rance, N. (2014). How to use thematic analysis with interview data. In A. Vossler & N. Moller (Eds.), *The counselling & psychotherapy research handbook*, 183–197. Sage.

Brockett, R. G., & Hiemstra, R. (1991). *Self-direction in adult learning: Perspectives on theory, research, and practice*. Routledge.

Brookfield, S. (2013). *Powerful techniques for teaching adults*. Jossey-Bass.

Businesswire, (2020). New Udemy report shows surge in global online education in response to COVID-19. https://www.businesswire.com/news/home/20200430005243/en/

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research*, *65*(3), 245–281. https://doi.org/10.3102%2F00346543065003245

Candy, P. C. (1991). *Self-direction for lifelong learning. A comprehensive guide to theory and practice*. Jossey-Bass. https://eric.ed.gov/?id=ED353470

Chang, M. M. (2007). Enhancing web-based language learning through self-monitoring. *Journal of Computer Assisted Learning*, *23*(3), 187–196. https://doi.org/10.1111/j.1365-2729.2006.00203.x

Chang, R. I., Hung, Y. H., & Lin, C. F. (2015). Survey of learning experiences and influence of learning style preferences on user intentions regarding MOOCs. *British Journal of Educational Technology*, *46*(3), 528-541. https://doi.org/10.1111/bjet.12275

Chen, P. J., & Chen, Y. H. (2014). Facilitating MOOCs learning through weekly meet-up: A case study in Taiwan. *Proceedings of the first ACM conference on Learning@ scale conference*,183–184. ACM. https://doi.org/10.1145/2556325.2567872

Chuang, I., & Ho, A. (2016). HarvardX and MITx: Four years of open online courses--fall 2012-summer 2016. https://dx.doi.org/10.2139/ssrn.2889436

Clow, D. (2013, April). MOOCs and the funnel of participation. In *Proceedings of the third international conference on learning analytics and knowledge*, 185-189. https://doi.org/10.1145/2460296.2460332

Conole, G., & Brown, M. (2018). Reflecting on the impact of the open education movement. *Journal of Learning for Development*, *5*(3), 187-203. https://jl4d.org/index.php/ejl4d/article/view/314/346

Delclos, V. R., & Harrington, C. (1991). Effects of strategy monitoring and proactive instruction on children's problem-solving performance. *Journal of Educational Psychology*, *83*(1), 35. https://psycnet.apa.org/buy/1991-19728-001

Durksen, T. L., Chu, M. W., Ahmad, Z. F., Radil, A. I., & Daniels, L. M. (2016). Motivation in a MOOC: A probabilistic analysis of online learners’ basic psychological needs. *Social Psychology of Education*, *19*(2), 241–260. https://doi.org/10.1007/s11218-015-9331-9

edX (2020). 2020 impact report. https://www.edx.org/assets/2020-impact-report-en.pdf

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly*, *48*(1), 18–33. https://doi.org/10.1177/07417 13697 04800 103

Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science motivation questionnaire II: Validation with science majors and nonscience majors. *Journal of Research in Science Teaching*, *48*(10), 1159-1176. https://doi.org/10.1002/tea.20442

Grow, G. O. (1991). Teaching learners to be self-directed. *Adult Education Quarterly*, *41*(3), 125-149. http://journals.sagepub.com/doi/pdf/10.1177/0001848191041003001

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*(1), 59-82. https://doi.org/10.1177/1525822X05279903

Haney, W., Russell, M., Gulek, C., & Fierros, E. (1998). Drawing on education: Using student drawings to promote middle school improvement. *Schools in the Middle*, *7*(3), 38-43. https://eric.ed.gov/?id=EJ561666

Hew, K. F., & Cheung, W. S. (2014). Students’ and instructors’ use of massive open online courses (MOOCs): Motivations and challenges. *Educational Research Review*, *12*, 45-58. https://doi.org/10.1016/j.edurev.2014.05.001

Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distributed Learning*, *15*(1), 133–160. https ://doi.org/10.19173 /irrod l.v15i1 .1651

Kauffman, D. F. (2004). Self-regulated learning in web-based environments: Instructional tools designed to facilitate cognitive strategy use, metacognitive processing, and motivational beliefs. *Journal of Educational Computing Research*, *30*(1-2), 139-161. https://doi.org/10.2190%2FAX2D-Y9VM-V7PX-0TAD

Kauffman, D. F., & Kiewra, K. (2010). What makes the matrix so effective: An empirical test of indexing, extraction, and localization effects. *Instructional Science*, *38*(6), 679–706. https://doi.org/10.1007/s11251-009-9095-8

Kauffman, D. F., Zhao, R., & Yang, Y. S. (2011). Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology*, *36*(4), 313-322. https://doi.org/10.1016/j.cedpsych.2011.04.001

Kiewra, A. K., DuBois, N. F., Christian, D., McShane, A., Meyerhoffer, M., & Roskelley, D. (1991). Note-taking functions and techniques. *Journal of Educational Psychology*, *83*(2), 240–245. https://psycnet.apa.org/doi/10.1037/0022-0663.83.2.240

Kim, M., Jung, E., Altuwaijri, A., Wang, Y., & Bonk, C. J. (2014, Spring). Analyzing the human learning and development potential of websites available for informal learning. *International Journal of Self-Directed Learning*, *11*(1), 12-28.

Kizilcec, R. F., & Halawa, S. (2015). Attrition and Achievement Gaps in Online Learning. In *Proceedings of the Second ACM Conference on Learning @ Scale*. http://dx.doi.org/10.1145/2724660.2724680

Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2016). Recommending self-regulated learning strategies does not improve performance in a MOOC. In *Proceedings of the third (2016) ACM conference on learning@ scale*, 101-104. https://doi.org/10.1145/2876034.2893378

Kizilcec, R. F., & Schneider, E. (2015). Motivation as a lens to understand online learners: Toward data-driven design with the OLEI scale. *ACM Transactions on Computer-Human Interaction*, *22*(2), 1-24. https://doi.org/10.1145/2699735

Kobayashi, K. (2005). What limits the encoding effect of note-taking? A meta-analytic examination. *Contemporary Educational Psychology*, *30*(2), 242–262. https://doi.org/10.1016/j.cedpsych.2004.10.001

Koller, D., Ng, A., Do, C., & Chen, Z. (2013). Retention and intention in massive open online courses: In depth. *EDUCAUSE Review*, *48*(3), 62–63.

Kop, R., & Fournier, H. (2010). New dimensions to self-directed learning in an open networked learning environment. *International Journal for Self-Directed Learning*, *7*(2), 1–19. https ://docs.wixst atic.com/ugd/dfdea f_b1740 fab6a d144a 980da 17036 39aee b4.pdf

Kop, R., Fournier, H., & Mak, J. S. F. (2011). A pedagogy of abundance or a pedagogy to support human beings? Participant support on massive open online courses. *International Review of Research in Open and Distributed Learning*, *12*(7), 74-93. https://doi.org/10.19173/irrodl.v12i7.1041

Lan, W. Y. (1998). Teaching self-monitoring skills in statistics. *Self-regulated learning: From teaching to self-reflective practice*, 86-105.

Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *The Internet and Higher Education*, *29*, 40-48. https://doi.org/10.1016/j.iheduc.2015.12.003

Liu, M., Kang, J., & McKelroy, E. (2015). Examining learners' perspective of taking a MOOC: reasons, excitement, and perception of usefulness. *Educational Media International*, *52*(2), 129–146. https://doi.org/10.1080/09523987.2015.1053289

Lohr, S. (2020). Remember the MOOCs? After near-death, they're booming. *The New York Times*. https://www.nytimes.com/2020/05/26/technology/moocs-online-learning.html

Loizzo, J., Ertmer, P. A., Watson, W. R., & Watson, S. L. (2017). Adult MOOC learners as self-directed: Perceptions of motivation, success, and completion. *Online Learning*, *21*(2), n2. https://doi.org/10.24059/olj.v21i2 .889

Maag, J. W., Rutherford Jr, R. B., & Digangi, S. A. (1992). Effects of self-monitoring and contingent reinforcement on on-task behavior and academic productivity of learning-disabled students: A social validation study. *Psychology in the Schools*, *29*(2), 157-172.

Makany, T., Kemp, J., & Dror, I. E. (2009). Optimising the use of note-taking as an external cognitive aid for increasing learning. *British Journal of Educational Technology*, *40*(4), 619-635. https://doi.org/10.1111/j.1467-8535.2008.00906.x

Malone, L. D., & Mastropieri, M. A. (1991). Reading comprehension instruction: Summarization and self-monitoring training for students with learning disabilities. *Exceptional Children*, *58*(3), 270-279. https://doi.org/10.1177%2F001440299105800309

Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. In S. B. Merriam (Ed.), *The new update on adult learning theory, (Vol. 89)* (pp 3-13). San Francisco: Jossey- Bass.

Milligan, C., & Littlejohn, A. (2016). How health professionals regulate their learning in massive open online courses. *The Internet and Higher Education*, *31*, 113-121. https://doi.org/10.1016/j.iheduc.2016.07.005

Milligan, C., & Littlejohn, A. (2017). Why study on a MOOC? The motives of students and professionals. *International Review of Research in Open and Distance Learning*, *18*(2), 92–102. https://doi.org/10.19173/irrodl.v18i2.3033

MIT (2001). MIT to make nearly all course materials available free on the World Wide Web. *MIT News*. http://web.mit.edu/newsoffice/2001/ocw.html

Nawrot, I., & Doucet, A. (2014). Building engagement for MOOC students: Introducing support for time management on online learning platforms. Paper presented at the 23rd International World Wide Web Conference, Seoul, South Korea, 1077-1082. https://doi.org/10.1145/2567948.2580054

Ossiannilsson, E., Altinay, F., & Altinay, Z. (2015). Analysis of MOOCs practices from the perspective of learner experiences and quality culture. *Educational Media International*, *52*(4), 272-283. https://doi.org/10.1080/09523987.2015.1125985

Pintrich, P., Wolters, C., & Baxter, G. (2000). Assessing metacognition and self-regulated learning. In G. Schraw & J. C. Impara (Eds.), *Issues in the measurement of metacognition*, 43–97. Buros Institute of Mental Measurements.

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science*, *363*(6423), 130-131. https://doi.org/10.1126/science.aav7958

Rieber, L. P. (2017). Participation patterns in a massive open online course (MOOC) about statistics. *British Journal of Educational Technology*, *48*(6), 1295–1304. https://doi.org/10.1111/bjet.12504

Rohs, M., & Ganz, M. (2015). MOOCs and the claim of education for all: A disillusion by empirical data. *International review of research in open and distributed learning*, *16*(6), 1-19. https://doi.org/10.19173/irrodl.v16i6.2033

Romero-Frías, E., Arquero, J. L., & del Barrio-García, S. (2020). Exploring how student motivation relates to acceptance and participation in MOOCs. *Interactive Learning Environments*, 1-17. https://doi.org/10.1080/10494820.2020.1799020
Schrum, L., & Hong, S. (2002). Dimensions and strategies for online success: Voices from experienced educators. *Journal of Asynchronous Learning Networks*, *6*(1), 57–67. http://actxelearning.pbworks.com/f/10.1.1.109.3649.pdf
Schunk D. H. (1982). Progress of self-monitoring: effects on children's self-efficacy and achievement. *Journal of Experimental Education*, *51* (2), 89–93. https://doi.org/10.1080/00220973.1982.11011845
Shah, D. (2019). A review of MOOC stats and trends in 2019. *Class Central*. https://www.classcentral.com/report/moocs-stats-and-trends-2019/
Shah, D. (2020). By the numbers: MOOCs during the pandemic. *Class Central*. https://www.classcentral.com/report/mooc-stats-pandemic/
Terras, M. M., & Ramsay, J. (2015). Massive open online courses (MOOCs): Insights and challenges from a psychological perspective. *British Journal of Educational Technology*, *46*(3), 472-487. https://doi.org/10.1111/bjet.12274
Titsworth, S., & Kiewra, K. A. (2004). Organizational lecture cues and student note taking. *Contemporary Educational Psychology*, *29*, 447–461. https://doi.org/10.1016/j.cedpsych.2003.12.001
Veletsianos, G., Collier, A., & Schneider, E. (2015). Digging deeper into learners' experiences in MOOCs: Participation in social networks outside of MOOCs, notetaking and contexts surrounding content consumption. *British Journal of Educational Technology*, *46*(3), 570-587. https://doi.org/10.1111/bjet.12297
Walji, S., Deacon, A., Small, J., Czerniewicz, L., & Czerniewicz, L. (2016). Learning through engagement: MOOCs as an emergent form of provision. *Distance Education*, *37*(2), 208-223. https://doi.org/10.1080/01587919.2016.1184400
Wang, Y., & Baker, R. (2015). Content or platform: Why do students complete MOOCs? *Journal of Online Learning and Teaching*, *11*(1), 17.
Weller, M. (2014). *Battle for open: How openness won and why it doesn't feel like victory.* London: Ubiquity Press. https://doi.org/10.5334/bam
Wiley, D., & Hilton III, J. (2009). Openness, dynamic specialization, and the disaggregated future of higher education. *The International Review of Research in Open and Distributed Learning*, *10*(5). https://doi.org/10.19173/irrodl.v10i5.768
Winne, P. H. (1996). A metacognitive view of individual differences in self-regulated learning. *Learning and Individual Differences*, *8*(4), 327–353. https://doi.org/10.1016/S1041-6080(96)90022-9
Yin, R. (2013). Case study research: Design and methods (5th ed.). Sage.
Zhang, K., Bonk, C. J., Reeves, T. C., & Reynolds, T. H. (Eds.). (2020). *MOOCs and open education in the Global South: Challenges, successes, and opportunities.* Routledge.
Zheng, S., Rosson, M. B., Shih, P. C., & Carroll, J. M. (2015). Understanding student motivation, behaviors and perceptions in MOOCs. In *Proceedings of the 18th ACM conference on computer supported cooperative work & social computing*, 1882-1895. https://doi.org/10.1145/2675133.2675217
Zhu, M. (2021). Enhancing MOOC learners' skills for self-directed learning. *Distance Education, 42*(3), 441-460. https://doi.org/10.1080/01587919.2021.1956302

Zhu, M., & Bonk, C. J. (2019a). Designing MOOCs to facilitate participant self-directed learning: An analysis of instructor perspectives and practices. *International Journal of Self-Directed Learning*, *16*(2), 39–60. https://6c02e432-3b93-4c90-8218-8b8267d6b37b.flesusr.com/ugd/6c1db2_3ab135498618442abe908811fb68a1b2.pdf.

Zhu, M., & Bonk, C. J. (2019b). Designing MOOCs to facilitate participant self-monitoring for self-directed learning. *Online Learning, 23*(4), 106–134. https://doi.org/10.24059/olj.v23i4.2037.

Zhu, M., Bonk, C. J., & Doo, M. Y. (2020). Self-directed learning in MOOCs: Exploring the relationships among motivation, self-monitoring, and self-management. *Educational Technology Research & Development*, *68*(5), 2073–2093. https://doi.org/10.1007/s11423-020-09747-8

Zhu, M., Bonk, C., & Sari, A. (2018). Instructors' experience of designing MOOCs in higher education: Considerations and challenges. *Online Learning, 22*(4), 203-241. https://doi.org/10.24059/olj.v22i4.1495

Appendix

Semi-Structured Interview Questions

1. Please introduce yourself briefly.
2. Please tell us your experience in taking this MOOC. Were you successful in what you wanted to accomplish? Why or why not?
3. What are the learning strategies that help you learn best in this MOOC?
4. What motivated you to enroll and stay in this MOOC?
5. What strategies help you manage your learning in the MOOC (e.g., set up specific learning time)?
6. What strategies help you in self-monitoring your learning (e.g., reflection, evaluate learning)?
7. How do you think the design or instruction of this MOOC facilitates your self-directed learning skills?
8. Can you please give us an example of the design or instruction of this MOOC that facilitates your self-directed learning skills? Why?
9. What would you suggest your instructor do to help you develop your self-directed learning skills in this MOOC?
10. In general, what did you learn about self-directed learning (SDL) and about yourself as a learner when taking this MOOC?

Implementing Blended First Year Chemistry in a Developing Country Using Online Resources

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Abstract
Decades of rapid development in information and communication technologies (ICTs) have resulted in tremendous global evolution in computer and online instruction. Many developing countries, however, are still struggling to successfully integrate ICTs into their teaching and learning practices, subsequently leading to slower rates of adapting digital learning pedagogies. To understand how blended instruction might operate in higher education in a developing country, this study explored students' perspectives on the implementation of blended learning in a first-year chemistry program delivered in the Philippines. Through the resource-based learning framework, multiple types of online learning resources were employed for blended delivery of topics on periodic trends, chemical bonding, Lewis structures, molecular shape, and polarity through the learning management system, Moodle. To understand students' experiences, a mixed methods approach was employed through a survey, focus groups, and learning analytics. Despite the scarcity of technological resources (such as access to a reliable internet connection), 57.5% of 447 student respondents favoured blended learning because of the flexibility, wider access to various types of interactive learning resources, variety of learning activities, and perceived increase in learning productivity. While most respondents (75.7%) had ICT skills sufficient for education, significantly fewer had access to computers (19.7%). 40.0% of students self-reported that they preferred a traditional mode of instruction primarily due to the perceived difficulty of chemistry as subject matter and the perceived need for face-to-face discussions, including concept explanation and Q & A opportunities.

Keywords: Blended learning, first-year chemistry, resource-based learning

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DOI: 10.24059/olj.v26i1.2508

In contemporary teaching, it is now commonplace to use a combination of both traditional face-to-face and online instruction and interactions. This is broadly defined as blended learning (Bonk & Graham, 2005; Crawford & Jenkins, 2017) and comes in various forms. Blended learning is now ubiquitous in developed countries with the widespread adoption and availability of digital learning technologies, as predicted almost two decades ago (Bonk & Graham, 2005). This has resulted in an increased level of integration of computer-mediated instructional modalities with the traditional face-to-face learning experience. Consequently, rapid developments in blended learning pedagogies have intensified the need for stakeholders (i.e., teachers, students, and school leaders) "to take advantage of learning opportunities afforded through improved personalisation, collaboration, and communication enabled by learning technologies" (Watterston, 2012, p. 12) towards a continuous learning process.

Through an effective mix of traditional classroom teaching with online activities, blended learning provides innovative educational solutions and other benefits over any single learning delivery mode (Singh, 2003). To support learning, the explosion of information and communication technology (ICT) resources has become an important pedagogical consideration, such that use of technology to enhance practice does not challenge traditional pedagogies, rather it can support the transformation of teacher-centric teaching practices into more collaborative and constructive learning activities (Yelland et al., 2008).

A key aspect of successful blended learning is the seamless integration of ICT resources, both online and digital. However, while such integration is routine in developed countries, the widespread adoption of ICT to support learning in developing economies is constrained by limited infrastructure, high costs of electricity, slow internet speeds, insufficient continuous staff development (Sarvi & Pillay, 2015), and other social and cultural factors (Tubaishat et al., 2006). Educational institutions in developing countries must be both creative and efficient when using available resources to ensure the delivery of a sustainable program (Mercado et al., 2012).

In this study, an instructional approach to implementing blended learning in a university first-year chemistry context in a developing country is presented. As part of the design of blended first-year chemistry, existing internet-based resources are explored and leveraged as a viable option for instructional delivery. Students' perceptions of their blended learning experiences and learning analytics data from the learning management system (LMS) were also considered in this study. The following questions guided the research:

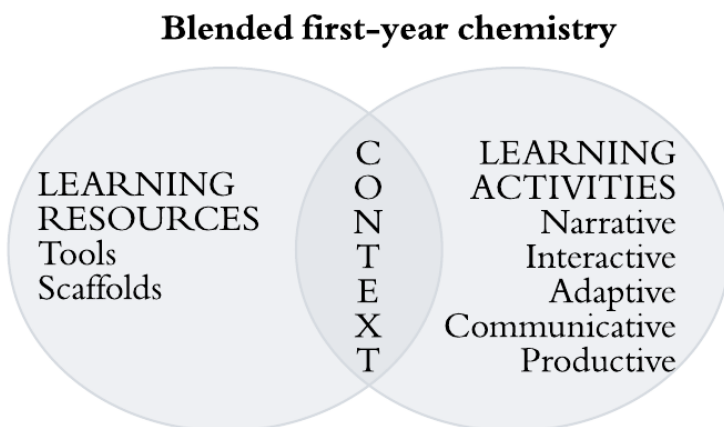
1. What are effective ways to implement blended first-year chemistry in a tertiary institution in a developing country?
2. What opportunities and challenges become evident in employing online resources for blended first-year chemistry informed by the perspectives of the students from a developing country?

Literature Review

Tertiary science education is fertile ground for the development and integration of ICTs to enhance teaching and learning practice in a blended environment. ICTs in tertiary science education present considerable opportunities to respond to the emerging, rapid evolution of learner-centred pedagogies which encourage "collaboration, knowledge creation and knowledge sharing" (Wallet & Melgar, 2014, p. 19). Appropriate instructional design for blended learning creates high-quality teaching materials and methods for specific groups of students, considers how students learn, effectively helps them achieve their academic goals, and ensures they receive instruction in a form that is meaningful to them (Purdue University Online, n.d.).

This study employed two frameworks to inform the instructional design of blended first-year chemistry at a university in a developing country (Figure 1). The resource-based learning (RBL) framework was applied to inform the process of selection and combination of learning resources that were sourced from the internet and employed in the blended learning environment. Laurillard's conversational framework (LCF) (2002) guided the design of learning activities using these online resources.

Figure 1
Study framework based on RBL and Laurillard's conversational framework



Resource-Based Learning (RBL) Framework for Identifying and Employing Resources in Blended Learning

The approach to sourcing and implementing a variety of resources in a learning environment was first proposed by Beswick in 1977 (Hill, 2012) and was referred to as RBL. Beswick (1977) focused on how students learned from their interactions with varied resources as he encouraged movement away from traditional, direct, fact-based instruction towards a student-centred generation of knowledge and understanding (Beswick, 1977, cited in Hill, 2012). In 2007, Hannafin and Hill defined RBL as the "use and application of available assets to support varied learning needs across contexts" (p. 526). Although RBL was initially presented without embodying a particular epistemology (Hannafin & Hill, 2007), Hill (2012) explained that many of its key ideas are rooted in constructivist theory of learning such as "knowledge is constructed, prior knowledge and experience impacts learning, contextualization is important, and learning is an active process" (p. 2850). In line with these tenets, Hill (2012) defined the four basic components involved in RBL:

1. Resources—including, but not limited to, media, people, places, and ideas, all used to support the learning process
2. Contexts—defined situations or problems that orient learners to a need or problem
3. Tools—assist with the creation and/or use of resources
4. Scaffolds—any supports provided to assist learners as they are engaging in a task

By employing the RBL framework, resources are implemented within established contexts, through the aid of tools for creation and use, and with scaffolds that guide and support students in differentiated interpretation, use, and understanding (Hannafin & Hill, 2007; Hill, 2012). In this era of massive ICT growth, accessible online resources have proliferated rapidly allowing RBL to achieve wider applicability across a variety of learning contexts, including blended learning. A more dynamic learning environment has resulted from the number and variety of resources, their enhanced availability, and the ability to repurpose the resources to enable the accommodation of diverse learning needs. Hannafin and Hill (2007) noted several factors that further increase the suitability of resources for learning in an online environment, such as adaptation for previously unavailable contexts, increased flexibility in their use, and enhanced capability to manipulate and share resources across multiple contexts and purposes.

Laurillard's Conversational Framework (LCF) for Effective Use of Technology

The successful integration of technology in blended learning requires the provision of support for authentic, meaningful, and active learning (Yelland et al., 2008). One way to achieve this is to take a more cognitive approach to the design of the learning activities and take advantage of the numerous types of media resources that abound on the internet. Bates & Poole (2003) argued that media can be useful for providing learners activities and exercises in support of their learning in a technology-mediated environment.

LCF (2002) for the effective use of learning technologies aims to help teachers think about teaching and learning from the perspective of the students. LCF is a complex framework of teaching and learning based on an iterative process between conception and practice (Laurillard, 2016, 00:35). Learning involves the integration of concepts and practice, which occurs when both teacher and student engage in discursive activities where they can share each other's understanding and generate action. When teachers give feedback on this action, it modifies students' conception of the subject which results in better practice. This iterative dialogue of concept and practice is "discursive, adaptive, interactive, and reflective" (Laurillard, 2002, p.86). LCF guides the classification of media resources through which the dialogic process of blended teaching and learning may be achieved. Based on LCF, media resources can be classified into narrative, interactive, adaptive, communicative, and productive forms. Laurillard further recommends that these media resources be used in combination to achieve the optimum balance for specific learning contexts with the provision for teacher-student dialogue.

Blended Learning Implementation in the Philippines

The slow growth of blended learning in the Philippines has been attributed to cost and lack of sufficient infrastructure, yet despite these obstacles. several studies have reported blended learning implementation at minimal cost through free online platforms and learning managements systems. University students enrolled in biological sciences (Beltran-Cruz & Cruz, 2013) and education (Robles, 2012) courses were introduced to blended delivery through Facebook, Edmodo, and Blackboard (free version). Even though this was a low-cost implementation, students perceived a better learning experience (Beltran-Cruz & Cruz, 2013), and exhibited evidence of improved academic performance (Robles, 2012). Cost of internet and access to it were also identified as significant barriers to online learning (Marcial et al., 2015), and to promote blended learning in regions where internet and computer technology are inadequate, low technology resources have been employed. A Bricolage approach using existing ICT resources was encouraged by Aguinaldo (2013) to provide a foundation for the implementation of blended learning in a rural public university in the Philippines.

The growth of blended learning is expected to continue to accommodate the diverse needs of students, educators, and institutions (Spring et al., 2016). However, despite promising advantages for enhanced learning experiences, blended learning has not been widely implemented in many developing regions, primarily due to a lack of sufficient ICT infrastructure. Where resources to develop original content are scarce, such as in developing regions, blended learning delivery is faced with complex challenges to design contextualised and culturally appropriate learning materials (Spring et al., 2016). In 2008, Larson and Murray argued that it was critical to provide language translations for the open educational resources designed and developed within the Blended Learning Open-Source Science or Math Studies Initiative (BLOSSOMS) implemented across various developing countries. This initiative allowed BLOSSOMS to promote local cultural and educational norms in the free resources delivered through the internet and other lower-technology platforms (i.e., CD, DVD, videotape). The last two decades have seen an increase in blended learning implementation and research across developed and developing countries (Anthony et al., 2020). This research contributes to the perspective that much more needs to be done to promote online teaching in countries with a culture of traditional face-to-face teaching.

Methodology

An RBL package was prepared for blended delivery, consisting of learning resources and activities that met the learning goals prescribed by the first-year chemistry curriculum. This RBL package also served as a study guide for each topic. Learning resources were identified and carefully curated to support the following five topics in first-year chemistry: (a) periodic table and trends, (b) introduction to chemical bonding, (c) Lewis structures, (d) molecular shapes, and (e) polarity. The researcher who is not part of the course teaching staff designed the RBL package to be implemented over a two-week period. Due to the variety of online resources readily available from the internet, the researcher developed the following criteria to guide the selection of resources:

1. The quantity and scope of relevant learning resources should be sufficient to meet the learning objectives.
2. There should be a variety of resources from credible sources that provide accurate and up-to-date information.
3. Resources should be fully accessible even with a low-bandwidth internet connection.
4. Resources should be hosted on reliable websites that are less likely to be susceptible to link death.
5. Resources should have an open-access license (Sandanayake, 2019) or should reside in the public domain to avoid potential copyright breaches.
6. Resources are in the English language, the university’s medium of instruction.

By applying the RBL framework, a combination of online resources was employed for instructional delivery. Resources employed for content delivery ranged from text, videos, interactive simulations, and interactive presentations. Online quizzes and problem sets were designed and implemented by the researcher to provide formative assessments. The four components of the RBL framework in this blended delivery were reflected in the online resources that aimed to meet the learning objectives (i.e., the context), through the aid of tools for creation and use, and with scaffolds that guide and support students in differentiated interpretation, use, and understanding (Hannafin & Hill, 2007; Hill, 2012). Tools that aided students to create evidence of their understanding and to process and evaluate information were already embedded within some of these online resources. To provide the necessary scaffolding to assist learners in engaging with the tasks, all online resources and activities were curated and annotated. Guided by the selection criteria listed above, curation involved extensive selection of numerous resources available from the internet ensuring that there was sufficient variety and number of accessible learning resources providing accurate and up-to-date information.

Screenshots of sample resources are provided in Figure 2. Annotation produced a summary and description of each resource to help students navigate learning by providing information on important aspects of, and procedures to, use the resources and fulfil the tasks. Moodle was used as the LMS for this blended delivery. Based on the RBL framework, an RBL package for each topic was designed to contain each of the following sections:

1. Introduction
2. Learning Objectives
3. Learning Activities
4. Self-check

An ungraded, formative assessment for each topic was employed in the form of either a Moodle quiz, an external online quiz, problem sets, posting on an online bulletin board or participating in a discussion forum. A portable document format (PDF) version of the RBL package was posted on the course site for students to download. This was done so that students could access the learning materials without needing to access the Moodle course site if the site was inaccessible (for example due to connectivity issues).

Instructional Setting

The participating university in this study is the second largest constituent university (CU) of the premier national university in the Philippines, which is a university system comprised of eight constituent universities and one autonomous college. The campuses of the university system are spread throughout 17 strategic locations in the country. This participating CU is in the province of Laguna in the Southern Tagalog administrative region (Region IV-A). It is approximately 65 kilometres south of Metropolitan Manila, the country's capital, and centre of government and economy.

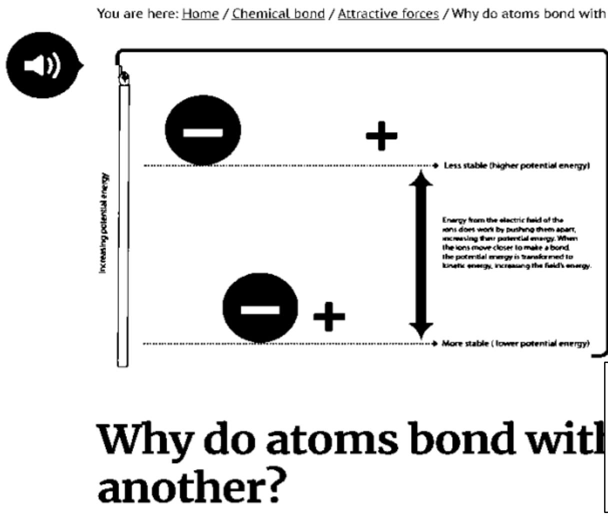
The first-year chemistry course involved in this study is usually offered to students enrolled in this university in the first semester of each academic year. On some occasions, the course is also offered during the second semester if there is demand from repeating students (i.e., students who failed to pass during the first semester) or transferees from other universities. The academic year in this university begins in August and ends in July of the following year. It includes two semesters and a shorter midyear term. Each semester has 100 class days spread across 16-18 weeks and one final examination week, while the midyear term includes 28 class days across 4-5 weeks and two days of final examination.

Data Collection

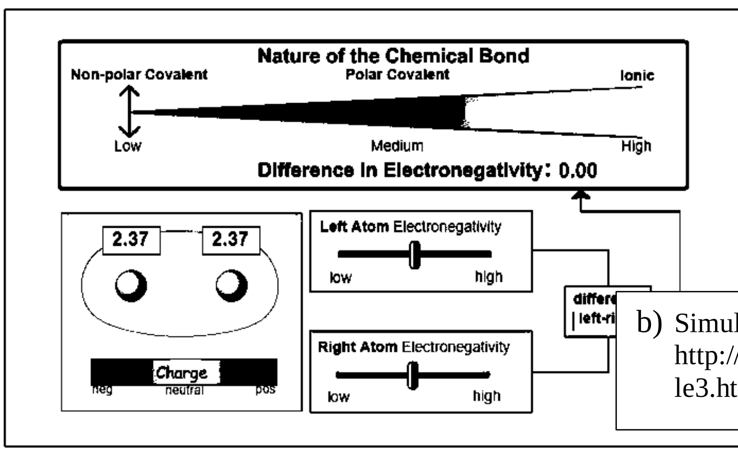
Statement of ethics

The research adhered to ethical standards and guidelines as the nature of study demanded. Consent was collected of the participants and the statistical analysis was performed using non-identifiable data.

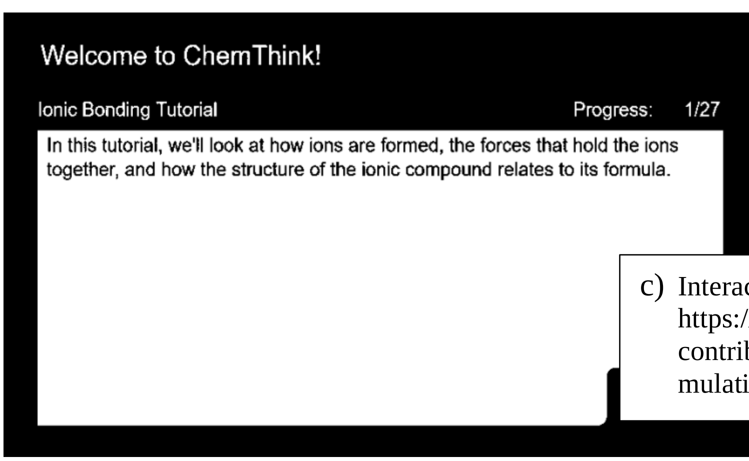
Figure 2
Sample Resources Used in the Development of the RBL Package



a) Webpage - Why do atoms bond with another?
https://masterconceptsinchemistry.com/index.php/2017/09/24/why-do-atoms-bond-with-one-another/



b) Simulation – Nature of the Chemical Bonds
http://mw2.concord.org/public/part2/bondtype/customDipole3.html



c) Interactive presentation - Ionic Bonding
https://pbslm-contrib.s3.amazonaws.com/WGBH/arct15/SimBucket/Simulations/chemthink-ionicbonding/content/index.html

Student Survey

To promote a greater response rate, researchers preferred a pen-and-paper survey (Appendix A) to an online survey. Surveys were manually distributed to students after lecture sessions and in laboratory classes seven days after the end of the two-week implementation period. Completed surveys were returned by respondents, either through the designated submission box or through their lecturers or laboratory instructors.

The survey contained 11 questions, including four demographic questions, five multiple choice questions about previous high school stream, university program, technological skills and resources, and preferred learning mode, and an open-ended question to explain the latter. The internal consistency of the survey instrument was evaluated through Cronbach's alpha (IBM SPSS 25.0) on a pilot test (Romero Martínez et al., 2020) with a sample size of 70 students. The reliability of the survey yielded a value of $\alpha = 0.752$ which indicated an acceptable level of internal consistency (Taber, 2018). The face and construct validity of the survey was evaluated by a science education expert who was not part of the research team. Content analysis was performed on responses to open-ended questions to obtain observable themes, and coding was done with moderate agreement between two coders (Cohen's $\kappa = 0.687$).

In addition to demographic information, the survey consisted of multiple choice-type questions related to students' ICT skills and the perceived usefulness of various types of online resources and activities provided to them on the Moodle course site. Students were also asked about their preferred mode of instructional delivery and the reasons for their choice. Students were given seven days to complete the survey. A total of 447 complete and anonymous survey responses (45.4% response rate) were obtained. Students were coded as Student 1 to Student 447.

Focus Groups

Following the implementation of the survey, students were invited to participate in focus group discussions (FGD) to further elaborate on their answers to the survey. Participants were given a blank copy of the previously distributed survey at the start of the session to serve as a guide in the focus group discussion (Appendix B), to help them recall their answers to the questions, and to encourage them to elaborate on their responses for richer explanation. Forty-five students voluntarily participated in one of the 16 FGD sessions offered (maximum group size of 5). Student participants were coded as Participant 1 to Participant 45. Each FGD lasted for around 25-40 minutes. Participants were anonymised and all discussions were audio-recorded. Recordings were transcribed in the participants' first languages i.e., English, Filipino or Tagalog. Excerpts of the transcripts in Filipino and Tagalog used in this report were translated into English. Content analysis was performed on transcripts to obtain observable themes, and coding was done with strong agreement between two coders (Cohen's $\kappa = 0.871$).

Participants

Participants were students enrolled in a first-year chemistry course offered during the first semester of the academic year 2019-2020 at the second largest constituent university (CU) of the premier national university in the Philippines.

A total of 985 students across eight lecture sections participated in this study. Each section had an average class size of approximately 120 students and was facilitated by a lecturer. All 985 students were enrolled in a Moodle course site and were grouped according to their lecture sections. For nearly all students, this was the first time they were enrolled in Moodle and their first experience with an LMS. A small number of students had been exposed to online platforms before; however, this was typically limited to posting of announcements and the use of file repositories.

All students enrolled in the Moodle course site (n = 985) were invited to participate in the survey seven days after the end of the two-week implementation period. Pen-and-paper surveys were manually distributed to students after a short verbal announcement from their teachers at the conclusion of a lecture or laboratory classes. Students were informed that responding to the survey was voluntary, that they could withdraw at any time, and that withdrawal would not affect their academic record. A statement reiterating these terms was included with the survey. No incentive was offered for completing the survey.

A total of 447 students participated in the survey. Female respondents comprised 58.6% while 38.5% identified as male. Most respondents were 18-19 years old (87.7%) and recent high school graduates under the relatively new basic education curriculum of the Philippines (K-12 curriculum). Most students (91.5%) completed the Science, Technology, Engineering and Mathematics (STEM) strand (Appendix C). These students qualified for admission to their respective undergraduate academic programs (Appendix D) through the nationwide college admission test administered by the university.

Survey respondents completed high school in 49 of 81 provinces in the Philippines (Appendix E), with one respondent from an international high school outside the country. Respondents originated from various provinces around the country (Appendix E), and therefore 24 different Philippine languages and 2 dialects were spoken by the respondents. Most students (77.6%) spoke at least two languages with a majority mainly using the Philippines' official languages—Filipino (61.1%) and English (66.9%) (Eberhard et al., 2019). While 4.5% of respondents reported not speaking Filipino or English in their homes (Appendix C) they had met the institutional admission language requirements.

Learning Analytics Measurements

Analytics data from Moodle were obtained from the standard log dataset. RStudio (version 3.6.1) was used to clean and process the data to obtain a tidy data set. Standard log data were exported to obtain the number of clicks students made during the two-week implementation period. Student data were anonymised during the data cleaning and processing.

Data Analysis

Anonymous student responses from the pen-and-paper survey collected after the blended learning implementation were encoded manually in a spreadsheet prior to analysis. Descriptive statistics were performed on the quantitative data collected from question numbers 1 to 11. Responses to the open-ended question to explain students' answer on question # 11 were coded inductively using NVivo 11. The moderate agreement of almost 70% between two coders was determined through Cohen's κ inter-rater reliability measurement.

Focus group discussions were audio-recorded and transcribed into text by the researcher (CR). Transcriptions were imported into NVivo 11 and coded inductively to identify themes through saturation. A strong agreement exceeding 80% between two coders was likewise determined through Cohen's κ inter-rater reliability measurement.

After downloading the standard log dataset from Moodle, RStudio was used to process the data to generate a heatmap of hourly LMS actions performed by the students within the two-week implementation of the RBL package. Each cell in the heatmap generated in this study represents a cluster of collective LMS activities performed by students for every hour of the day within the implementation period. The colour of each cluster or cell indicates the quantity of student clicks and recorded by Moodle (Moodle terms in parentheses) such as clicks leading to the course site (course viewed) and the learning resources (course module viewed), as well as the clicks to access the quizzes (course module viewed) and the discussion forums (discussion viewed).

Findings

Learning Resources and Activities for Blended First-year Chemistry

Resources and the Implementation of the RBL Framework

The Philippines has previously been categorised under a group of regions that have commenced applying ICT in education and testing various strategies (UNESCO, 2011, cited in Kennepohl, 2012). The country's uptake of ICT for education has remained low, as evidenced by its ranking 107th in the world's ICT Development Index in 2016 (UNESCO, 2018). Given the limitations of the ICT infrastructure in the Philippines, the primary consideration in the design of the blended delivery of selected first-year chemistry topics was the accessibility of the instructional materials. In the context of a learning environment in a developing country, RBL presented itself as a suitable framework that enabled the use of resources which were readily accessible online. Existing resources, many of which were open educational resources (OERs) (Sandanayake, 2016), were packaged into learning activities for utilisation in the blended delivery of first-year chemistry topics instead of creating new online resources. Table 1 summarises the quantity and media forms of learning resources used in one of the topics delivered in this study. A complete list of resources used for all five topics is presented in Appendix F. Thirty-five online resources and activities were sourced from the internet, packaged as learning activities, and posted on the Moodle course site. All learning materials were in English (the medium of instruction at the University).

Table 1

Learning Resources Employed for Blended Delivery of Introduction to Chemical Bonding

Media Form and Number [1]	Resource Name	Source of Resource
Web page (2)	Chemical Bonding: The Nature of the Chemical Bond	https://www.visionlearning.com/en/library/Chemistry/1/Chemical-Bonding/55
	Why do atoms bond with another	https://masterconceptsinchemistry.com/index.php/2017/09/24/why-do-atoms-bond-with-one-another/
Simulation (1)	Chemical Bonds	http://mw2.concord.org/public/part2/bondtype/customDipole3.html
Interactive presentation (2)	Ionic Bonding	https://pbslm-contrib.s3.amazonaws.com/WGBH/arct15/SimBucket/Simulations/chemthink-ionicbonding/content/index.html
	Covalent Bonding	https://pbslm-contrib.s3.amazonaws.com/WGBH/arct15/SimBucket/Simulations/chemthink-covalentbonding/content/index.html
Electronic book (1)	Naming Compounds	https://courses.lumenlearning.com/boundless-chemistry/chapter/naming-compounds/
Practice set (2)	Worksheet 1: Naming Ionic and Covalent Compounds	https://www.gardencity.k12.ny.us/cms/lib/NY01913305/Centricity/Domain/584/Ionic_CovalentNameRace.pdf
	Worksheet 2: Naming Ionic and Covalent Compounds	http://misterguch.brinkster.net/PRA015.pdf
Online quiz (3)	Review Quiz: Periodic Trends	Moodle

	Practice Quiz: Naming Ionic and Covalent Compound	https://www.quia.com/quiz/3124061.html?AP_rand=1897061935
	Quiz on Chemical Bonding	Moodle
Online forum (1)	Ask us!	Moodle

[1]*Note*. Numbers in parentheses indicate quantity.

The four components of the RBL framework were enacted in the use of online resources for this blended delivery. For each of the five chemistry topics included in this study, selected online resources addressed the learning objectives of the first-year chemistry course. Tools for using resources, processing content, and generating evidence of understanding were provided as needed. For each learning activity using resources, scaffolding was put in place to aid students in completing the tasks. An example of how the RBL components were enacted is shown in Table 2.

Table 2
Example Enactment of RBL Framework Components in the Design of a Learning Activity for an Online Resource for the Topic of Molecule Shape

Components	**Particulars**
Topic	*Shapes of Molecules*
Learning objective (context)	Identify the shape of the molecule based on the VSEPR theory
Learning resource	Molecule Shapes (a PhET simulation available at https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_en.html)
Media form	Simulation
Scaffolding (Hill, 2012)	Procedural scaffolding in the form of step-by-step instruction to use and explore the simulation. Conceptual scaffolding by highlighting the important concept being demonstrated by the simulation Strategic scaffolding in the form of a prepared worksheet to accompany the online resource (i.e., simulation)
Excerpt from the annotation (instructional text for the resource provided in the RBL package)	Let us begin this section by exploring the simulation “Molecule Shapes”. This will introduce you to the concept of molecular geometry. The simulation will demonstrate the implication of the Valence Shell Electron Repulsion (VSEPR) theory on the resultant geometry of a molecule given the number of its bonding and non-bonding (lone) electron pairs. There are two sections in this simulation. Follow the instructions and complete the tasks for the first section before proceeding to the second one. A document in pdf version is provided below which contains the Worksheet for Parts 1 and 2 of this activity. Further instructions on how to explore the simulation is provided in the same document.

Learning Activities and LCF

Learning resources were categorised into media types and the learning activities they support were informed by the LCF. Table 3 illustrates how these media types were employed in the learning activities designed for each topic included in this study. As shown in Table 3, learning activities were designed according to the form of the media learning resource (Laurillard, 2002).

To avoid creating new resources, narrative media resources that were readily available online in text format, web pages, and videos were employed to present introductory topics in periodic trends and properties and Lewis structures. Most of these narrative media contained not only plain text but also images and audio components that allowed students to integrate the information represented in multiple modes. Adaptive and interactive media resources such as web-based hypertexts and simulations were employed to demonstrate concepts (i.e., how chemical bonding occurs, explore various molecular shapes).

Table 3
Different Learning Tasks Supported by the Media Type Employed in This Study Classified According to the LCF

Media type	Media Form	Learning activity(ies) Supported
Narrative	Text, web page, video, infographic, ebook, wiki page	Gathering of concepts through reading, watching videos, summarising and reflection about learning
Interactive	Hypertext, hypermedia	Pursuing other information beyond those directly presented through varying responses from input-based exploration of the resource
Communicative	Online discussion forum	Online discussion with peers
Adaptive	Simulation, interactive presentation	Virtual experimentation Exploration of various cases (based on students' input to the simulation)
Productive	Online quiz, problem set, online discussion board	Practice problem solving Formative assessment Online presentation of output

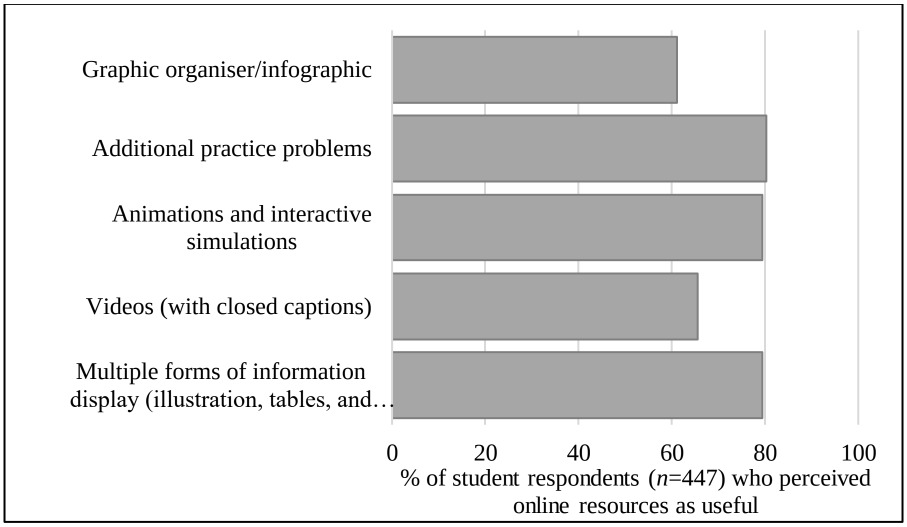
Students' Perceptions on the Utility of Various Online Learning Resources

Survey results showed that students generally found multiple modes of presenting information useful (Figure 3). Most student respondents deemed the provision of additional problem sets (80.3%) and videos (65.5%) useful. Students in FGD elaborated on how these resources had been useful to them personally (Table 4). A majority of FGD participants found the resources were very helpful because they could change the pace of their study whenever necessary. According to one participant,

> In the lecture, [I] cannot simply stop the lecturer during his/her discussion if there is something that [I] do not understand, and [I] am embarrassed to ask questions in the lecture where everybody in the class would stare at me. With the resources provided, [I] can pause reading the content in the text to allow myself to understand, or to go back while watching videos, or to fast-track to the next topic if I know that I have already learned this topic.

Figure 3

Perception of Student Respondents on the Usefulness of Other Types of Learning Resources



Note. These are students' responses from a multiple-answer type of question (Question #9 in Appendix A)

Table 4

Benefits of Employing Various Forms of Resources in First-year Chemistry Course as Perceived by the Students

Resource	**Students' Self-reported Perceived Benefits**	**Sample Quotes**
Animation and interactive simulation	Helpful in visualisation	"Animations for interactive learning are the ones that really helped me since in chemistry, it is difficult to visualise the molecules. It really helped visualise the geometry of molecules."
	Provides avenue to discover other possibilities	"Using animation and interactive simulations, it is us who discover the possibilities in the concepts that we are learning."
Videos	Concise presentation of information	"The links to videos really helped. Concepts are explained more concisely in videos than in the lecture."
	Good alternative for reading long texts	"I prefer watching videos rather than reading long texts because reading requires a lot of time. They present the same information anyway."
	Shorter study time	"Because they are short videos, and they present concepts that are similar to the ones presented in the lecture, my required study time shortened."
Additional practice problems	Opportunities to test understanding	"With the additional practice problems, we are able to practice what we learned from the readings."
	Helpful in tracking progress	"It helps me test my learnings and makes me aware what knowledge I have acquired. The additional practice problems enable us to become aware of how much we have learned and which ones we need to further study."

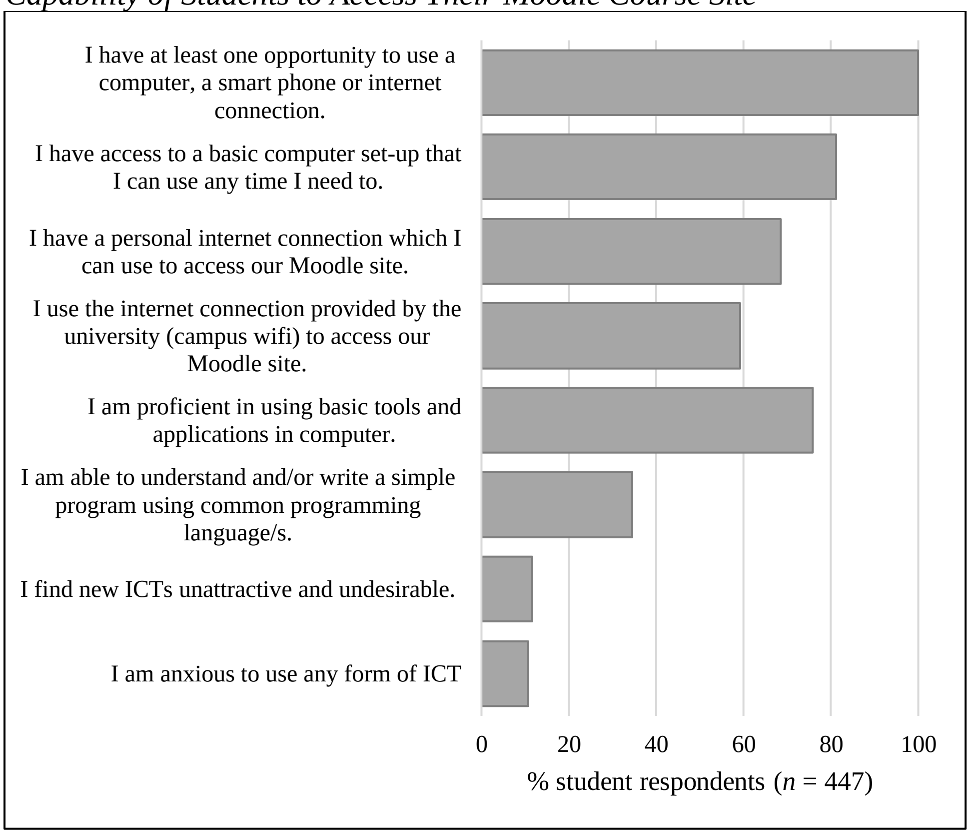
Graphic organiser/infographic	Serves as a simple guide for the topics being covered	"Sometimes, lecture notes are not easy to understand but with the infographic on periodic trends made it easier for me to understand the lesson."
	Helpful in tracking progress	"The infographic on periodic trends served as a list of the concepts that I need to study."

Students' Diverse Backgrounds and Capability to Access Online Resources

Participants in this study were from various provinces in regional Philippines and originated from widely diverse social and academic backgrounds, having completed different high school qualifications. For almost all students, this was the first time they had experienced a blended-learning environment. For example, only a small percentage of high schools (28%) possess ICT capabilities for use in pedagogical purposes (UNESCO, 2018). Despite their diverse originating provinces, this large cohort of students shared a common lack of prior exposure to blended learning. This is likely to have impacted their experiences as they transitioned from traditional face-to-face instructional delivery to blended learning. Participants in this study reported not having equal access and/or skill and confidence to employ digital technologies in their learning. Students reported a range of ICT capabilities to access their Moodle course site (Figure 4).

Figure 4

ICT Skills and Capability of Students to Access Their Moodle Course Site



Note. These are students' responses from a multiple-answer type of question (Question #10 in Appendix A)

Survey results revealed that 81.2% of respondents had ready access to a basic computer set-up which they either personally owned, borrowed, or rented. In addition, most respondents (68.5%) accessed the Moodle course site through their personal internet connection through home broadband or mobile data (68.5%), or through the university's wi-fi connection (59.3%). However, a notable 5.1% of respondents had neither an internet connection at home nor used the campus connection. This small group of students may have accessed the Moodle course site through computer shops which are prevalent around the campus. Users pay a rental fee of PhP20.00 (approximately US$0.40) per hour to use computers with internet connection or to connect their personal devices to the internet.

More than 75% of the respondents self-reported that they were adept with basic tools and applications in computer and/or smart phones, including document processing, spreadsheets, presentations, and publisher. A significant number of respondents (34.5%) claimed more advanced ICT skills to understand and/or write computer programs. Although all respondents had access to at least one form of ICT (i.e., smart phones, computers), 10.7% of respondents remained anxious about ICT. Furthermore, some respondents (11.6%) expressed disinterest and dislike of new ICTs such as new phone applications and computer software. To employ digital technology in teaching and learning, Frawley (2017) underscored the importance of continuously challenging our assumptions about students' relationships with technology and to provide appropriate support and options for students to navigate outside their traditional learning environment. In this study, preliminary support was provided by a brief introductory talk about blended learning, a customised Student Guide to Moodle, and an introductory email containing instructions on how to proceed with their blended learning.

Students' Blended Learning Experience in First-year Chemistry

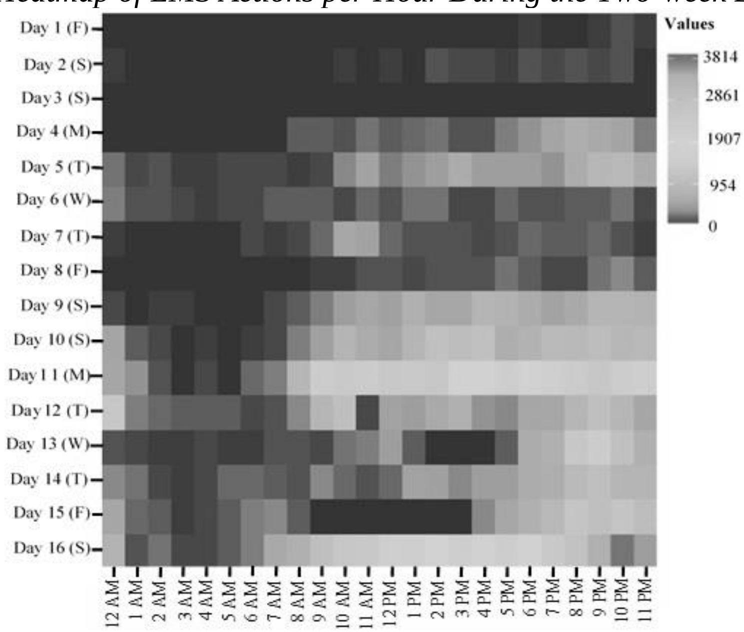
Further insight into the experiences of students during the blended learning mode was obtained through learning analytics measurements of their interactions on Moodle. Figure 5 shows the hourly volume of clicks made by students in Moodle over the two-week period. Students made a total of 231,434 clicks, averaging 14,464 total clicks daily and 15 (± 7) clicks per day per student; this included all clicks recorded by Moodle (Moodle terms in parentheses) leading to the course site (course viewed) and the learning resources (course module viewed), as well as the clicks to access the quizzes (course module viewed) and the discussion forums (discussion viewed).

The heatmap (Figure 5) displays the relative number of clicks as a function of time: cold (i.e., blue) colours in the heatmap indicate low number of clicks, while higher number of clicks is indicated by warm (i.e., orange) colours. The relative intensity in colour indicates the relative magnitude in numbers of clicks. An increase in activity of students commencing from the day the course opened on Day 1 (Friday) is observed in Figure 5, with prominent peaks during weekends and Mondays, and the days leading to the last day of submission of requirements for formative assessments on Day 16 (Saturday). Lower average daily clicks (4248 clicks per day) were recorded on the first eight days of implementation (Day 1 to Day 8), after which, there was a constant and evident increase in LMS activities on most days (average daily clicks of 24,680 on Days 9 to 16).

The lower activity on the LMS observed on the first week reflected time spent becoming familiar with the new learning environment. Over time, the number of clicks increased as students became more familiar with the LMS. This observation serves as a good reminder that when a new learning environment is introduced, students should be allowed some time to learn how to navigate the new environment. While students may become skilled at navigating the LMS to access resources and tools for learning (Kintu et al., 2017), it is critical to provide support for students during their adjustment to the new learning environment. This may take the form of technical support (like the user manual provided to the students in this study and individual emails addressing common issues on logging in and accessing learning materials and activities) and pedagogical support in terms of the number of learning activities expected of students at the early part of the implementation of the new learning environment.

The highest number of daily clicks was recorded on Day 16 (total of 56,954 clicks), with a highest peak at 23:00 (3,814 clicks). In addition to the activity peaks shown, the heatmap likewise captures the days and times when there was zero activity resulting from unavailability of the course site due to a server upgrade, and power and internet outages. Power interruptions occurred at the university during the whole day of Day 3 (Sunday); activities on the course site resumed only on Day 4 (08:00, Monday). Interruption in activities on the course site occurred for 3 hours on Day 13 (14:00-16:00, Wednesday) due to a server upgrade, and on Day 15 (09:00-15:00, Friday) due to a university-wide power interruption.

Figure 5
Heatmap of LMS Actions per Hour During the Two-week Blended Learning



Students' access to ICT was further limited by the university's unreliable power supply and slow internet connection. The fundamental inadequacy of ICT resources available for the students in a developing country such as the Philippines remains a primary barrier for implementing blended learning. In their survey on global blended learning implementation, Barbour et al. (2011) reported limited growth in online learning in the Philippines due to lack of infrastructure that supports online learning. Unfortunately, electricity and internet connection in the Philippines remain below demand capacity even at this present time. Cost of electricity ranks second highest in Asia (Lectura, 2018) while internet speed in the country has remained below the global average in both mobile internet and fixed broadband internet (Speedtest, 2020). The impact of readily available ICT infrastructure on blended learning implementation in the Philippines was evident, not only in students' newly gained learning experiences in a blended environment but also in observable interruptions in learning activities during power outages. The unreliable supply of expensive electricity coupled with slow internet connection have had a significantly negative impact on the interest in blended learning of some participants of this study as shown in Table 5.

Table 5
Opportunities and Challenges Perceived by Students with Blended Learning Using Online Resources Based on Survey Open-ended Responses[1]

Variable	Blended learning
Opportunities	• Presents variety of interactive learning resources and learning activities that facilitate easier understanding of the concepts but are not afforded in a lecture class (43) • Fosters complementary perspectives and benefits from both online and face-to-face modes (49) • Provision for flexibility of learning i.e., learn at own pace, relieves pressure of learning within timed lectures (70) • Cultivates self-directedness in learners i.e., time management, self-evaluation of progress (22) • Promotes fun and interesting learning environment (11)
Challenges	• Expensive and scarce ICT resources (computers, mobile phones) for studying purposes (3) • Unreliable internet connection (13) • Lacks student-teacher and student-student interactions (60) • Stimulates negative impacts of isolation and self-studying i.e. procrastination (22)

[1]*Note.* Number inside parentheses indicate the number of student responses.

Students' Preference in Learning Mode in First-year Chemistry

When asked which learning mode they preferred, 57.5% of student respondents chose blended mode while 40.0% preferred traditional face-to-face lectures. The remaining 2.5% preferred a fully online mode. Students who preferred the blended learning mode cited a wider range of learning resources and activities than the PowerPoint lectures available in the traditional delivery as the reason for their preference. Students also preferred self-paced learning, giving them "control in terms of when [they] can/choose to study the topics," and that "there are different lessons that can be explained better through videos and interactive programs." These findings support the argument of Davis and Frederick (2020) who concluded that online courses integrated with multimedia resources favour students' diverse learning preferences and promote students' performance and learning experience. Furthermore, students valued the perceived flexibility and accessibility of blended learning since some "students [were] able to learn even after class hours." Student responses to the open-ended questions in the survey led to identification of a numbers of themes as given in Table 5.

While most students found multimedia resources useful in the blended learning environment, a significant number of students preferred face-to-face lecture sessions. The primary reason for their preference was their need for interaction with their lecturers and peers. Based on the survey responses, some students preferred "to have an interaction between the students and the professor" and a "direct communication between [the student's] peers and teacher," while others perceived that "[t]here are some topics that are easier when discussed by the professor," "hearing it from the professor and writing it (notes) down helps [the student] in retaining the lessons." Previous studies (Shea, Li, & Pickett, 2006; Shea et al., 2010) have demonstrated that a sense of community is significantly associated with perceived learning gains. The need for face-to-face interactions with their lecturers and peers by students is an indication of the importance of making social presence more pronounced in an online environment. Garrison & Arbaugh (2007) defined social presence in an online environment "as the ability of learners to project themselves socially and emotionally, thereby being perceived as real people in mediated communication." As they shifted from a traditional face-to-face mode to an online environment, students who were used to an environment with very distinct social presence may struggle adapting to an online environment where social presence is fostered inexplicitly. For example, in this study, communicative media resources such as discussion forums were employed to provide an avenue for open communication for students to express themselves socially. Students were likewise encouraged to post questions at the end of each topic for lecturers to respond to. Unfortunately, students were not yet familiar with this medium of interaction to develop their community of learning, i.e., their peers and lecturers in the timeframe of the study.

Discussion

Online learning has been widely integrated in the teaching of many disciplines in higher education in many developed countries. Teaching with online platforms has taken advantage of rapidly evolving ICTs to complement face-to-face teaching through blended, flipped, or hybrid learning models. For over two decades, academic institutions in these countries have established a systematic use of LMS as a core aspect of their teaching.

In contrast, many developing countries are still struggling to successfully integrate online learning with their traditional teaching. Many of the pedagogical innovations routinely used in developed countries have not yet reached classrooms in developing countries due to high cost of building ICT infrastructure or the lack of a quality internet connection. The cost and time required to build an online learning environment consisting of learning resources for content delivery can also be attributed to the slow growth of blended learning for teaching and learning. In a developing country such as the Philippines, these factors have significantly limited the growth of online learning in many disciplines in higher education.

This study explored the possibility of implementing blended learning in first-year chemistry in a premier state university in the Philippines. Application of the RBL framework supported the combination of readily available online resources to deliver a blended learning environment for five topics that are common to general chemistry. Although the use of an LMS is already a core aspect of teaching first-year chemistry in many developed countries, this was the first time that blended learning using an LMS (Moodle) was implemented for first-year chemistry at this university. The LMS was designed to promote a community of online learners interacting not only with the content but also with their peers. This study attempted to foster learning within the online platform by allowing students to perform a variety of learning activities through the online learning resources. This was achieved through the application of the RBL framework that guided the use of readily available, quality online learning resources for a learning design with various learning activities which were guided by the LCF.

Findings from this study suggest that there is substantial potential for utilising a combination of readily available online resources to facilitate blended leaning in first-year chemistry within a limited online learning capacity. Student perceptions of the benefits of blended learning reflected the impact of a carefully designed RBL package containing a variety of learning resources and learning activities. Compared to traditional lectures, most participants preferred blended learning because of the flexibility it afforded, further perspectives it provided, and the new learning experiences it allowed.

Limitations

When interpreting the findings, we acknowledge that the implementation period was limited to two weeks. While the data gathered during this period provided a glimpse of students' immediate behaviour in a new learning environment, a longer period of implementation would have allowed for an understanding of students' behaviours after they became accustomed to the learning environment. Given the positive impact of our initial intervention, we are planning a longer intervention for future research. This will allow students to become more at ease with the new learning environment and lead to further discovery of how students cope with a sense of community in an online learning environment.

Furthermore, this study focussed on the perception of students on the implementation of blended learning in a first-year chemistry with the use of online resources. It did not explore the impact of the new learning modality on students' learning. No pre- and post-test were conducted to determine whether the new modality caused a positive or negative effect on students' learning. In the future, when we can implement the study over a longer period, we will investigate the impact of blended learning modality on students' academic achievement in first-year chemistry.

Future Directions

While students perceived many benefits from blended learning, the challenges that came with online delivery were undeniable. The persistence of unstable electricity supply and unreliable internet connection negatively impacted the blended learning experiences of a significant number of student participants. At the beginning of this study, the researchers had anticipated these challenges, hence, the design incorporated parameters for easier access of the learning materials. This foresight allowed the researchers to compensate for the scarcity in ICT resources and other facilities that the students encountered through the flexibility and accessibility features integrated in the design of the blended learning delivery.
Based on this study, the researchers recommend an expanded implementation of blended learning, both in terms of time (for example, an entire semester) and topic (for example, other chemistry courses).

More in-depth exploration of further opportunities to strengthen interactions among teachers, students, and the content within a blended learning environment and the challenges that may hinder them are strongly recommended. With the rapid developments in ICT and considering the trend of lowering cost of online learning through readily available online learning resources, now is the strategic time to expand blended learning to include the way chemistry is taught in a developing country. It is hoped that by keeping up with current trends in education, improvements in pedagogical practices in chemistry may advance academic institutions in a developing country to become more competitive in the global community.

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Declarations

The author(s) received approval from the ethics review board of Monash University, Australia for this study.

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References

Aguinaldo, B. E. (2013). Implementing blended learning in an impoverished academic institution using a bricolage approach model. *International Journal of Information and Education Technology*, *3*(2), 211–216. https://doi.org/10.7763/ijiet.2013.v3.266

Anthony, B., Kamaludin, A., Romli, A., Raffei, A. F., Danakorn Nincarean A. L. Eh Phon, Abdullah, A., & Ming, G. L. (2020). Blended learning adoption and implementation in higher education: A theoretical and systematic review. *Technology, Knowledge and Learning*. doi:10.1007/s10758-020-09477-z

Barbour, M., Brown, R., Waters, L. H., Hoey, R., Hunt, J. L., Kennedy, K., Ounsworth, C., Powell, A., & Trimm, T. (2011). Online and blended learning: A survey of policy and practice from K-12 schools around the world. *International Association for K-12 Online Learning*. https://files.eric.ed.gov/fulltext/ED537334.pdf

Bates, T., & Poole, G. (2003). *Effective teaching with technology in higher education: foundations for success* (1st ed.). Jossey-Bass.

Beltran-Cruz, M., & Cruz, S. B. (2013). The use of internet-based social media as a tool in enhancing student's learning experiences in biological sciences. *Higher Learning Research Communications*, *3*(4), 14–31.

Beswick, N. (1977). *Resource-based learning*. Heinemann.

Bonk, C. J., & Graham, C. R. (2012). *The handbook of blended learning: Global perspectives, local designs*. John Wiley & Sons.

Crawford, R., & Jenkins, L. (2017). Blended learning and team teaching: Adapting pedagogy in response to the changing digital tertiary environment. *Australasian Journal of Educational Technology*, *33*(2), 51-72.

Davis, T., & Frederick, T. V. (2020). The impact of multimedia in course design on students' performance and online learning experience: A pilot study of an introductory educational computing course. *Online Learning*, *24*(3).

Eberhard, D. M., Simons, G.F. & Fennig, C.D. (Eds.). (2019). *Ethnologue: Languages of the world* (22nd ed.). SIL International. http://www.ethnologue.com.

Frawley, J. (2017, February 27). The myth of the 'digital native'. *Teaching@Sydney*. https://sydney.edu.au/education-portfolio/ei/teaching@sydney/digital-native-myth/

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education*, *10*(3), 157-172.

Hannafin, M. J., & Hill, J. (2007). Resource-based learning. In M. Spector, M. D. Merrill, J. van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 525–536). Erlbaum.

Hill, J.R. (2012). Resource-Based learning. In N.M. Seel (Ed), *Encyclopedia of the sciences of learning*. Springer.

Kennepohl, D. (2012). Pitfalls and prospects: Integrating ICTs in tertiary science education. In J. Peterson, O. Lee, & T. Islam (Eds.), *Effectively implementing information communication technology in higher education in the Asia-Pacific region*. Nova Science Publishers.

Kintu, M. J., Zhu, C. & Kagambe, E. (2017). Blended learning effectiveness: The relationship between student characteristics, design features and outcomes. *International Journal of Educational Technology in Higher Education*, *14*(7), 1-20. https://doi.org/10.1186/s41239-017-0043-4.

Larson, R. C., & Murray, M. E. (2008). Open educational resources for blended learning in high schools: overcoming impediments in developing countries. *Journal of Asynchronous Learning Networks*, *12*(1), 85–103.
Laurillard, D. (2002). *Rethinking university teaching: A conversational framework for the effective use of learning technologies* (2nd ed.). RoutledgeFalmer.
Laurillard, D. (2016). *Introduction to the six learning types* [Video]. https://mediacentral.ucl.ac.uk/Play/4358#!
Lectura, L. (2018, August 7). Average electricity price in PHL 2nd highest in Asia–think tank. *Business Mirror*. https://businessmirror.com.ph/2018/08/07/average-electricity-price-in-phl-2nd-highest-in-asia-think-tank/
Marcial, D. E., Caballero, R. D. B., Rendal, J. B., & Patrimonio, G. A. (2015). "I am offline": Measuring barriers to open online learning in the Philippines. *Information Technologies and Learning Tools*, *45*(1), 28. https://doi.org/10.33407/itlt.v45i1.1170
Mercado, C., Domantay, R., Villacillo, R., Nisperos, S., & Pimentel, E. (2012). ICT maturity of HEIs in selected regions in the Philippines. *International Journal of Modern Education Forum*, 1(1), 1-15.
Purdue University Online. (n.d.). *What is Instructional Design?* https://online.purdue.edu/blog/what-is-instructional-design
Robles, A. C. M. (2012). Blended learning for lifelong learning: An innovation for college education students. *International Journal of Modern Education and Computer Science*, *4*(6), 1–8. https://doi.org/10.5815/ijmecs.2012.06.01
Romero Martínez, S. J., Ordóñez Camacho, X. G., Guillén-Gamez, F. D., & Bravo Agapito, J. (2020). Attitudes toward technology among distance education students: Validation of an explanatory model. *Online Learning*, *24*(2), 59-75.
Sandanayake, T.C. (2019). Promoting open educational resources-based blended learning. *International Journal of Educational Technology in Higher Education, 16*(3). https://doi.org/10.1186/s41239-019-0133-6
Sarvi, J., & Pillay, H. (2015). *Integrated information and communication technology strategies for competitive higher education in Asia and the Pacific*. Asian Development Bank.
Shea, P., Hayes, S., Vickers, J., Gozza-Cohen, M., Uzuner, S., Mehta, R., Valchova, A., & Rangan, P. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *The Internet and Higher Education*, *13*(1-2), 10–21. https://doi.org/10.1016/j.iheduc.2009.11.002
Shea, P., Sau Li, C., & Pickett, A. (2006). A study of teaching presence and student sense of learning community in fully online and web-enhanced college courses. *The Internet and Higher Education*, *9*(3), 175–190. https://doi.org/10.1016/j.iheduc.2006.06.005
Singh, H. (2003). Building effective blended learning programs. *Educational Technology, 43*(6), 51-54.
Speedtest (2020). *Speedtest Global Index*. https://www.speedtest.net/global-index
Spring, K. J., Graham, C. R., & Hadlock, C. A. (2016). The current landscape of international blended learning. *International Journal of Technology Enhanced Learning*, *8*(1), 84–102. https://doi.org/10.1504/IJTEL.2016.075961
Taber, K. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*,1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tubaishat, A., Bhatti, A., & Qawasmeh, E. E. (2006). ICT experiences in two different Middle Eastern universities. *Issues in Informing Science & Information Technology*, *3*, 667+. https://link.gale.com/apps/doc/A205363679/AONE?u=monash&sid=AONE&xid=4f3fe0ea

UNESCO (2011). *Trends in Asia and the Pacific*. http://www.unescobkk.org/education/ict/themes/teaching-learning/trends-and-casestudies/trends-in-asia-pacific

UNESCO (2018). *Positioning ICT in Education to Achieve the Education 2030 Agenda in Asia and the Pacific: Recommendations for a Regional Strategy*. https://unesdoc.unesco.org/ark:/48223/pf0000261661

Wallet, P., & Melgar, B. V. (2014*). Information and Communication Technology (ICT) in Education in Asia: A comparative analysis of ICT integration and e-readiness in schools across Asia*. http://dx. doi. org/10.15220/978-92-9189-148-1-en

Watterston, J. (2012). *Foreword*. Blended learning: A synthesis of research findings in Victorian education 2006-2011. https://www.education.vic.gov.au/Documents/about/research/blendedlearning.pdf

Yelland, N., Neal, G., & Dakich, E. (2008). *Rethinking education with ICT: New directions for effective practices*. Sense Publishers.

Appendix A

Survey for the implementation of blended learning in first-year chemistry

Part A. Your background information

On boxes provided, please put a tick mark to your chosen answer.

1. What program are you enrolled in? (*Please choose one*)
   - ☐ BS Agriculture
   - ☐ BS Agricultural Chemistry
   - ☐ BS Biology
   - ☐ BS Chemistry
   - ☐ BS Mathematics
   - ☐ BS Applied Mathematics
   - ☐ BS Chemical Engineering
   - ☐ BS Food Technology
   - ☐ BS Math and Science Teaching
   - ☐ Doctor of Veterinary Medicine
   - ☐ Other Please provide ________________

2. What is your age? ________

3. What is your gender orientation?
   ☐ Female ☐ Male ☐ Non-binary ☐ Rather not say

4. What is your status as a student?
   ☐ Full time ☐ Part time

5. Which senior high school strand did you complete?
   - ☐ ABM
   - ☐ GAS
   - ☐ HUMSS
   - ☐ STEM
   - ☐ TVL
   - ☐ Sports
   - ☐ Arts and Design
   - ☐ Others, please provide ___________________
   - ☐ I completed the old basic education curriculum.

6. What province is your high school located? _____________________________

7. What language/s are spoken at your home? (*Please list all*) ________________

8. Are you a recipient of a scholarship program or grant that supports you financially at university?
   ☐ Yes ☐ No

Part B. Your learning experiences

The following questions seek to capture your experiences on learning the topics covered in the last two weeks i.e., periodic trends, chemical bonding, Lewis structure, molecular shapes and polarity. To help you answer these questions, recall the way the lessons were delivered in the previous two weeks of your study.

9. Which of the following did you find useful for your study? (*Tick ✔ all that apply*)
   - ☐ Closed caption (CC) videos or videos with subtitles
   - ☐ Multiple forms of information display (i.e., text, tables, illustrations, and diagram)
   - ☐ Animation and interactive simulation supplementary to the lecture
   - ☐ Additional practice problems of various types
   - ☐ Graphic organisers and infographics that accompany lecture notes

10. Which of the following statements do you identify with? (*Tick ✔ all that apply*)
    - ☐ I lack digital experience because I am anxious to use any form of information and communications technology (ICT) which includes the use of smart phones and computer (desktop or laptop).

- ☐ I find new ICTs including new applications and software unattractive and undesirable.
- ☐ I have access to a basic computer set-up (personally owned, rented or borrowed) that I can use any time I need to.
- ☐ I have a personal internet connection (home Wi-Fi, mobile data) which I can use to access resources and activities from our Moodle site.
- ☐ I use the internet connection provided by the university (campus Wi-Fi) to access our Moodle site.
- ☐ I am proficient in using basic tools and applications in computer (or smart phones) such as Microsoft Office or Mac OS (document processing, spreadsheet, presentations, publisher, etc.).
- ☐ I am able to understand and/or write a simple program using common programming language/s.
- ☐ I have never had an opportunity to use a computer, a smart phone or internet connection.

11. Which was your preferred mode of delivery of the topics taught over the past two weeks? (*Choose one mode only*)
    - ☐ Traditional lecture class (PowerPoint, board and pen)
    - ☐ Blended mode (mixture of lecture and online component)
    - ☐ Fully online

    Briefly explain your response to question #11.

    ____

    ____

    ____

Appendix B

Guide questions for the focus group discussion on the blended learning implementation of first-year chemistry

Instructions for the students: The questions for this discussion refer to your learning experiences with resources and activities specifically covering the topics on electronic configuration, Lewis structure, molecular shapes and hybridisation.

1. In the survey, you were asked to identify which learning material/s were helpful in your study. Why did you think these learning material/s is/are most helpful?

2. Were there any aspects of the blended delivery of the topic that makes it difficult for you to access, understand or complete?

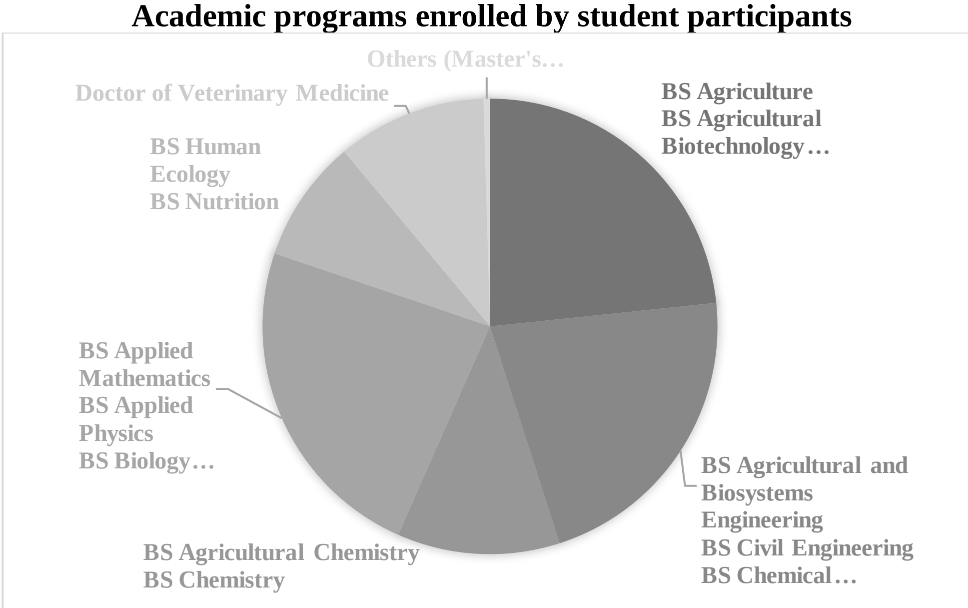
Appendix C

Respondents’ demographic information

	Number of respondents (*n* = 447)
Gender	Female = 262 (58.6%) Male = 172 (38.5%) Non-binary = 7 (1.6%) Rather not say = 6 (1.3%)
High school strand completed	Science, Technology, Engineering and Mathematics (STEM) = 409 (91.5%) Accountancy, Business and Management (ABM) = 8 (1.8%) Humanities and Social Sciences (HUMSS) = 8 (1.8%) Technical Vocational Livelihood (TVL) = 3 (0.7%) General Academic Strand (GAS) = 8 (1.8%) Completed basic education curriculum (prior to 2016) = 11 (2.5%)
Respondents' originating provinces	Laguna = 140 (31.3%) Metropolitan Manila = 95 (21.3%) Luzon (excluding Metropolitan Manila and Southern Luzon) = 167 (36.2%) Visayas = 13 (2.9%) Mindanao = 28 (6.3%) Outside Philippines = 1 (0.2%) Not indicated = 3 (0.6%)
Major languages spoken by respondents	English = 299 (66.9%) Filipino = 273 (61.1%) Tagalog = 171 (38.3%) None of the above = 20 (4.5%)

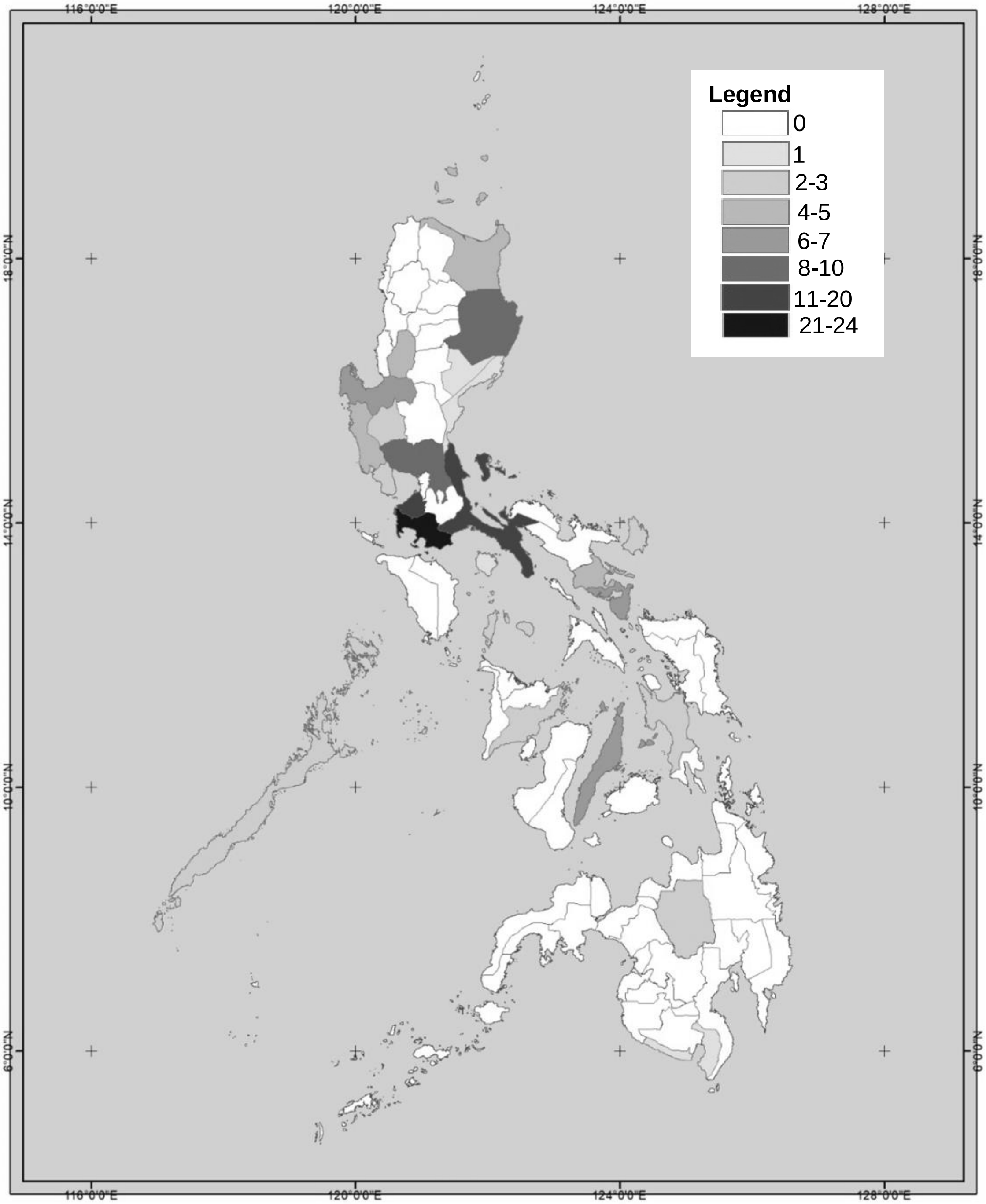
Appendix D

Academic programs enrolled by student participants



Appendix E

Originating provinces of survey respondents
(Shading corresponds to the number of respondents from each province)



Appendix F

Learning resources that were employed for blended delivery of first-year chemistry topics

Topic	Media form and number [1]	Particulars	Source of resource
Preliminary resources (Moodle student guide and electronic book)	Text (1)	Student guide to the Moodle course site	Prepared by the researcher
	Hypertext (1)	Atoms First (2nd ed)	https://openstax.org/details/books/chemistry-atoms-first-2e
Periodic table and periodic trends	Web page (2)	Development of the Periodic Table	https://www.rsc.org/periodic-table/history/about
		The Evolution of the Periodic System	https://www.scientificamerican.com/article/the-evolution-of-the-periodic-system/
	Hypertext (1)	IUPAC Interactive Periodic Table	http://www.rsc.org/periodic-table
	Video (1)	The Periodic Table and Trends	https://www.youtube.com/watch?v=hePb00CqvP0
	Infographic (1)	Mastering Periodic Trends (ACS)	https://www.acs.org/content/dam/acsorg/education/students/highschool/chemistryclubs/infographics/mastering-periodic-trends-infographic.pdf
	Electronic book (1)	Periodic Trends	https://opentextbc.ca/introductorychemistry/chapter/periodic-trends-2/
	Online quiz (1)	Quiz on Periodic Trends	http://www.uplifths.org/ourpages/auto/2015/3/31/54112596/PeriodicTrendsPracticeSUB1106.pdf
	Online forum (2)	Chemistry in my name	Moodle
		Ask us!	Moodle
Introduction to chemical bonding (including naming compounds)	Web page (2)	Chemical Bonding: The Nature of the Chemical Bond	https://www.visionlearning.com/en/library/Chemistry/1/Chemical-Bonding/55
		Why do atoms bond with another?	https://masterconceptsinchemistry.com/index.php/2017/09/24/why-do-atoms-bond-with-one-another/
	Simulation (1)	Chemical Bonds	http://mw2.concord.org/public/part2/bondtype/customDipole3.html
	Interactive presentation (2)	Ionic Bonding	https://pbslm-contrib.s3.amazonaws.com/WGBH/arct15/SimBucket/Simulations/chemthink-ionicbonding/content/index.html

		Covalent Bonding	https://pbslm-contrib.s3.amazonaws.com/WGBH/arct15/SimBucket/Simulations/chemthink-covalentbonding/content/index.html
	Electronic book (1)	Naming Compounds	https://courses.lumenlearning.com/boundless-chemistry/chapter/naming-compounds/
	Practice set (2)	Worksheet 1: Naming Ionic and Covalent Compounds	https://www.gardencity.k12.ny.us/cms/lib/NY01913305/Centricity/Domain/584/Ionic_CovalentNameRace.pdf
		Worksheet 2: Naming Ionic and Covalent Compounds	http://misterguch.brinkster.net/PRA015.pdf
	Online quiz (3)	Review Quiz: Periodic Trends	Moodle
		Practice Quiz: Naming Ionic and Covalent Compound	https://www.quia.com/quiz/3124061.html?AP_rand=1897061935
		Quiz on Chemical Bonding	Moodle
	Online forum (1)	Ask us!	Moodle
Lewis structures	Wiki (2)	Drawing Lewis Structures	https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/08._Basic_Concepts_of_Chemical_Bonding/8.5%3A_Drawing_Lewis_Structures
		Violations of the Octet Rule	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Chemical_Bonding/Lewis_Theory_of_Bonding/Violations_of_the_Octet_Rule
	Practice set (1)	Practice Problems on Lewis Structure	Uploaded by the researcher
	Online quiz (1)	Quiz on Lewis Structures	Moodle
	Online forum (1)	Ask us!	Moodle
Geometry of molecules	Simulation (1)	Molecule Shapes	https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_en.html

	Wiki (1)	Geometry of Molecules	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Chemical_Bonding/Lewis_Theory_of_Bonding/Geometry_of_Molecules
	Online bulletin board (1)	Draw and share on Padlet	https://padlet.com/cha_reyes/n53itd5149h5
Polarity	Hypermedia (1)	Polarity of Molecules	http://glencoe.mheducation.com/olcweb/cgi/pluginpop.cgi?it=swf::640::480::/sites/dl/free/0003152012/931049/Polarity_of_Molecules.swf::Polarity%20of%20Molecules
	Web page (2)	How to determine molecular polarity	https://preparatorychemistry.com/Bishop_molecular_polarity.htmhttps:/preparatorychemistry.com/Bishop_molecular_polarity.htm
		How polarity makes water behave strangely	https://www.youtube.com/watch?v=ASLUY2U1M-8
	Video (1)	Influence of shape on a molecule's polarity	Uploaded by the researcher
	Problem set (1)	Exercise on molecular shape and polarity	Uploaded by the researcher
	Online quiz (1)	Quiz on Polarity	Moodle
	Online forum (1)	Ask us!	Moodle

[1]Numbers in parentheses indicate quantity.

"Simplicity is Key": Literacy Graduate Students' Perceptions of Online Learning

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Abstract
Even before COVID-19, literacy graduate coursework was increasingly offered online, replacing the traditional campus-based courses This study investigated how graduate literacy students perceive coursework in an online learning environment. This understanding is important because (a) student perceptions regarding online learning are critical to motivation and learning; and (b) faculty designing courses need to consider student voice in course development. This survey research queried literacy master's degree candidates their perceptions prior to and after taking online classes, their confidence levels using technology, and about the technological tools that have impacted their learning. Results indicated initial perceptions of online learning changed positively after engagement in coursework, but course design influenced collaboration and engagement. Statistical significance was found in changes in initial perceptions of online learning to a more positive overall feelings toward online learning. The results of this study raise important considerations for implementing online coursework for literacy graduate students.

Keywords: graduate, technology, student perceptions, online education, literacy

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In 2015, "of the three million graduate students enrolled in postsecondary institutions, 1 million, or 34.3 percent enrolled in at least some DE (Distance Education) courses" (Miller et al., 2017, p. 18). This means even before COVID-19, teacher educators had increasingly turned to distance education to meet their student's learning needs (Kentor, 2015). While online learning is not new, COVID-19 removed options for face-to-face teaching and made online learning the new normal in designing and implementing instruction. Faculty tasked with designing and implementing coursework for online delivery often tried to replicate face-to-face methods to online learning, which may not be appropriate in an online environment (Supiano, 2020).

As literacy teacher educators, we experienced the move towards online education prior to and during COVID-19. This group of educators began to question how students perceived this change to an online format and how students' ability to use technology influenced their perceptions of the learning experience. Essentially, what were students' perceptions of these online programs. Giving students a voice regarding their experience allows faculty to think more deeply about course design and creates an opportunity for improved methods for teaching. This paper explores graduate students' perceptions of online learning and the influences of technology in their online experience.

Literature Review

Online learning has been an option for students since 1989 when the University of Phoenix offered the first fully online degrees (Kentnor, 2015). Online teaching and learning are distinct from the face-to-face environment. In an online classroom environment, the learner is more active and in control of their learning experience while the faculty shifts towards more coaching and mentoring (Boettcher & Conrad, 2016). Students in higher education choose online learning platforms for multiple reasons including, but not limited to, flexibility, convenience, access, and personal health (Harris & Martin, 2012). The perceptions students have of online learning experiences are impacted by student attitude and digital literacy capabilities (Prior et al., 2016).

It is important that we focus on the perceptions of our students because of the unique nature of students in literacy education master's programs. Research by Money and Dean (2019) indicated that differences between populations of online students impacts online learning outcomes. Literacy graduate students are unique in that they are certified teachers (or eligible for certification) engaging in advanced studies in the teaching of literacy, a field in which they have some experience. Yet despite the uniqueness of this population, few researchers have focused on the investigation of literacy master's degree programs. Swaggerty and Broemmel (2017) examined the online learning experience preferences of students from one Master's in Reading Education program. They concluded that the strength in online course effectiveness was in communication and collaboration, shared feelings of membership in the online learning community, and the authenticity of assignments and course activities. Because this was the only study that specifically examined literacy education in an online environment, the field is ripe for learning more about students' perceptions of online literacy master's coursework.

In expanding on Swaggerty and Broemmel (2017), we take a broader and more current view as we sought to understand how candidates' perceptions of online literacy courses in 2020 before and after COVID-19 have been impacted by course design, self-efficacy, and perceptions of online learning (Prior et al., 2016), and the application of the literacy course to literacy teaching K–12.

Effective and Engaging Online Courses

Previous research on students' perceptions of online learning in education demonstrate that candidates prefer learning environments that engage them to develop content knowledge with opportunities for application. Throughout these experiences' candidates described the need for professors to engage directly with the community of learners in the course (Leader-Janssen et al., 2016). Faculty teaching online strive to engage students by designing classes that follow the key features of the Community of Inquiry (CoI) Framework (Garrison, 2017). CoI has been utilized to understand effective online teaching; the model uses the concepts of social presence, cognitive presence, and teaching presence to represent a meaningful learning experience (Garrison, 2017).

Social presence revolves around how students and instructors interact with one another and is characterized by how authentic online interactions feel. Rourke et al. (2007) found that social presence supported critical thinking and in turn then impacted cognitive presence. Cognitive presence refers to how learners can build meaning and knowledge throughout the course. The third aspect of the CoI framework, teaching presence mediates and regulates both social and cognitive presence (Akyol et al., 2009). Teaching presence is demonstrated by the instructional decision of the course instructor and its activities. A fourth factor has been added to the CoI framework, which is Learner Presence (Shea, 2012). Learner presence examines the relationship between a students' self-efficacy and their perception of an online learning environment. It is important in online learning in that the students who exhibited learner presence generated more knowledge (Shea et al., 2013), and is evident in more complex learning activities that promote collaboration and is correlated with course grades (Shea et al., 2012).

Self-efficacy and Perceptions of Online Learning

Shea and Bidjerano (2010) indicate that there is a positive relationship between elements of the CoI framework and self- efficacy. Self-efficacy is an individual's belief in their ability to succeed or fail in a task (Bandura, 1993). In an online learning environment, self-efficacy is central as students are not only engaged in a complex learning environment where independence is central but where their opportunities for interaction with others is limited to intentional practices (Peechapol et al., 2018). Students' self-efficacy in online classes is connected directly to their technology competency and experience with digital literacy. Learners' self-efficacy may lead to differences in help seeking behaviors and in turn engagement with the material (Shea, 2012).

Thus, candidates engaged in online learning need to have self-efficacy regarding both the focus of the course as well as with digital literacy. Digital literacy can be defined as having the attitude and ability to use digital tools in a variety of situations (Martin, 2006). Although many students are familiar with digital technologies and use them for their daily lives, they do not necessarily know how to use digital tools for learning (Gurung & Rutledge, 2014). Since we know that students with high self-efficacy regarding their digital literacy capabilities and online course work have demonstrated the ability to determine appropriate courses of action for learning (Zimmerman, 2010), and thus, we know that they are more likely to achieve academic success (Peechapol et al., 2018).

The way students perceive social interaction, sense of community, and their roles in achieving success in online learning (Fedynich et al., 2015; Sher, 2009; Swaggerty & Broemmel, 2017; Young & Norgard, 2006) contributed to their self-efficacy and satisfaction. Typically, there are three types of interaction: (1) student-instructor interaction; (2) student-student interaction; and (3) student-content interaction (Sher, 2009). Further, Fedynich et al. (2015)

found that the interaction between graduate students and the instructor has a major impact on their satisfaction. Students were highly satisfied with the clarity and organization of instruction using sufficient resources, which identified the instructor's role as being vitally important to students' satisfaction. Similarly, Young and Norgard (2006) demonstrated the students' needs in regard to interaction with professors and classmates and course content. Students also voiced the need to develop a consistent course structure across classes and to provide extended technical support hours. These are some factors that could influence online student learning and self-efficacy.

Connecting Online Learning to Field Experiences

Literacy Masters programs require that students engage in field experiences, teaching elementary and/or secondary students, as part of knowledge development. The value of field experiences in education (applied assignments/practice assignments) is an integral part of teacher education programs (Simpson, 2006) as teachers are exposed to different situations that prepare them or enhance their knowledge (Barbour et al., 2009). It is the "testing ground" for theory and practice (Simpson, 2006, p. 241) where students receive support and develop community within their teaching environment. Field experiences may look different in the online learning environment. This experience requires that teacher candidates engage in complex cognitive behaviors requiring self-regulation to attain teaching and social presence as teachers (Shea & Bidjerano, 2012). The online environment requires not just a different pedagogical approach but different ways of engaging. Prior to COVID-19, many literacy master's degree students did their field experiences in local schools and submitted some form of recording or were supervised remotely.

Although there have been field experiences offered virtually for some time (Kennedy & Archambault, 2012), these experiences were less common prior to COVID-19. Virtual field experiences require planning and executing instruction in a virtual setting and motivating distance students (Kennedy & Archambault, 2012). Waters and Russell III (2016) found benefits to virtual field experiences for teacher candidates enrolled in online classes for different reasons. First, for convenience, virtual field experiences are a "highly motivating factor" (p. 10). Virtual field experiences offer flexibility to meet home, work, and financial responsibilities. It also alleviates students from having to travel to schools and helps those who lack reliable transportation by conducting their field experience virtually.

The perceptions of literacy graduate students engaging in online learning are impacted by the course design, student self-efficacy, and the integration of field experiences. Using what we know from the literature, how do literacy master's students perceive these factors? Additionally, do these students see applications from their graduate classes to their K–12 classrooms? In this study we sought to answer these questions.

Methods

Seven researchers, each from different higher education institutions, joined together through a shared interest in online literacy graduate education at the Literacy Research Association annual conference. Our experiences as online faculty range from novices to 14 years of teaching in higher education. Our respective programs have existed online for a range of first time-implementation to online literacy programs in existence for 22 years. Researchers from this group develop and teach online courses, as well as belong to committees supporting online learning.

The purpose of this multi-institutional collaborative research project was to discern literacy graduate students' perceptions of their experiences in completing literacy coursework when enrolled using an online instructional format. Online coursework is defined for the purpose of this research project as instruction delivered as hybrid (face-to-face *and* online) or fully delivered in an online environment. The participants of the survey have all received or are eligible for their initial teacher licensure in either elementary or secondary settings. The initial phase of the study took place in February 2020, prior to the transition to online teaching due to COVID-19.

The 28-question survey collected demographic and institutional information, perceptions of online learning as related to efficacy, technology influences on learning, especially as they related to field experiences. The survey was a combination of 5-point Likert scale (1–strongly disagree, 2–disagree, 3–neither agree or disagree, 4–agree, and 5–strongly agree), multiple choice, and open-ended questions. Each researcher secured IRB approval following their institutional guidelines.

The survey went through an iterative process. In phase one, researchers met via video conferencing to discuss and create initial survey questions. The focus of these meetings was to align survey responses to the research question of perceptions of learning in an online environment. As the researchers in this study are all faculty, teaching graduate courses the goal was to discern if the transition to online learning impacted learning. The survey was then entered into Qualtrics for ease of distribution and analysis. In phase two, the research team members individually completed the survey to ensure alignment to the research question and theoretical perspective. Upon revisions, the new pilot survey was given to six graduate students from different institutions for additional input on question clarity and ease in completing the survey. Comments received from the pilot survey were used by the research team to improve question clarity and final edits were then completed.

In phase three, the survey was distributed to graduate students who were previously or currently enrolled in hybrid or online literacy coursework associated with each team member's institution. In addition, a call was emailed through the LRA Listserv for faculty assistance in sharing the survey with their online/hybrid literacy classes. Consistent with snowball sampling procedures (Coffey & Atkinson, 1996) both faculty and student participants were encouraged to share the survey link with colleagues that met the survey demographic requirement. In the final phase, four additional open-ended questions were sent to 41 participants who shared their email addresses and agreed to expand on their answers from the survey. Fourteen responses were received. These four questions focused on (a) advice for professors; (b) helpful online tools used in their K–12 classrooms; (c) aspects of coursework that help them become a better literacy teacher; and (d) comments on online literacy teaching and learning.

Participants

One hundred twenty-seven participants from 16 states completed the survey with all surveys usable as data points. A response rate is unable to be determined as this survey was distributed as a convenience sample through the research teams' institutions and the LRA Listserv. The responses then came through snowball sampling as literacy faculty were encouraged to share the link with other literacy faculty and with graduate students. These results attained through a convenience sample while not generalizable, do allow for a gathering of literacy graduate student perceptions. These perceptions become the foundation for literacy faculty to reflect on practice and consider how to best meet the learning needs of students. The participants ranged in age and teaching experience. Participants ranging in ages from 22 to 64, with 37 as the mean age (see Table 1). One hundred twenty-one participants identified as female (93%), five identified as male (4%), and one participant chose not to answer.

Table 1
Age Range of Participants

Age range	**Frequency, n (%)**
21–30	39 (32%)
31–40	40 (32%)
41–50	26 (21%)
Older than 50	18 (15%)

Note. N = 123. Four missing data points.

Participants were also asked to indicate their years of teaching experience, which ranged from those being brand new teachers to three teachers with 26 years or more of teaching experience with a mean teaching experience of nine years (see Table 2).

Table 2
Years of Teaching Experience

Range of Years of Teaching Experiences	**Frequency, n (%)**
Less than 1 year	8 (6.3%)
1–5	41(32.5%)
6–10	34 (27.0%)
11–15	21 (16.7%)
16–20	12 (9.5%)
21–25	7 (5.6%)
26–30	3 (2.4%)

Note. N = 126. One missing data point. For ease in reporting, all participants in their first year of teaching counted this as zero years of teaching.

Seventy-six participants (60%) indicated they teach in a PK–5 grade setting, 32 participants (25%) teach in 6–12 grade settings, and 15% are not currently teaching. Responses were received from 16 different states. Participants were also asked if they were taking coursework in their state of teaching residency. One hundred thirteen were taking coursework in their state (89%) while 14 participants indicated they were enrolled in a program outside of their state residency teaching. Many of the participants understood that the coursework could lead to a literacy endorsement (111 participants or 87%), eight participants indicated the coursework did not meet endorsement requirements, and another eight participants were unsure if the coursework would lead to a literacy endorsement.

Findings

The increasingly more common online learning environments has changed how teacher educators consider avenues for student learning in the delivery of literacy coursework. Initial questions queried the category of online program enrollment with 77% of participants enrolled in completely online coursework and 23% in a hybrid program.

Perceptions of Online Learning

To understand the perceptions of the respondents before and after the survey, a question asked students to identify preference on the type of program for literacy learning. Participants were asked to identify their preferred method of learning with 50% of the students indicated they preferred a hybrid format, 22% favored face-to-face, and 28% preferred learning online. An ANOVA was conducted to analyze for differences in age group, teaching experience, and grade level teaching with no significance identified between any of these groups. In regard to having synchronous or asynchronous requirements for online coursework, 75% of the participants preferred courses designed for asynchronous learning (i.e., everyone may choose the time he/she/they want to work), and 25% chose a combination of synchronous and asynchronous format. However, this combination could be done in a face-to-face or virtual environment. Less than 1% of the participants chose synchronous courses (i.e., everyone is required to be online at the same time).

Table 3

Preference for Method of Learning (N=127)

Instructional Delivery Method	**Frequency, n (%)**
Hybrid	50%
Face-to-face	22%
Online	28%

The 127 participants were also asked to choose a course topic that had impacted their teaching practice. Twenty-six percent of the participants believed that a course focusing on intervention or working with at-risk readers had the greatest impact. Nineteen percent of participants reported content area literacy, and eleven percent found children's/adolescent literature were important. The least courses reported by the participants to be impactful to his/her/their practice were classes focused on digital literacies (2%) or assessment (3%).

Table 4

Course Topic Most Impacting Teaching Practice (N=127)

Course Topics	**Frequency, n (%)**
Working with at-risk readers	32 (5%)
Content area literacy	25 (20%)
Children/adolescent literacy	15 (12%)
Social and critical literacy	10 (8%)
Research	9 (7%)
English Language Learners	9 (7%)
Teaching writing	7 (6%)
Instructional coaching	6 (5%)
Assessment	4 (3%)
Digital Literacy	3 (2%)
Other	7 (5%)

Inferential statistics were used to determine the differences and relationships in the constructs of confidence and perceptions of online learning. The survey first sent out in February 2020 provided opportunities to compare pre-COVID-19 confidence and perceptions of online learning to face-to-face courses that went online around March 15. A Fisher's Z analysis was used to compare pre- and post-March 15 responses. One construct investigated was participants' perceptions of confidence in using technology in daily life, online learning, and teaching. Results indicated there were no changes in confidence in any of the above areas before and after the COVID-19 transition to all online teaching. Participants' responses were also analyzed for changes in initial and current perceptions on literacy courses. A paired samples t-test was conducted comparing perceptions of engagement at the beginning of taking online courses to current perceptions of enrollment in online courses. There was a significant finding of overall perceptions ($t = 6.572$, $p < .05$).

A Fisher's Z analysis was conducted to query perceptions of literacy coursework indicating significant relationship in the participants' pre- and post-coursework perceptions of online learning (.34, $p < .001$). The Fisher's Z analysis also found that there were no significant differences between the participants' current perceptions of online learning in relation to the grade levels they were teaching (-.45, $p = 0.78$). A chi-square analysis indicated a significant result on the relationship with the mode of learning (face-to-face, online, hybrid) and the number of completed online courses (18.043, $p < .005$). This result indicated as students completed more courses in a program, this increased the probability of a preference for hybrid instruction of learning.

Students were queried on their perceptions of online learning literacy course work using a Likert 1–5 scale (see Table 3). Prior to beginning literacy courses, 9% of the participants were not looking forward to the online experiences, 43% of the students had no idea what to expect, 44% of the students loved online learning depending on the instructional design, and 4% loved online learning no matter what the situation. However, after taking literacy courses online 7% were still not looking forward to online learning (down slightly from initial perceptions), 2% still had no idea what to expect, 83% of the students loved literacy online courses depending on the instructional design, 7% loved online learning no matter what, but a new result indicated that one person (<1%) hated the idea of online learning.

Table 5
Perceptions of Engagement in Online Coursework (N=127)

	Initial perceptions of online literacy coursework (Mean and Standard Deviation)	**Perceptions after taking online literacy courses (Mean and Standard Deviation)**
Hated the idea	0	1 (<1%)
Not looking forward to it	($M = 2.67$, $SD = 0.71$)	($M = 3.27$, $SD = 1.10$)
No idea what to expect	($M = 2.50$, $SD = 0.71$)	($M = 3.82$, $SD = 0.70$)
Love online learning depending on the instructional design	($M = 3.49$, $SD = 0.63$)	($M = 4.04$, $SD = 0.80$)
Love online learning no matter the circumstance	($M = 3.78$, $SD = 0.97$)	($M = 4.40$, $SD = 0.55$)

Course Design that Supports Online Learning

Course design that supports online learning included schedules (course calendars), time or pace flexibility, helpful course materials and/or tools, sequence and interaction structure, and application of course content in practice. Students' expectations of online learning or suggestions emphasized the importance of the professor (interaction, prompt feedback, and guidance), expectation of course materials (clear presentation and assessment, perfecting the practice, weekly timeline, videos or recordings, and authentic assignments), and supportive interaction with peers. Participants asserted the challenges of online classes containing unnecessary or worthless discussion board activities, lack of support (professor, program, college and university levels), hard-to-meet course requirements due to field components or the time due to the short length of courses (courses taking place in an accelerated semester—some online programs compress a semester into 5 weeks), and feedback that lacks comprehensive and personalized. Finally, participants asked for university support for online students by providing distal access to various campus resources from speakers to meetings.

The findings in this area were further explored in the final phase of the study—participants confirmed and/or clarified many of their survey responses. Students also offered advice to professors for constructive changes to online learning. There were a variety of suggestions, including ways to pace courses, the resources that are used in courses, and opportunities for engagement.

As to ways to pace courses, comments include providing course calendars to help students keep up with assignments and due dates: "My professors have given me calendars as well as the syllabus which I find extremely helpful. It helps me add reminders into my digital calendar and set reminders. I worry about making a mistake. The calendar helps me know I don't make a mistake" (Q1: 2).

Students appreciate structure in course navigation. As examples, they cited that having clear expectations for discussion boards and assignments is helpful. They want to know "why" they need to complete a particular assignment—otherwise it might feel like assignments were made "just to assign them" (Q1: 4).

Meanwhile, it was "very powerful" "to observe live or recorded lessons, along with concurrent discussions" as it taught them "to closely observe student responses to teaching moves and plan specific next steps for individualized instruction." They found "the dialogue between teachers about the lesson is most valuable" and "a powerful collaborative learning opportunity" (Q3: 5). It is worth highlighting a participant's comment: "the courses equipped me with terminology and rationale as to why certain approaches were beneficial and in what context" though these were what she had been doing already in the classroom to varying degrees (Q3: 10).

Overall, participants summarized that effective online literacy teaching and learning should include clear expectations, discussion board engagement, small groups, and well-designed class structure (organization, syllabus, routines). The most effective online literacy courses all had clearly established "expectations and protocols for discussion and collaboration" and the best online classes they shared included "effective discussions, both synchronous and asynchronous" (Q4: 5). Small group work helped to "keep students engaged and motivated." (Q4: 7). The key lies in the design of online courses is "simplicity" (Q4: 10). It is extremely helpful to have a "predictable routine of assignments...a handful of well-curated readings/videos/supplementary material." They appreciated that "syllabus was shared before the course went live" (Q4: 10).

Students want personal engagement. This engagement comes in the form of instructor-to-students, but also student-to-student interaction is appreciated. Respondents had a few suggestions on how to structure these interactions, to reap maximum benefits. Some of these suggestions are simple, such as prompt replies to email and other requests for help, and some are more complex, such as developing online environments that include a variety of formats including whole group and break-out discussions, synchronous, and asynchronous opportunities.

Field Experiences and Online Tools

When asked what made an online literacy class more effective than other online literacy classes, 31% of the participants reported field based/practicum assignments, 24% reported faculty feedback, 19% chose course readings/videos, and 18% selected interactions with peers with 8% believing written reflection was helpful.

Table 6

Components of Effective Online Literacy Class (N=127)

Effective Literacy Class	**Frequency, n (%)**
Field based/practicum assignments	39 (31%)
Faculty feedback	30 (23%)
Choice of readings/videos	25 (20%)
Interactions with peers	23 (18%)
Written reflection	10 (8%)

Participants reported that the aspects of applied or field assignments that have helped or could help them to be a better literacy teacher included remote option, working with students to actually apply the content, observations of live or recorded lessons, connecting readings to observations, individualized instruction, practice with strategies and assessments, and use of terminology and rationales for various approaches. A remote option in field assignment would help them "know how to teach virtually" (Q3: 2), which is significant during the COVID-19 pandemic. Working with students in practicum or courses with field components allowed them to apply what they learned, practice with "new literacy strategies and assessments," "make notes of (students') challenges," and use "actual data to inform (their) instruction" (Q3: 3 & 4).

When reporting technology tools that they have used in online classes that have furthered learning, participants listed technology tools in four major categories: website, learning management system, resource, and other. Types of software that was found useful were tools that (a) allowed for collaboration; (b) video conferencing that allow live and recorded communication; and (c) tools that organize course material and assignments.

Discussion

Considering increasing enrollment in online courses and online-only degree programs, the continued assessment and evaluation of student experiences has an important role in the development of advanced literacy practitioners (teachers, coaches, and leaders). In the years since Miller et al. (2017) reported suggestions for improving online learning, the number of online course opportunities has exploded. As we write this manuscript, during the global pandemic of 2020, these opportunities approach 100% as entire universities shift toward online-only instruction.

Looking more closely at the findings three areas of discussion are uncovered: (a) the impact of online learning on self-efficacy and perceptions of confidence in completing online coursework; (b) course design that considers the key factors that can build a CoI; and (c) students' appreciation of opportunities to engage in field experiences even when classes are online. As Garrison (2017) exemplified, the creation of a CoI impacts the effectiveness of online learning.

Engaging in online learning impacts self-efficacy and perceptions

Students' engagement in online learning impacted their perceptions of this modality and built self-efficacy for using online applications for teaching and learning. Throughout the study, students highlighted different applications that were used for learning that they may try to use for their own teaching. Participants shared the fact that programs for infographics, reading data bases, and tools for interactive learning that were used in their online graduate education courses could be used in their face-to-face courses as well. Research on self-efficacy (Zimmerman, 2010) indicates that an individual's beliefs about technology could impact their ability to engage with technology across teaching and learning. The findings in this study support the fact that students engaged in online learning for their literacy graduate work could have a deeper sense of self-efficacy for applying digital literacy within their K–12 classrooms.

One of the most interesting findings from this study was that students' perceptions of online learning changed after engaging in an online graduate course. As reported in the findings, students' self-efficacy about using technology in different domains was not impacted by engaging in online learning; however, after taking an online course, students were almost twice as likely to love online learning than prior to taking an online course. This finding is key because it demonstrates how perception of online learning is impacted by participation in online learning. Students enter online learning with a vast difference in experience with online coursework. Faculty need to be cognizant of these differences as they support especially novice online users to assure that they not just know how to use the digital tools but that they engage in the CoI.

Many teachers received their teacher education training in face-to-face programs (Author, 2016), so the frame of reference for learning is via a traditional model of instruction. This potential apprehension was displayed in students' pre-perceptions in their expectations for online learning. Students' perceptions of favorability of online learning almost doubled from pre-program perceptions. While there may be initial concerns of the unknown aspect of online learning, participants indicated a strong confidence in the use of technology in their personal and work lives. This is good news for instructors who are concerned about student's ability to navigate among different digital resources. While there may be initial concerns on using new technology or new digital platforms, this confidence demonstrates self-efficacy in a world of digital/online learning. When students have success in navigating online learning, this increases their perceived ability to complete coursework.

Effective online learning develops a Community of Inquiry

Garrison and colleagues (2000) stated that effective online teaching engages social presence, cognitive presence, and teaching presence, while teaching presence is essential to balance cognitive and social presence. Participants in the study reported supportive interaction with peers was key to the creation of a CoI and thus fosters a positive online learning environment. Some of the participants believed that their interaction with other students was instrumental in developing and growing their literacy knowledge as they exchanged information and experience. This informed their knowledge and enriched their teaching experiences. Peer support and instructor's presence increased student's satisfaction and limited their feeling of isolation.

Students in our study placed a high value on the professors' feedback, guidance, and interaction with students throughout the course, as also found in Anderson, Rourke, Garrison, & Archer's (2001) study on teaching presence. However, the social and cognitive presence of the courses could not have occurred without the effective implementation of teaching presence that is influenced by the instructional design of the course. Students found accelerated courses, courses without clear schedules for learning, and lacking university support as problematic. Throughout the survey's students highlighted the need for clearly established expectations (teaching presence), interactive activities to support learning and collaboration (cognitive presence) and include personal engagement (social presence). Course assignments that did not build a CoI included assignments such as reflections and were viewed as less effective by the respondents. As found in Swaggerty and Broemmel (2017), the effectiveness of online courses relied on communication and collaboration, shared feelings of membership in the online learning community, and the authenticity of assignments and course activities. Fedynich et al. (2015) indicated the instructor's role as being vitally important to students' satisfaction.

Results indicated a conflicting result in the area of students' perceptions of mode of instruction (face-to-face, all online, hybrid) and how students' complete coursework (synchronous, asynchronous). In analysis, 72% of participants indicated they preferred some type of shared learning experience that would occur in either hybrid or face-to-face interactions. These learning experiences would be synchronous, times when all students are required to attend a specified class time. However, there was a strong preference for asynchronous learning (75%), meaning this work was done at their own pace and time. This conflict in mode of instruction versus independent could create conflict during the class. While students may perceive some type of interaction valuable, the flexibility of asynchronous learning has a greater value in their daily lives for managing work and home life needs. Cox and Cox (2008) contended that asynchronous, threaded discussions can be effective in creating a collaborative learning environment as well as interpersonal and group dynamics. Yuan and Kim (2014), however, suggested that asynchronous and synchronous technologies should both be used to create a shared space in which students and instructor interact. The question for faculty becomes how to balance the amount of face-to-face requirement (even if done virtually) with independent work.

Field experiences in online classes

Throughout the surveys, participants highlighted the impact of applied assignments or field experiences to support learning. Since the participants in this study were practicing teachers or eligible for certification, they all have had some experience in the classroom. Yet, applied assignments (videos of classrooms) or field experiences (practices within classrooms) were highly valued by the participants. In fact, field experiences were highlighted as the most effective tool for learning in online literacy courses. Simpson (2006) explained that in field experiences teacher candidates test theory and practice, which allows them to attain unique classroom management skills, differentiate instruction, and reflect on their teaching practices (Jackson & Jones, 2019; Kennedy & Archambault, 2012). Moreover, Graziano and Feher (2016) found that in virtual field experiences, cooperating teachers could give teacher candidates critical feedback and have more meaningful conversations, including giving them advice on technology, content and delivery of lessons, and timely feedback

Prior to COVID-19 teacher candidates took part in virtual field experiences because of convenience and flexibility where they had more time to accomplish things, fulfill family obligations, balance work and school schedules, and eased financial stress (Waters & Russell, 2016). Picciano and Seaman (2009) reported that over 1,030,000 students in elementary school, middle school, and high school are attending online schools; therefore, there is a demand for preparing teacher candidates to teach in online environments. Teachers' commitment to unpaid internships have added financial hardships on students (Waters & Russell, 2016). Having teacher candidates complete their field experiences online allows them to have an income while completing their field experience. Teacher candidates' success in being effective in online classes are connected to their pedagogical beliefs, technology platforms used, and their time management skills (Hemschik, 2009). Teacher candidates' internships could be creatively implemented all depending upon the logistics and design of their field experience. Effective instructors will understand their student experience and are able to positively shape their experiences in their online field placements.

Recommendations

These findings support the idea that course design has an impact on student's self-efficacy (confidence in technology), building a CoI, and faculty impact. While the finding of the importance of course design is not surprising nor a new idea, it does create implications for literacy educators as we forge into the new normal of online instruction.

Student Self-efficacy and the Community of Inquiry

First, student self-efficacy is built through a well-designed class that embeds chances to build self-efficacy through peer modeling and interaction (The Education Hub, 2015). When students do not feel supported, student's self-efficacy does not grow. Peer interactions play an important role in "academic identity and self-efficacy beliefs" (Taylor, 2017, p. V), but often require a greater effort to build in online instruction (Nagel et al., 2009). Course design must thoughtfully consider how to make asynchronous classes embedded with opportunities for social interaction. As students noted in this study, initial perceptions of online learning left students unsure of what to expect, but their confidence quickly grew to loving online work after taking courses. This confidence equates into feelings of self-efficacy, as students are successful engaging in online learning.

Also, not surprising, but still warranting attention, is the need for faculty to consider the design of the coursework to embed opportunities for social interactions to enhance learning through the CoI (Garrison, 2009). Learning does not happen in a vacuum, but if students do not have chances to interact, learning becomes an isolated activity (Cattone, 2001). This isolation can be especially problematic in online education, as students are isolated by physical distance and denied a readily accessible peer group (McInnerney & Roberts, 2004). This means the faculty building these courses have the responsibility to develop meaningful interactions.

A primary mode for interactions in online courses comes via the use of discussion boards. These discussion boards are used to mimic the student-to-student interactions found in face-to-face classes. However, students, while indicating a want of these types of collaborative interactions found in synchronous classes, at times, find discussion boards less useful. As faculty design courses there is a need for clear purpose provided for discussion boards. Often discussion boards have a minimum length of responses, with the length of response used as an indicator of students thoughtfully responding to a prompt. However, without a clear statement from the instructor about the importance of the discussion, this social interaction becomes busywork or a task to complete.

Another implication for faculty is to review discussion board questions for purpose and building of classroom community. If the intent is to foster relationships, faculty may want to consider other means to create these relationships than just using discussion boards. This is where the use of technology tools can be used to create an alternative to discussion boards.

Knowing your Learners

A somewhat surprising implication relates to a strong confidence in using technology in both personal and professional use and the implication for course design. While there will always be some students who are not as confident in using technology, this seemed to be the minority of respondents. One reason for this could be the age of the participants. With 64% of study participants aged 40 and younger, there may be a perception that technology is used consistently in day-to-day living and the use of technology in online learning would not cause undue stress. This means teacher educators can implement technology that may have been perceived as too technical or complicated to be used in an online format. If these results hold true, comfort in using technology is not a hindrance to course design. While one participant referred to the need for a simple design, simple does not have to equate with students functioning independently, without social interactions.

Teacher Educator Impact and the Use of Technology

This implication in course design begins with the instructor's pedagogical goal that includes technology that supports learning (Ertmer & Ottenbreit-Leftwich, 2013). Teachers are taught not to use technology just for the sake of using technology (Wilson, 2016). However, in online learning, technology is a critical aspect of instruction. Yet, knowledge of technology tools and knowing what works with content can take years to perfect. The transition from face-to-face to online, for many, was not gradual but instantaneous. This meant that the time for piloting tools disappeared, as teacher educators jumped into creating online courses. Effective course design is dependent on faculty who are well-trained in online teaching methods (Zweig & Stafford, 2016). Literacy faculty are well-versed in face-to-face courses as the trainers of teachers in best practice methods of instruction. However, instructional methods in a face-to-face format do not always translate into online instruction. Online instruction has been a reality for years, but "we have few assurances that [educators] are able to use technology for teaching and learning" (National Education Association, 2008, p. 1)

For teachers to be effective in online instruction it is necessary to provide adequate professional development to both novice and veteran faculty (Crawford-Ferre & Wiest, 2012). Faculty need training to create courses that include carefully designed instruction, purposeful implementation of content, and methods to evaluate instruction (beyond the end-of-course evaluations). Similarly, Crawford-Ferre and Wiest (2012) suggested that online faculty have professional development and sufficient professional training related to the online design and instructions.

This lack of time in developing online courses creates an implication regarding sharing of instructional content and methods. In a perfect world, faculty would have the time to: (a) research resources and materials that offer teaching tips for using technology tools in the classroom (virtual and face-to-face; (b) try the technology tools in a small group setting; and (c) transition to larger online classes. However, with the pandemic there has been a loss of time in discerning the best tools to use in specific teaching literacy content to graduate students. This lack of time to create strong content and use engaging technology creates an implication for the sharing of ideas between teacher educators. While the internet is littered with resources, the pandemic has amplified the need to share materials and technology resources that work. K–12 teachers have organized efforts and are joining together to share teaching resources (Will, 2020).

However, higher education literacy faculty do not seem to be as organized as K–12 teachers in efforts of sharing materials. It would be advantageous to all literacy faculty to have access to what works best in teaching the essential aspects of literacy. When faculty have access to materials that can be modified to meet the needs of their learners, it eases some of this individual intense time in researching tools and content. The focus can be spent on interacting with students, with not as much time spent on just figuring out how to implement the content. A shared database for field-based or applied assignments to improve online teaching.

A final implication surrounds the vocabulary of online education formats. There seems to be no one single or clear definition of the terms "hybrid," "synchronous," or "asynchronous" (College of Dupage, 2020). Faculty need to be specific in describing the meeting formats with students to avoid misunderstanding of class formats. For example, many learners would identify hybrid *instruction* to be a mix of online and face-to-face teaching formats. However, face-to-face no longer just means sitting in a classroom, but the meeting of a group of students with a faculty. The face-to-face in a classroom has been replaced with the face-to-face in an online setting. The same implication surrounds the words "synchronous" and "asynchronous." Participants in this survey indicated a preference for asynchronous learning. But "asynchronous" could mean independent work or not meeting as a class at the same time. Teacher educators need to make clear expectations for how and when the class will meet, beyond just using the common vocabulary of online instruction.

Conclusion

COVID-19 amplified the need to consider aspects of online teaching and the impact on literacy graduate students' learning. This study was created to discern not faculty wants or needs, but to gather the perceptions and voice from students about their online learning experience. As highlighted in the result, students do embrace online formats while still seeking the feel of instruction typical in face-to-face environments. It is time then for teacher educators to also embrace online instruction while acknowledging the landscape of higher education instruction may be permanently altered and may never return to pre-COVID-19 type of teaching methods. Teacher educators should use this time as an opportunity to reflect and change instructional methods so students can continue to have opportunities for new learning. Old tried-and-true methods that were used in face-to-face classes do not have to be completely dismissed but may need a major overhaul in delivery. One of the tenets of teacher education is the ability to model methods of best practice to our learners. The modeling may look different than in the past, but it now includes best practices in online instruction. What our graduate students learn while engaged in their own online learning experiences is an opportunity to transfer these best practices to their own instruction of K–12 students.

Declarations

The author(s) declared no conflicts of interest with this study.

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All authors adhered to approval from the ethics board at their respective institutions located in the USA for this study.

References

Akyol, Z., Arbaugh, J. B., Cleveland-Innes, M., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. (2009). A response to the review of the community of inquiry framework. *International Journal of E-Learning & Distance Education/Revue Internationale du e-learning et la Formation à Distance*, *23*(2), 123–136.

Anderson, T., Rourke, L., Garrison, D. R., Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(20), 1–17.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning *Educational Psychologist*, *28*(2), 117–148.

Beck, V. S. (2010). Comparing online and face-to-face teaching and learning. *Journal on Excellence in College Teaching, 21*(3), 95–108.

Boettcher, J. V., & Conrad, R. M. (2016). *The online teaching survival guide: Simple and practical pedagogical tips*. John Wiley & Sons.

Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data: Complementary research strategies.* Sage Publications.

College of DuPage & Creative Commons. (n.d.). *An introduction to hybrid teaching: Learning technologies*. https://www.codlearningtech.org/PDF/hybridteachingworkbook.pdf

Cottone, R. R. (2001). A social constructivism model of ethical decision making in counseling. *Journal of Counseling & Development*, *79*(1), 39–45.

Cox, B., & Cox, B. (2008). Developing interpersonal and group dynamics through asynchronous threaded discussions: The use of discussion board in collaborative learning. *Education*, *128*(4), 553–565.

Crawford-Ferre, H. G., & Wiest, L. R. (2012). Effective online instruction in higher education. *The Quarterly Review of Distance Education*, *13*(1), 11–14.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approach.* Sage Publications.

The Education Hub. (n.d.). *6 strategies for promoting student self-efficacy in your teaching.* https://www.theeducationhub.org.nz/wp-content/uploads/2018/03/6-strategies-for-promoting-student-self-efficacy.pdf

Ertmer, P. A., & Ottenbreit-Leftwich, A. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers & Education*, *64*, 175–182.

Fedynich, L., Bradley, K .S., & Bradley, J. (2015). Graduate students' perceptions of online learning. *Research in Higher Education Journal*, *27*, 1–13.

Garrison, D. R. (2017). *E-Learning in the 21st century: A community of inquiry framework for research and practice* (3rd ed.). Routledge/Taylor and Francis.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2–3), 87–105.

Graziano, K. J., & Feher, L. (2016). A dual placement approach to online student teaching. *Contemporary Issues in Technology and Teacher Education*, *16*(4), 495–513.

Gurung, B., & Rutledge, D. (2014). Digital learners and the overlapping of their personal and educational digital engagement. *Computers & Education*, *77*, 91–100.

Harris, H. S., & Martin, E. W. (2012). Student motivations for choosing online classes. *International Journal for the Scholarship of Teaching and Learning*, *6*(2), 1–8.

Hemschik, T. (2009). Course designs, instructional strategies, and support systems in K–8 online education: A case study. [Doctoral dissertation, University of Phoenix]. ProQuest Dissertations Publishing.

Jackson, B. L., & Jones, W. M. (2019). Where the rubber meets the road: Exploring the perceptions of in-service teachers in a virtual field experience. *Journal of Research on Technology in Education*, *51*(1), 7–26.

Kennedy, K., & Archambault, L. (2012). Offering preservice teachers field experiences in K–12 online learning: A national survey of teacher education programs. *Journal of Teacher Education*, *63*(3), 185–200.

Kentnor, H. E. (2015). Distance education and the evolution of online learning in the United States. *Curriculum and Teaching Dialogue*, *17*(1), 21–34.

Martin, A. (2006). A European framework for digital literacy. *Nordic Journal of Digital Literacy, 1*(2), 151–161.

McInnerney, J. M., & Roberts, T. S. (2004). Online learning: Social interaction and the creation of a sense of community. *Journal of Educational Technology & Society*, *7*(3), 73–81.

Miller, A., Topper, A. M., & Richardson, S. (2017). *Suggestions for improving IPEDS distance education data collection*. https://nces.ed.gov/ipeds/pdf/NPEC/data/NPEC_Paper_IPEDS_Distance_Education_2017.pdf

Nagel, L., Blignaut, A. S., & Cronjé, J. C. (2009). Read-only participants: A case for student communication in online classes. *Interactive Learning Environments*, *17*(1), 37–51.

National Education Association. (2008). *Technology in schools: The ongoing challenge of access, adequacy, and equity*. NEA Policy and Practice Department.

Peechapol, C., Na-Songkhla, J., Sujiva, S., & Luangsodsai, A. (2018). An exploration of factors influencing self-efficacy in online learning: A systematic review. *International Journal of Emerging Technologies in Learning (iJET)*, *13*(9), 64–86.

Peltier, M., Scales, R., Bemiss, E., Shimek, C., Van Wig, A, Hopkins, J., …Scales, W. D. (2018). A national survey of literacy teacher educators' perceptions of alignment across coursework and fieldwork. *Literacy Practice and Research, 44*(2) 27–39.

Picciano, A., & Seaman, J. (2009). *K–12 online learning: A 2008 follow-up of the survey of U. school district administrators*. Sloan Consortium.

Prior, D. D., Mazanov, J., Meacheam, D., Heaslip, G., & Hanson, J. (2016). Attitude, digital literacy and self-efficacy: Flow-on effects for online learning behavior. *Internet and Higher Education*, *29*, 91–97.

Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of a communities of inquiry in online and blended learning environments. *Computers & Education, 55*(1), 1721–1731.

Shea, P., & Bidjerano, T. (2012). Learning presence as a moderator in the Community Of Inquiry model. *Computers and Education, 59*(2), 316–326.

Shea, P., Hayes, S., Uzuner-Smith, S., Vickers, J., Bidjerano, T., Gozza-Cohen, M., Jian, S., Pickett, A., Wilde, J., Tseng, C. (2013). Online learner self-regulation: Learning presence, viewed through quantitative content-and social network analysis. *International Review of Research in Open and Distance Learning, 14*(3), 427–461.

Shea, P., Hayes, S., Uzner, S., Vickers, J., Wilde, J., Gozza-Cohen, M., & Jian, S. (2012). Learning presence: A new conceptual element within the Community of Inquiry (CoI) framework. *Internet and Higher Education, 15*(2)*, 89–95.*

Sher, A. (2009). Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in web-based online learning environment. *Journal of Interactive Online Learning*, *8*(2), 102–120.

Simpson, M. (2006). Field experience in distance delivered initial teacher education programmes. *Journal of Technology and Teacher Education*, *14*(2), 241–254.

Supiano, B. (2020, April 30). *Why you shouldn’t try to replicate your classroom teaching online*. https://www.chronicle.com/newsletter/teaching/2020-04-30

Swaggerty, E. A., & Broemmel, A. D. (2017). Authenticity, relevance, and connectedness: Graduate students’ learning preferences and experiences in an online reading education course. *The Internet and Higher Education*, *32*, 80–86.

Tucker, P. D., & Stronge, J. H. (2005). *Linking teacher evaluation and student learning*. ASCD.

Waters, S., & Russell, W. (2016). Virtually ready? Pre-service teachers’ perceptions of a virtual internship experience. *Research in Social Sciences and Technology*, *1*(1), 1–23.

Will, M. (2020, March 16). Teachers share resources for teaching online during coronavirus school closures. *Teaching Now, Education Week.* https://blogs.edweek.org/teachers/teaching_now/2020/03/teachers_sharing_resources_online_coronavirus.html

Wilson, L. (2016). *Technology for technology’s sake is meaningless*. K–12 Blueprint. https://www.k12blueprint.com/blog/leslie-wilson/technology-technologys-sake-meaningless

Young, A., & Norgard, C. (2006). Assessing the quality of online courses from the students’ perspective. *The Internet and Higher Education*, *9*(2), 107–115.

Yuan, J., & Kim, C. (2014). Guidelines for facilitating the development of learning communities in online courses. *Journal of Computer Assisted Learning*, *30*(3), 220–232.

Zimmerman, B. J. (2010). Self-regulated learning and academic achievement: An overview. *Educational Psychologist*, *25*(1), 3–17.

Zweig, J., & Stafford, E. (2016). Training for online teachers to support student success: Themes from a survey administered to teachers in four online learning programs. *Journal of Online Learning Research*, *2*(4), 399–418.

Development and validation of the Online Instructor Support Survey (OISS)

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Abstract
Online instructors play a critical role in online student success and need various forms of institutional support to succeed in online teaching. This article describes the creation, validation, and results of the Online Instructor Support Survey (OISS) based on seven areas identified in the literature: (a) technology infrastructure; (b) technical support; (c) online course development and teaching; (d) instructor rewards and incentives; (e) administrative and academic support; (f) institutional policies and culture; and (g) program and legal support. Online instructor (N = 275) responses highlighted areas of support that are largely prevalent and areas where further support and awareness of such support is needed at higher education institutions. A 7-factor model explained 67% of the variance in these data. A discussion and limitations are provided.

Keywords: faculty support, online education, institutional support, online teaching, online instructor survey, online instructor support

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Online education has experienced tremendous growth in the last two decades, with over one-fifth of higher education institutions (HEI) in the 2019 CHLOE report (Garrett et al., 2019) reporting that more than 50% of their courses were offered online. The median growth rate of enrollment in fully online courses at participating institutions in the United States between spring 2017 and 2018 was 10% (Garrett et al., 2019). HEI around the world are expanding their online course offerings, and several temporarily transitioned to emergency remote teaching (Hodges et al., 2020) due to the COVID-19 pandemic. Sixty-nine percent of reporting institutions in the 2020 CHLOE report provided additional resources (e.g., technologies, faculty development) for the pivot to remote teaching during the pandemic (Garrett, Legon, Fredericksen et al., 2020), and 18% were planning to convert remote courses to fully online courses. The adoption of online education requires changes to processes and the provision of various types of support for the large numbers of faculty expected to teach online or transition to online teaching. Online instructors play a critical role in online course success, student engagement, and student learning (Kibaru, 2018), and need institutional support structures to ensure they can teach successfully in online environments that facilitate student learning.

The purpose of this research was to create a survey to explore online instructors' perceptions of support available to them at their institutions. Faculty support has been identified as a critical factor for successful online learning and as a key element of online learning quality (Daniel & Uvalic-Trumbic, 2013; Martin et al., 2017). The Online Learning Consortium identifies Faculty satisfaction as a pillar of online learning quality (http://olc.org). Much research also exists on the barriers faced by faculty who teach online, based on which researchers have identified several areas for faculty support and professional development (Berge et al., 2002; Kebritchi et al., 2017; Lloyd et al., 2012). Given the importance of faculty support for online teaching, it would be helpful to institutions, departments, and administrators to be able to use a survey to identify the various forms of support available to online instructors at their institutions, and those that might be needed for online education to succeed. As increasing numbers of HEIs around the world adopt online education or expand their online offerings, such an instrument can be useful to administrators, support centers, those that engage in faculty development, and faculty themselves to assess the types of support already in existence, and how online instructors can be supported better.

Review of Literature

The first phase of survey development involved a review of literature on faculty support for online teaching, as well as a review of quality frameworks and standards in online post-secondary education to identify institutional support that is recommended for quality online teaching in higher education (Pedro & Kumar, 2020). The literature reviewed was independently analyzed and discussed by two researchers to identify different forms of support for online instructors. This resulted in seven identified areas of support for online instructors in higher education: technology infrastructure; technical support; online course development and teaching; online instructor incentives and rewards; administrative and academic support; institutional culture and policies; and program and legal support.

Technology Infrastructure

Technology infrastructure has been documented as foundational for successful distance teaching and learning for over two decades (Berge et al., 2002). For online education to take place and succeed at higher education institutions, infrastructure has to be in place in the form of hardware and servers, cloud storage, bandwidth, and software for several purposes. Institutional support includes the provision of technology infrastructure such as "learning management systems and their associated systems; library systems; cloud-based tools and services; mobile technologies, hardware (computers, telecommunications, and ancillary equipment) and networks, both internal and external" (Sankey et al., 2014, p. 20) that facilitate online education. Additionally, such systems must be aligned and function across an institution and its various campuses or units and embedded in a larger support framework. Moore and Fodrey (2018) assert that four critical components—systems, objectives, evaluation, and personnel—are needed for technology infrastructure in online education.

Furthermore, online instructors do not always have access to the hardware (e.g., cameras) and software (e.g., to create Screencasts) that they might need in order to create online materials and teach online (Martin et al., 2019). These resources must be provided, maintained, and managed by the institution. To facilitate faculty mobility and online teaching from on-campus and beyond, infrastructure in the form of mobile devices for faculty (e.g., laptops) as well as secure connections (e.g., VPN connections) must be provided (Kear et al., 2016). Technologies for synchronous communication and group collaboration, as well as discipline-specific technologies or software needed for specific types of research should also be provided and accessible to online learners/instructors in online programs (Kumar & Dawson, 2018).

Technical Support

Faculty often do not possess the technical knowledge or skills to use the technologies needed for online education (Weaver et al., 2008). Both online instructors and students need to be aware of the technology available at their institution and should receive technical support to successfully access and use such technologies. Technical support for students ensures that online instructors do not have to become technical experts and can focus on teaching (Espiritu & Budhrani, 2019; Pedro & Kumar, 2020). Technical support for hardware (e.g., mobile devices), software, and all technologies needed for online learning (e.g., the Learning Management System) should be available 24/7 to assist faculty and students who always teach and learn online at their own pace (Olcott, 2014; Online Learning Consortium, 2016; Sankey et al., 2014). Furthermore, such support should be provided in different formats, such as online, by telephone, and in the form of online materials or tutorials (Kear et al., 2016).

Technical support staff should not only constantly update the technologies and assist faculty, but also have access to professional development and opportunities to update their skills (Hartman et al., 2014). The integrity, privacy, and security of data and information that is exchanged and amassed during online education should also be maintained (Martin et al., 2017; Online Learning Consortium, 2016). More recently, faculty also need support to access and view the different types of data available to them within the systems and technologies being used, in order to effectively apply that data to improve online courses and to be able to reflect and improve their online teaching (Kumar et al., 2019; Pedro & Kumar, 2020).

Online Course Development and Teaching

HEI have reported faculty development and training to be a top priority, followed by the provision of instructional design support for online instructors (Garrett et al., 2019). The transition to online education necessitates a shift from teacher-centered to learner-centered paradigms that is difficult for instructors and that should be scaffolded and supported in various ways (Baran & Correia, 2014; Kibaru, 2018). Online instructors need instructional design support for online course development and continuous improvement that HEIs provide in various ways at the institutional, college, or departmental level (Kumar & Ritzhaupt, 2017). Such support includes guidance during instructional design and online course development processes, such as the conceptualization and creation of new online courses, course materials, online activities, and assessments; revisions to existing online courses; and the creation and provision of resources, job aids, and checklists that can help online instructors (Kumar & Ritzhaupt, 2017; Lion & Stark, 2010; Pedro & Kumar, 2020). Additionally, instructional design support encompasses the development of course materials and media for online courses (e.g., graphic design, video production, screencast production), and guidance on the appropriate use of existing resources (e.g., Fair Use, Creative Commons) as needed by online instructors (Baran & Correia, 2014; Barker, 2002; Fetzner, 2003; Online Learning Consortium, 2017; Wang et al., 2009).

In addition to support for online course development and improvement, professional development and guidance in online teaching are needed by all instructors, and especially by those with little experience (Hunt et al., 2014). Centers of Teaching and Learning or Teaching and Learning Development Units at HEIs often provide such support (Herman, 2012). Professional development for online instructors addresses technologies used for teaching online; the facilitation of online activities and discussions; online course design, communication, and assessment; appropriate use of online resources; and policies and processes related to online teaching (Almpanis, 2013; Bailey & Card, 2009; CHE, 2014; Fetzner, 2003; Kibaru, 2018; Phipps & Merisotis, 2000; Vaill & Testori, 2012). Institutions provide faculty orientations to online teaching and mentoring opportunities for online instructors, and sometimes require mandatory training before online teaching (Lion & Stark, 2010; Vaill & Testori, 2012). In addition to on-campus and online workshops and hands-on training, self-paced training, communities of practice, peer mentoring, and other forms of peer support can also be helpful to online instructors (Baran & Correia, 2014; Rhode & Krishnamurthi, 2016; Wang et al., 2009). Furthermore, such professional development opportunities should be available in a flexible manner so that solely online or adjunct online faculty can also take advantage of them (CHE, 2014; Sankey et al., 2014; Sprute et al., 2019).

Online Instructor Incentives and Rewards

Online instructors who develop online courses and learn how to design, teach, and assess online courses invest a significant amount of time in doing so. In fact, the time investment in both online course development as well as online teaching has been recognized as more than the time spent on an on-campus course (Mandernach et al., 2013; Seaman, 2009). The lack of institutional recognition of this effort and the increased workload involved in this process were identified by Bolliger and Wasilik (2009) as significant barriers in online education. Along with providing professional development and support for course development or teaching, institutions must create supportive environments that enable faculty to participate in such learning opportunities, and reward faculty who engage in online education (Orr et al., 2009; Phipps & Merisotis, 2000).

Such incentives and rewards can take several forms. Institutions can recognize online teaching in several ways with awards, spotlights and recognition for online instructors, and financial support for professional development (Lion & Stark, 2010). This can also encompass compensation, stipends, time incentives, or course releases for online course development as well as online course improvement; technology rewards; rewards for online teaching excellence; funds for conference attendance; and the integration of online education activities in both evaluation and tenure and promotion processes (Herman, 2013; Kear et al., 2016; Kibaru, 2018; Marek, 2009; Mohr & Shelton, 2017; Wang et al., 2009). Finally, encouragement and recognition of the scholarship of online teaching in the form of support for instructors to research and improve their online teaching should also be provided (Pedro & Kumar, 2020; Olcott, 2014).

Administrative and Academic Support

The availability of online student support for administrative and academic processes such as student admissions, registration, financial aid, program planning, or graduation can help online instructors focus on online teaching and advising (Barker, 2002; Online Learning Consortium, 2017; Wang et al., 2009). Qualified staff who are dedicated to online student support in such areas can be very helpful to online instructors (Olcott, 2014). Online instructors might not have knowledge of administrative and academic processes for online students, and it can be challenging for them to support students in these areas in addition to teaching online (Pedro & Kumar, 2020; Wang et al., 2009).

Online student support in accessing and using library resources to complete their academic requirements; academic writing support for all levels of online students; advising and counseling services that are available and accessible to online students; and support for online study skills contribute to students' academic success and support online instructors (Kear et al., 2016; Kumar & Dawson, 2018; Marek, 2009; Online Learning Consortium, 2016; Oomen-Early & Murphy, 2009). At the same time, online instructors need to be provided information about such resources, so that they might communicate these to students. In a study conducted during the transition to online teaching during the COVID-19 pandemic, Johnson et al. (2020) found that the majority of faculty and administrators named increased support for students as the main area in which they needed help. Online orientations for students, resources and guidance in navigating the online environment, and in self-regulation and time management should be provided by the institution to lessen the need for online instructors to address these areas in their online courses in addition to their discipline-specific content (Johnson et al., 2020; Pedro & Kumar, 2020).

Institutional Policies for Online Education

An institutional culture that promotes and supports online education, as well as nurtures faculty engagement in online education is important for online instructor satisfaction and success at an HEI (Baran & Correia, 2014; Hicks, 2014; Kibaru, 2018; Orr et al., 2009). Such a culture would entail the involvement of stakeholders at all levels in online education, collaborations between stakeholders supporting online education across the institution, and the adoption or revision of policies that support online teaching (Espiritu & Budhrani, 2019; Marek, 2009; Weaver et al., 2008). Online teaching can involve large class sizes, an increased workload, and changes in teaching strategies or approaches that necessitate revised policies that support online instructors and ensure online instructor satisfaction (Pedro & Kumar, 2020; Wingo et al., 2017). Such policies should encompass not only full-time online instructors, but also adjunct online instructors who often work under difficult conditions in higher education (Sprute et al., 2019). Institutions should also institute clear policies to address the ownership and intellectual property of online course content or online courses, especially when online instructors work with online program management companies on the development of online courses (Herman, 2013; Online Learning Consortium, 2016; Garrett et al., 2020).

Additionally, an institutional strategy, a strategic plan, and goals for the implementation of online education; leadership that supports the strategy, investment in the learning development of online instructors; transparency and communication of strategic plans and policies to online instructors; and coordination between different support services and structures for faculty are needed (Hartman et al., 2014; Lion & Stark, 2010; Orr et al., 2009; Seaman, 2009). To ensure the quality of online education, HEIs should implement quality assurance processes such as online course quality guidelines and standards that online instructors can adopt when designing and continuously improving online offerings (Online Learning Consortium, 2016; Wang et al., 2009). Finally, the collection of data related to the effectiveness and evaluation of online education at an HEI can be helpful and should be made available to online instructors as they try to improve their online teaching or online courses (Olcott, 2014; Online Learning Consortium, 2016; Pedro & Kumar, 2020).

Program and Legal Support

Along with institution-wide policies and administrative and academic support for online students, support with the management of online programs is also an emerging area of support for online faculty. As the number of online programs increases, such programs are often led by full-time faculty who need support to deal with the processes essential for online program success and who might not have prior experience with running on-campus or online programs, managing and mentoring online courses or online instructors, hiring consultants or online adjunct instructors, or engaging in a review of overall program quality (Barker, 2002; Olcott, 2014; Pedro & Kumar, 2020; Sankey et al., 2014). The support and integration of teaching assistants and/or online tutors at the program level or in online courses is also an area where online faculty need assistance (Kear et al., 2016; Martin et al., 2019; Online Learning Consortium, 2016).

In addition to professional development in copyright or fair use of materials and open educational resources, and institutional policies related to the intellectual property of online course materials and courses, online instructors also need guidance and legal support in these areas (Online Learning Consortium, 2016; Pedro & Kumar, 2020; Phipps & Merisotis, 2000). Resources and staff to assist with issues concerning privacy and student data have to be provided by institutions (Martin et al., 2017). Intellectual property rights when designing and revising online courses serve as motivation for online instructors (Herman, 2013), but are also areas for concern and online instructor support given the various online education models and policies at HEIs, for example when partnerships with Online Program Management (OPM) companies exist (Garrett et al., 2020).

Conceptual Framework

The conceptual framework shown in Figure 1 formed the basis for survey development and is based on the seven areas identified in the literature: technology infrastructure; technical support; online course development and teaching; instructor rewards and incentives; administrative and academic support; institutional policies and culture; and program and legal support.

Figure 1
Conceptual framework for the development of the Online Instructor Support Survey

Research Questions

The purpose of this study was to develop, implement, and provide validity and reliability evidence of a survey to investigate the types of support available to online instructors at their institutions. The following research questions drove the study:

1. What are online instructors' perceptions of support available to them at their institutions?
2. What evidence of reliability and validity are available within this sample for the Online Instructor Support Survey?

Methodology

Survey Development

Based on the conceptual framework, a list of forms of support was created and organized according to the seven areas in the framework. It was analyzed independently by two researchers for similarities and redundancies across the seven areas. Following discussion, survey items were created in each of the seven areas from the list of types of support. Upon further discussion, the researchers decided to combine technology infrastructure and technical support into one section of the survey and integrate items pertaining to program and legal support into the administrative and academic support area. This resulted in a survey with five sections: (a) Technology and technical support; (b) Online Course Development and Teaching support; (c) Online Education Administrative and Academic Support; (d) Institutional Policies for Online Education; and (e) Online Instructor Recognition, Rewards, and Incentives. Each of the five sections began with the statement, "Please identify to what extent your institution provides:" followed by the list of items in the section. A 5-point Likert Scale ranging from "not at all" to "to a very great extent" (1 = Not at all, 2 = to a small extent, 3 = to some extent, 4 = to a great extent, 5 = to a very great extent) was used.

Demographic items such as online instructors' experience with online teaching, gender, discipline, years of teaching at that institution, etc. were included. The survey then underwent an expert review by a panel of five reviewers. Two reviewers were experts in quantitative methods and survey development who have taught online, and three reviewers were online education researchers who have experience with online teaching. Both methodology experts recommended the addition of a "don't know" option to the Likert-scale. Additionally, the experts recommended supplementing unclear items with examples, rephrasing some items, separating out a double-barreled item, moving two items to different sections, and adding a demographic question about instructor rank.

Data Collection

Following Institutional Review Board (IRB) approval, the Online Instructor Support Survey (OISS) was disseminated through professional organization listservs (Association for Educational Communications and Technology and Educause), resulting in 117 responses. Additionally, four leaders of Online Learning at two public universities in the U.S. sent out the survey and a follow-up reminder to about 1,500 online instructors, resulting in 238 responses. Although scheduled to be disseminated in March 2020, the survey was implemented during June and July 2020, during the COVID-19 crisis, which might have impacted the total number of survey responses.

Participants

A total of 355 participants opened the online survey and completed at least the informed consent page. As several of the participants did not complete the full survey, a decision was made to retain only participants that had responded to the full survey, which decreased the number of participants to $N = 275$ complete responses to the full survey. Since the intended purpose of this research was to validate the survey measure employed, incomplete responses would not provide sufficient information to the statistical models employed in this research.

Of the 275 participants, 60% (n = 166) were female, 36% (n = 98) male, 3.6% (n = 10) did not wish to respond, and 0.4% (n = 1) chose "other." Eighty-eight percent (n = 242) worked at public institutions, 10% (n = 28) at private institutions, and 2% (n = 4) at for profit institutions. Ninety-five percent (n = 261) of these were at four-year institutions and 5% (n = 13) at two-year institutions. Sixty-nine percent (n = 189) of respondents were full-time instructors, 27% (n = 74) were adjunct or part-time instructors, and 4% (n = 12) were teaching assistants. Fifty percent of the participants had at least six years of online teaching experience (Table 2).

Table 1

Faculty Experience at Current Institution

Years at current institution	**Frequency**	**Percent**
	2	0.7
0–1 Year	17	6.2
2–3 Years	59	21.5
4–5 Years	35	12.7
6–10 Years	58	21.1
More than 10 years	104	37.8
Total	275	100.0

Table 2
Faculty Online Teaching Experience

Online Teaching Experience	Frequency	Percent
	1	0.4
0–1 Years	30	10.9
2–3 Years	56	20.4
4–5 Years	52	18.9
6–10 Years	67	24.4
More than 10 years	69	25.1
Total	275	100.0

Data Analysis

Data were subjected to a variety of analyses, including descriptive statistics analysis, internal consistency reliability analysis, exploratory factor analysis (EFA), and correlation analysis (i.e., Pearson r correlations among factors). EFA was conducted to explore the underlying structure of the data collected using the OISS and to provide meaningful labels to the factors. Descriptive statistics analysis was conducted examine the patterns in this cross-sectional dataset, and to characterize the various factors on the OISS. Internal consistency reliability using Cronbach's alpha was used to provide reliability evidence for these data. Correlation analyses were employed to examine the internal structure of the measures. Underlying assumptions of the various statistical methods were evaluated. All quantitative analyses were conducted using SPSS version 25. An alpha level of .05 was used for all statistical tests.

Results

We first examined the data for the assumptions for conducting EFA. Bartlett's test of sphericity for these data had a Chi-square of 3,357.2 ($p < .001$), which suggested the intercorrelation matrix contained adequate common variance. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.95, which is above the 0.50 recommended limit (Kaiser, 1974). The participant-to-item ratio for the data was approximately ~6:1. While the participant-to-item ratio is below the 10:1 ratio suggested by Kerlinger (1974), the ratio is near thresholds described as more than adequate by some researchers in maintaining factor stability (Arrindell & Van der Ende, 1985; de Winter, Dodou, & Wieringa, 2009; Guadagnoli & Velicer, 1988). Thus, these data appeared to be well suited for EFA.

Exploratory Factor Analysis

The EFA model was executed using principal axis factoring and an oblique (promax) rotation, as the factors were anticipated to be related. The number of factors retained was based on the Kaiser criterion (Eigenvalue > 1) and inspection of the screen plots generated. Items were assigned to factors based on the greatest values in the pattern matrix. The EFA data from the initial model showed seven factors and data were extracted in eight iterations. The data did not exhibit a purely simple structure in the pattern matrix as there were some cross-loadings; however, all coefficients used to assign items to factors in the pattern matrix were at or above 0.275 with an average loading of 0.612. The factor model explained ~67% of the variance in these data with the seven-factor solution. The items did load into a meaningful factor structure to explain these data. Thus, the seven-factor solution was adopted for these data. Table 3 provides the results from the EFA by factor label along with the number of items, eigenvalue and cumulative percent of variance explained, reliability coefficients, and mean and standard deviations by factor.

Table 3
Factors Extracted from the OISS and Relevant Statistics

Factor Names	**Item # of Items**	**Eigenvalue**	**Cumulative %**	**Cronbach Alpha**	**M**	**SD**
1. Online course development, teaching support, and professional development	14	18.29	43.55	0.96	3.59	1.03
2. Institutional policies and procedures for online education	9	2.68	49.94	0.92	3.13	1.09
3. Incentives and recognition for online course development and teaching	5	2.00	54.70	0.92	2.44	1.17
4. Support for teaching assistants, program leaders, and legal issues	5	1.77	58.92	0.90	2.91	1.15
5. Technical support services for online education	2	1.33	62.08	0.95	3.92	1.16
6. Technology infrastructure for online education	2	1.14	64.79	0.72	4.46	0.73
7. Academic and administrative support services for online education	5	1.12	67.46	0.87	3.65	1.00

Correlational Analysis

Table 4 provides the correlation matrix for the seven factors extracted from the EFA of the OISS. As can be gleaned, all of the correlations were positive and significant at a .01 level, which suggests the factors of the OISS appear to measure a unifying set of constructs.

Table 4
Correlation Matrix of the Seven Factors From the OISS.

Factors	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Online course development, teaching support, and professional development	1						
2. Institutional policies and procedures for online education	.806**	1					
3. Incentives and recognition for online course development and teaching	.648**	.735**	1				
4. Support for teaching assistants, program leaders, and legal issues	.832**	.799**	.647**	1			
5. Technical support services for online education	.493**	.457**	.235**	.378**	1		
6. Technology infrastructure for online education	.500**	.450**	.309**	.276**	.391**	1	
7. Academic and administrative support services for online education	.810**	.798**	.629**	.804**	.569**	.481**	1

** Significant at a .01 level.

Descriptive Statistics

The descriptive statistics for the seven factors are presented in this section. Participants rated the provision of the different types of support at their institutions between “not at all” (1) and “to a very great extent” (5), but also had the option “Do not know” (0).

Online course development, Teaching support, and Professional development

The highest-rated items in this factor, with a mean rating over 4.0, were Item #7 “Online access to self-help technical support materials” (M = 4.20), Item #8 “Regular technical training activities targeted at instructors’ technical needs’ (M = 4.13), and Item #9 “Instructional Design support for course development” (M = 4.07). All other items had a mean rating between 3.08 to 3.99, except for Item #21 “Assistance with the use and analysis of data for learning design or course planning” (M = 2.89). Twenty-one percent of participants chose the “do not know” option for this item, indicating that such assistance might have existed at their institutions, but they might have been unaware of it.

Table 5

Online Course Development, Teaching Support, and Professional Development.

Item	**M**	**SD**	**1**	**2**	**3**	**4**	**5**	**0**
(7) Online access to self-help technical support materials (e.g., tutorials, etc.)	4.20	0.97	1.45	4.00	17.09	26.18	49.09	2.18
(8) Regular technical training activities targeted at instructors' technical needs (e.g., workshops)	4.13	1.06	2.91	5.82	14.18	27.64	47.64	1.82
(9) Instructional Design support for course development	4.06	1.06	1.45	8.00	18.55	24.36	44.36	3.27
(10) Support for multimedia (e.g., videos, screencasts) and course material development	3.84	1.05	1.09	9.45	27.64	24.36	34.18	3.27
(11) Instructional Design for continuous improvement of courses	3.69	1.26	4.73	14.91	21.45	18.55	36.00	4.36
(12) An orientation to online teaching	3.77	1.25	5.82	11.64	17.09	24.00	36.00	5.45
(13) Support for online teaching/course delivery during a course offering	3.99	1.09	3.27	6.18	20.00	27.27	40.73	2.55
(14) Access to regular professional development/training/workshops on topics related to online teaching.	3.97	1.12	3.27	8.73	17.09	28.00	41.45	1.45
(15) Other professional development opportunities related to online teaching (e.g., faculty Mentoring projects, Seminars, Online communities of practice, Podcasts, etc.)	3.53	1.25	5.82	15.64	22.91	20.73	28.00	6.91
(16) Online access to self-help pedagogical materials for online teaching (e.g., templates, best-practices showcases, etc.)	3.70	1.16	4.00	12.73	21.09	28.73	29.45	4.00
(17) Mentoring for online instructors	3.08	1.38	14.91	17.45	17.82	19.27	17.45	13.09
(18) Professional development for adjunct online instructors	3.22	1.39	9.45	14.18	10.55	16.36	15.64	33.82
(21) Assistance with the use and analysis of data for learning design or course planning (e.g., Learning analytics)	2.89	1.44	17.45	19.27	12.36	15.27	14.91	20.73
34) Has certification processes in online education for online instructors	3.34	1.52	15.64	10.55	11.27	16.73	26.18	19.64

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don’t know.

Institutional policies and procedures for Online Education

`The highest mean ratings for items within this factor were for Item #37 “Collects data about student satisfaction with online courses” (M = 3.89), Item #35 “Has quality assurance procedures and standards specific to online education” (M = 3.80), and Item #29 “Has an institutional strategy for online education” (3.64). This indicates that processes for continuous improvement of online courses and online teaching are implemented at the participants’ institutions, and that online education is part of the institutional goals. The lowest mean rating was for Item #33 “Has clear procedures for online course development and implementation” (M = 2.48), but 34.5% of participants also chose the “do not know” option for this item.

Table 6

Institutional Policies and Procedures for Online Education

Item	**M**	**SD**	**1**	**2**	**3**	**4**	**5**	**0**
(3) Discipline-specific online technologies for online Teaching and Learning	3.29	1.32	10.50	13.10	25.80	15.30	22.20	13.10
(29) Has an institutional strategy for online education	3.64	1.22	6.18	9.45	22.18	22.91	28.00	11.27
(30) Clearly defines the roles and responsibilities of online instructors (ex. time for response to online students)	3.22	1.38	12.73	17.82	21.45	17.45	23.27	7.27
(31) Identifies an online instructor-student ratio that recognizes online education as time-intensive and avoids excessive workload for faculty.	2.72	1.42	24.36	16.00	19.27	13.82	13.45	13.09
(32) Has clear procedures for recruiting, hiring, and maintaining online instructors	2.48	1.39	21.82	15.64	10.91	9.09	8.00	34.55
(33) Has clear procedures for online course development and implementation	3.27	1.38	12.73	16.36	17.82	20.73	22.91	9.45
(35) Has quality assurance processes and standards specific to online education (e.g., Quality Matters)	3.80	1.36	8.73	8.36	12.00	18.91	37.82	14.18
(36) Collects data about faculty satisfaction with online courses	2.80	1.50	23.64	13.82	13.09	14.91	14.91	19.64
(37) Collects data about student satisfaction with online courses	3.89	1.22	4.00	10.18	14.55	20.73	37.09	13.45

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don’t know.

Incentives and Recognition for online course development and teaching

1All items in this section had a mean rating between 2 and 3. Item #38 “Incentives for online course development” (M = 2.84) was rated the highest and the lowest mean rating was Item #40 “Incentives for attending training and other professional development initiatives related to online education” (M = 2.33). Twenty-three percent of participants and 18% of participants responded they "do not know" if "Support for scholarship of teaching and learning related to online education" and "Recognition for instructor engagement and/or excellence in online education," respectively, was provided at their institutions.

Table 7
Incentives and Recognition for Online Course Development and Teaching

Item	M	SD	1	2	3	4	5	0
(38) Incentives (e.g., time, compensation) for online course development	2.84	1.36	20.00	18.18	25.09	13.45	14.91	8.36
(39) Incentives (e.g., time, compensation) for online course improvement	2.39	1.45	36.00	14.55	17.45	7.27	12.73	12.00
(40) Incentives (e.g., time, financial support) for attending training and other professional development initiatives related to online education.	2.33	1.34	31.27	22.18	14.91	8.36	9.45	13.82
(41) Recognition for instructor engagement and/or excellence in online education (e.g., awards, value in promotion or tenure processes)	2.56	1.35	23.27	21.82	14.55	13.09	9.45	17.82
(42) Support for scholarship of teaching and learning related to online education	2.55	1.32	21.45	20.73	14.18	13.45	7.64	22.55

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don't know.

Support for Teaching assistants, Program leaders, and Legal issues

Items within this factor had mean ratings ranging between M = 2.6 for Item #27 "Access to legal staff support and to legal matters related to online teaching and learning" and M = 3.29 for Item #20 "Professional development related to online education for leaders of online programs." The percentage of respondents who chose "Do not know" for the items within this factor was high: 47% for Item #26 "Dedicated staff for online student assistance with financial support"; 42% for Item #27 "Access to legal staff support as well as to legal matters related to online teaching" and learning; 41% for Item #19 "Professional development for teaching assistants or tutors." These are areas that many faculty members might not need to engage with unless they are advising students, have intellectual property or copyright questions, or are supervising teaching assistants or tutors.

Table 8
Support for Teaching Assistants, Program Leaders, and Legal Issues

Item	M	SD	1	2	3	4	5	0
(19) Professional development for teaching assistants or tutors	3.03	1.39	10.91	12.36	10.55	14.18	10.91	41.09
(20) Professional development related to online education for leaders of online programs	3.29	1.40	8.36	14.18	9.82	15.27	17.09	35.27
(25) Teaching assistants for online courses	2.68	1.40	24.36	15.27	21.09	12.00	12.36	14.91
(26) Dedicated staff for online student assistance with financial support	2.94	1.38	10.91	10.55	12.00	10.91	9.09	46.55
(27) Access to legal staff support as well as to legal matters related to online teaching and learning (e.g., Intellectual properties issues, data protection, etc.)	2.60	1.34	16.36	12.73	13.09	9.82	6.18	41.82

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don't know.

Technical support services for Online Education

Both items in this factor, which pertained to technical support services for online instructors and online students had a mean rating of 3.92.

Table 9
Technical Support Services for Online Education

Item	M	SD	1	2	3	4	5	0
(4) Technical support services for online instructors (24-hour helpdesk)	3.92	1.17	5.45	5.45	18.91	25.82	38.91	5.45
(5) Technical support services for online students (24-hour helpdesk)	3.92	1.19	4.73	7.64	14.55	23.64	37.09	12.36

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don't know.

Technology infrastructure for Online Education

Both the items in this factor had high mean ratings above 4, with Item #1 "Technical infrastructure for online courses" having the highest mean rating (M = 4.60) for any item on the OISS.

Table 10
Technology Infrastructure for Online Education

Item	M	SD	1	2	3	4	5	0
(1) Technical infrastructure for online courses (e.g., Learning Management system or Virtual Learning Environment)	4.60	0.77	1.09	2.18	4.73	19.64	72.00	0.36
(2) Technology for synchronous communication between instructors and students	4.31	0.90	1.09	2.55	14.91	26.18	53.45	1.82

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don't know.

Academic and Administrative support services for Online Education

All items in this factor had mean ratings above 3.5. Item #6 "Well-qualified technical support staff" (M = 4.27) had the highest mean rating, followed by Item # 22 "Dedicated administrative staff to support online programs" (M = 3.72).

Table 11
Academic and Administrative Support Services for Online Education

Item	M	SD	1	2	3	4	5	0
(6) Well-qualified technical support staff	4.27	0.94	1.82	3.64	12.36	29.45	52.36	0.36
(22) Dedicated administrative staff to support online programs	3.72	1.27	6.55	11.27	17.09	22.91	33.82	8.36
(23) Dedicated library staff to support online programs	3.52	1.32	7.64	11.27	16.36	19.27	24.00	21.45
(24) Dedicated staff for student course enrollment	3.67	1.32	7.27	8.36	11.27	21.45	25.45	26.18
(28) Other student-related services for online education (e.g., Writing centers, Counselling, Professional Integration, Internships/Scholarships, etc.)	3.49	1.19	5.09	12.00	22.55	21.82	20.36	18.18

M = mean, SD = standard deviation, 1 = Not at all, 2 = To a small extent, 3 = To some extent, 4 = To a great extent, 5 = To a very great extent, 0 = Don't know.

Limitations

There were several limitations to this study. First, the sample size is relatively small, and participants were mainly from four-year institutions (95%), although the survey was disseminated both through professional organizations and at two four-year institutions. Additionally, 88% of participants were at public institutions and 69% of them were full-time faculty members. It is therefore not possible to generalize the results to all types of institutions and all types of online instructors. Second, all data were self-reported and the actual presence of different types of support for online instructors was not verified. Third, the different types of support listed were drawn from the literature review and might not be an exhaustive list of the types of support available at higher education institutions. Although an open-ended question was included asking participants about any other types of support that might not have been listed in the survey, they did not provide additional factors. The few open-ended responses only provided additional information about the existing items.

Discussion

The conceptual framework created from the literature review that formed the basis of this study consisted of seven areas of online instructor support. Of these, two areas (Technology Infrastructure and Technical Support) were combined, and one area (Program and Legal Issues) integrated into Administrative and Academic support, to form the five sections in the OISS survey. The EFA, however, revealed seven factors (Table 12). It is important to acknowledge that the various areas of online instructor support identified in this survey are combinedly needed for online instructor success.

Table 12
Conceptual Framework and Factors

	Areas in Conceptual Framework	**Factors following EFA**
1	Technology infrastructure	Technology infrastructure for online education
2	Technical support	Technical support services for online education
3	Online course development and teaching	Online course development, teaching support, and professional development
4	Instructor rewards and incentives	Incentives and recognition for online course development and teaching
5	Administrative and academic support	Academic and administrative support services for online education
6	Institutional policies and culture	Institutional policies and procedures for online education
7	Program and legal support	Support for teaching assistants, program leaders, and legal issues

Online education has been adopted at varying levels across higher education institutions over the last two decades. Researchers have studied barriers to online education implementation since the early 2000s (Maguire, 2005; Muilenburg & Berge, 2001) to identify the different types of resources and support needed for successful online education. Online instructors' experiences, skills, challenges, self-efficacy, and views of online education (e.g., perceptions of effectiveness) influence their satisfaction with online teaching and their need for support (Wingo et al., 2017). The level and types of support available to online instructors at an institution can vary based on how long an institution has been engaged in online education. According to Berge, Muilenberg, and Haneghan (2002), "organizational maturity" (p. 1) with distance or online education leads to institutions largely overcoming barriers of technology, administrative and organizational issues, student access, and student support. Following the dynamic increase and expansion of online education offerings across higher education institutions in the U.S. (Garrett et al., 2019; 2020), the results of our study reinforce these assertions. Over 58% of the faculty participants in our study had worked at their institutions for six years or more, and approximately 50% of them had at least six years of online teaching experience, with another 38% having taught online for at least two years. The results revealed a culture of support for online teaching (Espiritu & Budhrani, 2019; Marek, 2009), with higher support in the areas of technology infrastructure, technical support, online course development and teaching support, institutional policies and procedures, academic and administrative support, and less support in the area of incentives and recognition for online course development and teaching, and support for teaching assistants, program leaders, and copyright issues. The results also uncovered a lack of online instructor awareness of whether support is available in several areas, indicating a need for increased communication and information about support for online education at higher education institutions.

Participants rated the availability of technology infrastructure and technical support at their institutions as the most prevalent of all types of support, demonstrating awareness of the technologies available to them (Hartman et al., 2014), and alluding to the presence of technical infrastructure and support that are essential to successful online education (Martin et al., 2019; Sankey et al., 2014). However, 12% of the participants chose "do not know" for the item pertaining to technical support for online students. This indicates that institutions must make all online instructors, whether adjunct or full-time instructors, aware of technical support available to students, and provide them with such information. This can help online instructors communicate such information to students when they need technical support and can reduce any challenges that they might face trying to support their students with technology.

Corresponding to the CHLOE 3 report (Garrett et al., 2019), where faculty development and instructional design support for course development have been cited as a top priority of higher education institutions, participants in this study rated support for online course development, teaching support, and professional development quite high. This indicates that institutions at which the participants worked provided instructional design support, technical training, online access to self-help materials, support for course material development, and other forms of support necessary for online instruction (Herman, 2012; Lion & Stark, 2010; Pedro & Kumar, 2020). Faculty development and learning opportunities at higher education institutions typically take the form of instructional design guidance and training programs or workshops, with fewer opportunities for formal mentoring (Herman, 2012). This was reflected in our study where mentoring for online instruction was rated lowest in the types of learning opportunities for online instructors.

Assistance with data use for learning design or course planning was the lowest rated item, indicating that much has to be done in the area of communications and professional development about learning analytics and the availability and use of data for faculty (Kumar et al., 2019; Pedro & Kumar, 2020). Furthermore, 21% of respondents chose the "do not know" option for this item, indicating that they were unaware about such opportunities at their institutions. Likewise, 33% of respondents chose the "do not know" option when asked about professional development for adjunct online instructors. Given that 69% of the respondents were full-time faculty, it is highly likely that they were unaware of professional development opportunities for adjunct online instructors.

Although participants indicated support for online course development, teaching support, and professional development, all items pertaining to incentives and recognition for online course development and teaching had an average rating below 2.84. Despite the acknowledged increased workload and time taken for online course development and teaching (Bolliger & Wasilik, 2009; Mandernach et al., 2013; Seaman, 2009), and the need for compensation, incentives, and rewards to motivate faculty to engage in online education (Herman, 2013; Kibaru, 2018; Mohr & Shelton, 2017) this study reveals that institutions have yet to implement adequate support for online instructions in these areas, even if they have been engaged in online education for several years. Compensation and incentives are not only needed for online course development, but for continuous improvement of online courses. A lack of incentives can affect faculty motivation and satisfaction, which is crucial to the success of online education (Bolliger & Wasilik, 2009; Orr et al., 2009). In addition to student satisfaction, which is almost always considered by institutions engaging in online education, faculty satisfaction should also be assessed regularly and addressed.

Academic and administrative support for online programs and online education, which can be of great help to online instructors and influence online student success (Kear et al., 2016; Wang et al., 2009) were perceived by participants to be largely prevalent at their institutions. Twenty-one percent and 26% of participants chose “do not know” for the items pertaining to the availability of dedicated library staff and dedicated student support staff to support online, both areas essential to quality in online education (Olcott, 2014; Oomen-Early & Murphy, 2009). While these could correspond to the 27% of participants who were adjunct or part-time instructors, these ratings point to the need for increased awareness of the availability of these types of support.

Participant responses to items about institutional policies and procedures for online education indicate that online education is included in institutional goals and that processes for continuous improvement of online courses and online teaching are implemented at the participants’ institutions (Hartman et al., 2014; Lion & Stark, 2010; Pedro & Kumar, 2020). The item about the identification of an online instructor-student ratio that recognizes online education as time-intensive and avoids excessive workload for faculty had a low mean rating ($M = 2.72$). As mentioned earlier, faculty time and effort are different when teaching in the online environment (Bolliger & Wasilik, 2009), and this needs to be acknowledged in policies and incentives related to online education, also because it impacts faculty satisfaction. Participants’ ratings about the collection of data about faculty satisfaction with online courses was also low, indicating that faculty satisfaction with online courses does not receive as much attention as online student satisfaction at HEIs, although faculty satisfaction is important to student learning (http://www.olc.org).

The area of support that emerged as a separate factor in this survey was support for teaching assistants, program leaders, and legal issues, which have been identified as important in the literature (Martin et al., 2019; Mohr & Shelton, 2017; OLC, 2017; Pedro & Kumar, 2020), but are often lacking at higher education institutions. These are also areas with which many faculty members might not need to engage unless they are advising students, supervising teaching assistants or tutors, leading an online program, or experiencing intellectual property or copyright questions. Nevertheless, participant responses revealed a glaring lack of awareness about access to legal staff support as well as to legal matters related to online teaching (42% chose “do not know”), and professional development for teaching assistants or tutors (41% chose “do not know”). Given the increasing number of adjunct faculty and part-time instructors engaged in online education (Sprute et al., 2019), these results emphasize the need for professional development for these stakeholders, but also the need for information and awareness about such opportunities.

Conclusion

The purpose of this study was to create and implement a survey to explore online instructors’ perceptions of support available to them at their institutions. The OISS survey will be useful to administrators, leaders, instructional designers, and distance learning centers who can assess the types and extent of support available to online instructors at their institutions, identify gaps that might exist, and ensure that opportunities and resources exist in areas of missing or inadequate online instructor support. Given the key role that online instructors and online instructor satisfaction play in the success of online education (Bolliger & Wasilik, 2009; http://olc.org), such a survey can be very beneficial.

Given recent events such as COVID-19 that have led to new forms of online teaching such as emergency remote instruction, completely synchronous instruction and HyFlex instruction, and the continuous evolution of online education using emerging technologies (e.g., virtual reality), additional forms of support might be needed by online instructors. Future research can expand or adapt the OISS survey for different forms of online instruction, or other geographies, and consider surveying administrators with the same items to determine if these types of support exist at their institutions.

Declarations

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References

Almpanis, T. (2015). Staff development and institutional support for Technology Enhanced Learning in UK universities. *The Electronic Journal of e-Learning*, *13*(4), 366–375.

Arrindell, W. A., & Van der Ende, J. (1985). Cross-sample invariance of the structure of self-reported distress and difficulty in assertiveness. *Advances in Behavior Research and Therapy, 7*, 205–243.

Bailey, C. J., & Card, K. A. (2009). Effective pedagogical practices for online teaching: Perception of experienced instructors. *The Internet and Higher Education*, *12*(3), 152–155.

Baran, E., & Correia, A. P. (2014). A professional development framework for online teaching. *TechTrends*, *58*(4), 95–101.

Barker, K. (2002). Canadian Recommended E-Learning Guidelines (CanREGs). https://www.futured.com/pdf/CanREGs Eng.pdf

Berge, Z. L., Muilenburg, L. Y., & Haneghan, J. V. (2002). Barriers to distance education and training: Survey results. *The Quarterly Review of Distance Education*, *3*(4), 409–418.

Bolliger, D. U., & Wasilik, O. (2009). Factors influencing faculty satisfaction with online teaching and learning in higher education. *Distance Education*, *30*(1), 103–116.

Council on Higher Education (CHE). (2014). Distance higher education programmes in a digital era: Good practice guide. http://hdl.voced.edu.au/10707/342233

Daniel, J., & Uvalic-Trumbic, S. (Eds.) (2013). *A guide to quality in online learning*. https://www.academicpartnerships.com/Resource/documents/A-Guide-to-Quality-in-Online-Learning.pdf

de Winter, J. C. F., Dodou, D., & Wieringa, P. A. (2009). Exploratory factor analysis with small sample sizes. *Multivariate Behavioral Research*, *44*(2), 147–181.

Espiritu, J. L., & Budhrani, K. (2019). Cultivating an e-learning culture. *Scientia Pedagogica Experimentalis*, *56*(1), 3–32.

Fetzner, M. J. (2003). Institutional support for online faculty: Expanding the model. *Elements of quality online education: Practice and Direction*, *4*, 229–241.

Garrett, R., Legon, R., & Fredericksen, E. E. (2019). *CHLOE 3 behind the numbers: The changing landscape of online education 2019*. http://qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-3-report-2019

Garrett, R., Legon, R. & Fredericksen, E. E. (2020). *CHLOE 4: Navigating the mainstream, the changing landscape of online education*. qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-project

Garrett, R., Legon, R., Fredericksen, E. E., & Simunich, B. (2020). *CHLOE 5: The pivot to remote teaching in spring 2020 and its impact.* The Changing Landscape of Online Education. qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-project

Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin, 103*, 265–275.

Hartman, A., Barnet, B., Pfeifer-Luckett, R. Mann, P., & Wong, L. (2014). *Faculty and staff survey on online teaching, learning, and support report*. https://www.wisconsin.edu/systemwide-it/projects/fac-survey/Item #fs20141

Herman, J. H. (2012). Faculty development programs: The frequency and variety of professional development programs available to online instructors. *Journal of Asynchronous Learning Networks*, *16*(5), 87–106.

Herman, J. H. (2013). Faculty incentives for online course design, delivery, and professional development. *Innovative Higher Education*, *38*(5), 397–410.

Hicks, M. (2014). Professional development and faculty support. In O. Zawacki-Richter & T. Anderson (Eds.), *Online Distance Education: Towards a Research Agenda* (pp. 267–286). Athabasca University Press.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, *27*. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Hunt, H. D., Davies, K., Richardson, D., Hammock, G., Akins, M., & Russ, L. (2014). It is (more) about the students: Faculty motivations and concerns regarding teaching online. *Online Journal of Distance Learning Administration*, *17*(2), 62–71.

Johnson, N., Veletsianos, G., & Seaman, J. (2020). U.S. faculty and administrators' experiences and approaches in the early weeks of the COVID-19 pandemic. *Online Learning*, *24*(2), 6–21.

Kaiser, H.F. (1974). An index of factorial simplicity. *Pschometrika*, *39*, 31–36.

Kear, K., Rosewell, J., Williams, K., Ossiannilsson, E., Rodrigo, C., Sánchez-Elvira Paniagua, Á., Santamaría Lancho, M., Vyt, A., & Mellar, H. (2016). *Quality assessment for e-learning: a benchmarking approach*. https://oro.open.ac.uk/34632/

Kebritchi, M., Lipschuetz, A., & Santiague, L. (2017). Issues and challenges for teaching successful online courses in higher education: A literature review. *Journal of Educational Technology Systems*, *46*(1), 4–29.

Kibaru, F. (2018). Supporting faculty to face challenges in design and delivery of quality courses in virtual learning environments. *Turkish Online Journal of Distance Education*, *19*(4), 176–197.

Kumar, S., & Dawson, K. (2018). *An online doctorate for researching professionals: Program design, implementation and evaluation*. Athabasca University Press. http://www.aupress.ca/index.php/books/120272

Kumar, S., Martin, F., Budhrani, K., & Ritzhaupt, A. (2019). Award-winning faculty online teaching practices: Elements of award-winning courses. *Online Learning Journal*, *23*(4), 160-180. https://olj.onlinelearningconsortium.org/index.php/olj/article/view/2077

Kumar, S. & Ritzhaupt, A. R. (2017). What do instructional designers in higher education really do? *International Journal on E-learning*, *16*(4), 371-393.

Lion, R. W., & Stark, G. (2010). A glance at institutional support for faculty teaching in an online learning environment. *Educause Quarterly*, *33*(3), 23–39.

Lloyd, S. A., Byrne, M. M., & McCoy, T. S. (2012). Faculty-perceived barriers of online education. *MERLOT Journal of Online Learning and Teaching*, *8*(1), 1–12.

Maguire, L. L. (2005). Literature review–faculty participation in online distance education: Barriers and motivators. *Online Journal of Distance Learning Administration*, *8*(1), 1–16.

Mandernach, B. J., Hudson, S., & Wise, S. (2013). Where has the time gone? Faculty activities and time commitments in the online classroom. *Journal of Educators Online*, *10*(2), 1–15.

Marek, K. (2009). Learning to teach online: Creating a culture of support for faculty. *Journal of Education for Library and Information Science*, 275–292.

Martin, F., Polly, D., Jokiaho, A., & May, B. (2017). Global standards for enhancing quality in online learning. *The Quarterly Review of Distance Education, 18*(2), 1–10.

Martin, F., Wang, C., Budhrani, K., Moore, R. L., & Jokiaho, A. (2019). Professional development support for the online instructor: Perspectives of U.S. and German instructors. *Online Journal of Distance Learning Administration*, *22*(3).

Mohr, S. C., & Shelton, K. (2017). Best practices framework for online faculty professional development: A Delphi study. *Online Learning Journal*, *21*(4).

Moore, R. L., & Fodrey, B. P. (2018). Distance education and technology infrastructure: Strategies and opportunities. In A. Pina, V. Lowell, & B. Harris (Eds.), *Leading and Managing e-Learning* (pp. 87–100).

Muilenburg, L., & Berge, Z. L. (2001). Barriers to distance education: A factor-analytic study. *American Journal of Distance Education*, *15*(2), 7–22

Pedro, N. S. & Kumar, S. (2020). Institutional support for online teaching in quality assurance frameworks. *Online Learning Journal, 24*(3), 50-66. https://doi.org/10.24059/olj.v24i3.2309

Phipps, R., & Merisotis, J. (2000). *Quality on the line: Benchmarks for success in internet-based distance education*. The Institute of Higher Education Policy. https://eric.ed.gov/?id=ed444407

Online Learning Consortium. (2016). *Quality scorecard for the administration of online programs*. https://onlinelearningconsortium.org/consult/olc-quality-scorecard-suite/

Oomen-Early, J., & Murphy, L. (2009). Self-actualization and e-learning: A qualitative investigation of university faculty's perceived barriers to effective online instruction. *International Journal on E-Learning*, *8*(2), 223–240.

Olcott, D. (2014). *AVU quality assurance framework for open, distance and eLearning programmes*. http://www.avu.org/avuweb/wp-content/uploads/2016/05/QA_FRAMEWORK.pdf

Orr, R., Williams, M. R., & Pennington, K. (2009). Institutional efforts to support faculty in online teaching. *Innovative Higher Education*, *34*(4), 257–268.

Rhode, J., & Krishnamurthi, M. (2016). Preparing faculty to teach online: Recommendations for developing self-paced training. *International Journal of Information and Education Technology*, *6*(5), 376.

Sankey, M., Carter, H., Marshall, S., Obexer, R., Russell, C., & Lawson, R. (2014). *ACODE benchmarks for technology enhanced learning.* Australasian Council on Open, Distance and eLearning (ACODE), Canberra, Australia. http://www.acode.edu.au/mod/resource/view.php?id=216

Seaman, J. (2009). *Online learning as a strategic asset. Volume II: The paradox of faculty voices-views and experiences with online learning*. Association of Public and Land-Grant Universities. Babson Survey Research Group.

Shelton, K. (2011). A review of paradigms for evaluating the quality of online education programs. *Online Journal of Distance Learning Administration*, *14*(1). https://www.westga.edu/~distance/ojdla/spring141/shelton141.html

Sprute, K., McCabe, C., Basko, L., Danuser, P., & Mandernach, J. (2019). Virtual professional communities: Integrative faculty support to foster effective teaching. *Journal of Instructional Research*, *8*(2), 34–43.

Vaill, A. L., & Testori, P. A. (2012). Orientation, mentoring and ongoing support: A three-tiered approach to online faculty development. *Journal of Asynchronous Learning Networks, 16*(2), 111–119.

Wang, H., Gould, L. V., & King, D. (2009). Positioning faculty support as a strategy in assuring quality online education. *Innovate: Journal of Online Education*, *5*(6).

Weaver, D., Robbie, D., & Borland, R. (2008). The practitioner's model: Designing a professional development program for online teaching. *International Journal on E-Learning*, *7*(4), 759–774.

Wingo, N. P., Ivankova, N. V., & Moss, J. A. (2017). Faculty perceptions about teaching online: Exploring the literature using the technology acceptance model as an organizing framework. *Online Learning*, *21*(1), 15–35.

The Challenges of Remote K–12 Education During the COVID-19 Pandemic: Differences by Grade Level

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Abstract
The transition to remote teaching in K–12 schools during the spring of 2020 as a result of the coronavirus pandemic (COVID-19) presented new challenges to teachers across the United States. This survey-based mixed methods study investigates these challenges, as well as differences by grade level, to better understand teachers' experiences remote teaching. A total of 604 teachers who had completed the survey were included in this study. Findings indicate that some challenges were experienced by teachers across grade levels, with common challenges including student engagement, adjusting curriculum to the remote format, and the loss of the personal connection of teaching. Differences were also found by grade level, with elementary teachers struggling more with varying attitudes of parents regarding remote learning and adjusting their curriculum to an online format, and secondary teachers more often reporting student engagement and a general feeling of being lost or unsupported in their teaching as challenges. These challenges provide important context around the experience of remote teaching, as well as what supports teachers need to continue remote teaching.

Keywords: remote teaching, challenges of teaching, teaching during a pandemic, online teaching

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The coronavirus disease (COVID-19) pandemic shifted teaching in the United States to an entirely new format in the spring of 2020. This unprecedented national change presented a major adjustment for teachers and students. Some school districts only gave teachers a weekend to prepare, expecting them to restructure their lessons to a fully remote—which most often meant fully online—format (Herold, 2020). This shift alone was a major challenge for teachers, as was the following month and a half when many teachers taught remotely for the first time regardless of grade level or content area, while also living in a pandemic.

Teachers already face many challenges in their work when teaching in-person. Some of these challenges include handling disruptive classroom behaviors, feeling socially isolated, and struggling to balance work and family responsibilities (Bullough, 1987; Coates & Thoresen, 1978: Rosenholtz, 1989). While a remote format may lessen some of these challenges, others may be exacerbated by it. For example, social isolation would likely intensify with the switch to teaching remotely, while handling disruptive classroom behaviors may lessen when away from the physical classroom. The switch to remote, as well as the context of teaching during a global pandemic, would likely present teachers with a range of unique new challenges and difficulties because this situation is unfamiliar to many teachers and the change happened quickly.

Teachers have informally discussed their experiences of teaching remotely, with some teachers reporting more challenges than others (Rae, 2020). The current study seeks to explore teacher experiences, specifically looking at differences by grade level to understand how teachers may be experiencing this situation differently. Grade level will be divided into elementary (early childhood through 5th grade) and secondary (6th through 12th grade). Comparing these groups will likely provide a better understanding of what challenges are most prevalent for elementary and secondary teachers, and consequently, what supports these teachers need most.

The current study sought to explore teacher experiences with remote teaching in spring 2020 to understand what unique challenges teachers of different education levels and content areas may have experienced by answering the following research questions:

1. What challenges do teachers report facing in implementing remote learning?
2. How do these challenges differ by grade level (elementary versus secondary)?

Literature Review

The Stresses and Challenges of Teaching

Teaching is a stressful job, often demanding long hours and intense emotional strain (Lavian, 2012). Teachers often end up doing more than outlined in their contracts. For example, they may work more hours or take on additional responsibilities outside of those for which they initially signed up (Organization for Economic Co-operation and Development, 2019). They also face challenges related to classroom behavior, conflicts with district and school administration, and a lack of supervisor support (Burke, 1996). In addition, many teachers feel isolated socially and struggle to manage both work and home responsibilities (Bullough, 1987; Coates & Thoresen, 1978). Teaching is also a consistently underpaid profession. With low starting salaries and frequent cuts to education funding across the United States, it is difficult to retain teachers in the profession (Gonzalez et al., 2008; Leachman et al., 2015).

As a result of all of these difficulties, teachers often experience higher levels of stress and burnout than other professions, as well as many mental health concerns (Ingersoll & Perda, 2014; Shin et al., 2013). Teachers often enter the profession believing in their ability to succeed at their school and lose that feeling within the first year due to the high levels of stress (Lavian, 2012). Many teachers also report feeling exhausted and not engaged in their work, which contributes to the high burnout rate for teachers (American Federation of Teachers, 2017; Ingersoll & Perda, 2014; Gallup, 2013).

Differences in Teaching Elementary and Secondary Courses

Developmentally, elementary and secondary students have very different experiences, and teachers must adapt to the needs of the age level they teach (Epps & Smith, 1984; Hafen et al., 2012). Both students and teachers view these education levels differently, specifically perceiving the school culture of elementary school as less performance-focused and more task-focused than middle school (Midgley et al., 1995). Family perceptions are also different, with parents and teachers feeling more trust with each other at the elementary level than at the middle or high school level (Adams & Christenson, 2000).

The level of outside support that students at different grade levels receive may also be different. According to the Academic Communities of Engagement (ACE) framework, teachers must engage students by leveraging their personal and course community supports (Borup, Graham, West, Archambault, & Spring, 2020). The course community refers to those associated with the course, such as teachers, principals, and other school support staff. The personal community includes the people not involved in the course who may support the students, such as family members. A previous study found that, within an online learning environment, teachers struggled to support students due to the factors outside of their control (Borup et al., 2014). Grade level and age may also impact this dynamic and make it more or less difficult to keep students on track with their learning (Borup et al., 2020).

Studies that explore the differences in burnout and stress among elementary and secondary teachers have yielded conflicting results. One study found that elementary teachers reported feeling emotionally exhausted more often and experienced depersonalization, or disconnection from their life, more frequently in their work than secondary school teachers (Yavuz, 2009). A later study found that elementary and secondary teachers tend to feel similar levels of stress and burnout as a result of their job (Richards et al., 2016). Another study found that teachers who taught at multiple grade levels experienced more severe burnout than those that taught a single grade level (Bernhard, 2016).

Teaching Remotely

Although teaching remotely does not always mean teaching online, teachers most often used online platforms and systems to teach their students remotely (Lieberman, 2020). However, remote instruction is significantly different from online learning. In this study, “remote” is used to refer to the adapted lessons that teachers created as a result of the switch away from in-person learning. These lessons are not necessarily designed for online, but rather reformatted to work in the online format.

Research on teaching K–12 online has found that online instructors face unique challenges in their work. Larkin et al. (2016) found that online instructors struggled with inactive students, missing face-to-face student interactions, and workload. Another study found that online teachers struggled to draw lines between work and home, as working from home quickly erased these boundaries (Knott, 2014). Another study interviewed an online language teacher who also designed courses. The study reported that online teachers often experience the following challenges: few resources and trainings for teaching online, struggling to get students to collaborate with each other, and struggling to motivate students to engage with their lessons (De Paepe et al. 2018). In addition to lacking training and resources, many online teachers have also reported not knowing how to use online platforms and not knowing where to go to learn more (Mupinga, 2005).

While many K–12 teachers may not feel adequately trained or supported to teach in online formats (Pulham & Graham, 2018), a vast body of research exists on successful online teaching practices (Marcus-Quinn & Hourigan, 2016). In fact, many trace online K–12 teaching practices back to 1991 (Barbour, 2013; Clark, 2013; Hu et al., 2019), with Arensen et al. (2019) reporting the first peer-reviewed journal article on the subject was published in 1996. Since then, many challenges related to online schooling have been identified (Barbour & Reeves, 2009), including equity and access issues with regard to the "digital divide" (Berge & Clark, 2005; Shank & Cotton, 2013) as well as issues related to student readiness, engagement, and retention (Barbour & Reeves, 2009; Cavanaugh et al., 2005; McLeod et al., 2005), with the initially pervasive belief that in order for K–12 students to be successful when physically separated from their teacher, students must be more autonomous and achievement-oriented than would be required to succeed in a face-to-face format (Wedemeyer, 1981). However, in the past 15 years, alternative design principles specific to virtual environments began to be identified (Barbour, 2007; Barbour & Reeves, 2009; Cooze & Barbour, 2005).

DiPietro et al. (2008) identified 37 best practices for online teaching, broken down into four categories, including general characteristics, classroom management, pedagogical strategies, and technology (Pulham & Graham, 2019). Also, Ferdig et al. (2009) published a review of best practices for online K–12 teaching. Since these initial efforts to identify best practices, online teaching and learning recommendations have only become more refined and distinct from face-to-face practices (Pulham & Graham, 2019). As the development of these competencies continues to expand, one thing is clear: successful online teaching is not a direct translation from face-to-face teaching. Rather, successful online teaching is a distinct form of teaching which requires instructional design distinct from face-to-face teaching (Pulham & Graham, 2019).

However, suddenly switching to an entirely remote format is different from choosing to teach online. At the onset of the COVID-19 pandemic, many teachers had never taught online before, and had to learn how to use the necessary technology to continue to teach in this modality (Heim, 2020). As mentioned previously, inequities in access to and understanding of how to use digital devices is referred to as the "digital divide" (Berge & Clark, 2005; Shank & Cotten, 2013). The digital divide is considered to have two levels of digital divide factors: access to technology (first level) and the ability to use technology (second level). This is applicable to both teachers and students in a remote setting, as many teachers had to learn how to navigate new technologies with few resources while also supporting students in learning about these technologies.

In addition to the teaching challenges introduced by remote or online instruction, teachers may also be struggling with the loss of the things they found enjoyable or meaningful that are unique to in-person instruction. Despite all the unique stressors and challenges of K–12 teaching, research has shown that the teachers who do stay in the profession tend to do so because of their desire and motivation to work directly with children (Watt & Richardson, 2007). Indeed, many teachers who persist in the profession assert that their primary motivator is interacting with and developing meaningful teacher-student relationships with their pupils (Lachlan et al., 2020). As a USA Today/Ipsos poll pointed out (Lardieri, 2020), many teachers feel that teaching remotely or through distance learning does not offer the same level of meaning or satisfaction as teaching in person, which could lead to increased burnout and attrition in the teacher workforce.

Teaching During Crises

One study looked into the experience of teachers who taught in-person during the 2009 H1N1 pandemic. Teachers reported feeling increased stress and anxiety about their new responsibilities and challenges (Howard & Howard, 2012). They feared for their own safety, as well as their students' safety, and struggled with being expected to be "infection control agents."

Research has also explored school communities after Hurricane Katrina. One study examined teacher experiences of teaching directly after the hurricane hit. Teachers indicated it was the most difficult semester they had ever experienced, as they had to manage their own stress and anxiety as well as the emotions that their students felt (Alvarez, 2010). They reported that the hurricane impacted students differently, with some students acting unpredictably under the increased stress. Other research demonstrated that after schools shut down due to Hurricane Katrina, only half of the teachers who had been dismissed had returned to the teaching profession two years later (Lincove et al., 2017), which could be interpreted as further evidence of the toll of teaching during and in the wake of a crisis.

Teaching under these conditions places increased pressure on teachers, who are responsible not only for their own wellbeing, but often take on the burden of worrying for all of their students. Some research has shown that people who work with children who have experienced trauma more often develop compassion fatigue (Conrad & Kellar-Geunther, 2006; Meyers & Cornille, 2002). We would especially anticipate this to be the case when teachers are also feeling taxed about their own safety and wellbeing, as well as the safety and wellbeing of their families and students.

Emerging Research about the COVID-19 Pandemic

Some research has started to come out of China on the impacts of the pandemic on K–12 education. Most of this research has focused on the most effective format for teaching rather than the experience of teachers during this time (Chen et al., 2020). For example, one study looked at the most effective format for teaching an online chemistry class, while another study explored whether live online teaching was more effective than pre-recorded materials at a middle school (Chen et al., 2020; Yao et al., 2020).

Research on remote learning has also started to emerge out of the United States. One study explored high school chemistry courses, finding that it was difficult for both students and teachers to engage with the online version of the course (Kelley, 2020). This was partially due to the loss of in-person labs, as all experiments and demonstrations had to be done over Zoom or through videos. Relatedly, another study found that university-level biology (specifically, ecology and evolution) courses had a sharp decrease in fieldwork, which was associated with decreased student learning outcomes and lower engagement in the remote version of the course from both students and faculty (Barton, 2020). Other hands-on topics similar to chemistry and biology may also be more difficult to teach remotely. Another study conducted interviews with elementary teachers about their remote learning experiences. Teachers indicated that they lacked resources for converting their lessons to an online format and that it was difficult to teach younger students online (Anderson & Hira, 2020).

Another study found that teachers across content areas were struggling to translate their lessons to a remote format and to figure out to evaluate student learning (Trust & Whalen, 2020). This was echoed in another study that found that both remote and hybrid learning were more difficult than in-person learning for teachers as well as students (Raes et al., 2020). Similarly, another study documented the process by which university instructors rapidly adapted their course material from an in-person to a remote format, and how that process differed from the process of developing distance learning courses which were intended to be remote from the outset (Bryson & Andres, 2020).

Research into how teachers are experiencing remote teaching during the COVID-19 pandemic is currently emerging. One recent study examined the use and association of various coping strategies with psychological outcomes such as wellbeing and happiness for language teachers (MacIntyre et al., 2020). Using a close-ended survey with a list of hypothesized possible stressors, MacIntyre et al., 2020) were able to identify an assortment of stressors these language teachers were experiencing, including increased workload, worry about the health of family members, and loss of control at work, among others. While these findings provide an initial glimpse into the types of stressors and challenges language teachers faced when switching to remote teaching due to COVID-19, the potential list of stressors was created by the researchers, not by the participants. A more inductive approach using qualitative data from open-ended questions could provide a more in-depth understanding of the teacher experience. Furthermore, a direct comparison between elementary and secondary teachers' experiences during the COVID-19 pandemic has yet to be made.

Method

This study sought to investigate the challenges that K–12 teachers experienced remote teaching during the COVID-19 pandemic in the spring of 2020. This mixed methods study used a concurrent, partially mixed, qualitative dominant approach (Leech & Onwuegbuzie, 2009), wherein the data were collected at the same time (concurrently); were mixed only at the interpretation stage (partially mixed); and the qualitative data were given more emphasis (qualitative dominant). Study approval was obtained from the institutional review board of the authors' institution.

Participants

After obtaining IRB approval, invitations to participate were emailed to 19,574 potential participants with an active teaching license in a single western state. Some of these email addresses were not functional, leading to 18,891 potential participants. Of this number, 831 participants completed the survey, resulting in a 0.04% response rate. While this is a low response rate, it was determined to be an adequate sample size due to the circumstances of collecting data during a pandemic. State licensure requirements did not explicitly require training in online teaching; although the licensure requirements did include training in using instructional technology, this was in reference to using the technology available when teaching face-to-face.

The sample was further narrowed to only include teachers who reported that they taught exclusively at the elementary or secondary level, as some teachers indicated that they taught at both. This narrowed the sample to 604 participants. Out of 603 participants who indicated their gender identity, 75.5% identified as female, 24.0% as male, and less than 1% identified as "other." Most of the sample identified as White (94.5%), while 1.5% identified as American Indian or Alaskan Native, 1.3% identified as Black or African American, and 1.0% identified as Asian. 8.9% of participants reported that they were of Hispanic, Latinx, or Spanish origin. The gender, ethnicity, and racial composition of the respondents is representative of the population to whom the survey was sent.

Participants also indicated what age range they fell into: 24% were between 18- to 34-year-olds, 27.5% were between 35- to 44-year-olds, 29.0% were between 45- to 54-year-olds, 17.4% were between 55- to 64-year-olds, and 2.0% were 65 or older. Years in the profession ranged from 1 to 41 years with a mean of 15 years of experience. The majority of participants (58.3%) taught at the secondary level (sixth through twelfth grade), and the remaining 41.7% taught at the elementary level (early childhood through fifth grade). 81% taught core subjects (e.g., math, literacy, science) and the remaining 19.2% taught special subjects (e.g., art, music, drama).

Procedure

Email addresses were obtained for K–12 teachers in a western state through a public website. The survey was distributed via email and was administered through Research Electronic Data Capture (REDCap; Harris et al., 2009). REDCap is an online data capture tool for hosting surveys securely. Completing the survey took approximately 5 to10 minutes.

Instruments

Respondents were presented with six optional open-ended questions about their experiences with remote learning. Example questions include, “If you had to pick one advantage for the current remote teaching that you wanted to maintain in the future, what would that be?” and, “What else would you like us to know about your experiences with remote teaching?” For the purpose of this study, responses from the question, “What has been the biggest challenge with remote teaching?” were selected for further analysis in order to better understand what challenges teachers reported facing and how this may have differed by education level taught.

Two existing surveys were used to better understand teachers’ quality of life and the challenges experienced during remote teaching. The Professional Quality of Life Scale (ProQOL5; Stamm, 2010) was administered to measure teachers’ professional quality of life, which the ProQOL5 manual defines as “the quality one feels in relation to their work as a helper,” which includes both the positive and negative aspects of their work. Results of these scales are reported elsewhere (Leech, Benzel, Gullett, & Haug, 2020). The ProQOL5 manual includes Cronbach alpha coefficients for reporting internal consistency using 1,289 respondents across multiple studies (Stamm, 2010). Although these scales were excluded from the current analysis, the alpha coefficients for the compassion satisfaction, burnout, and secondary trauma scale were 0.88, 0.75, and 0.81 respectively.

The EDUCAUSE DIY Survey Kit: Remote Work and Learning Experiences (EDUCAUSE, 2020) was administered to measure what resources and barriers teachers had or experienced. Results of the EDUCAUSE survey are also reported elsewhere (Leech, Gullett, Howland Cummings, & Haug, 2020). Participants were also asked several demographic questions about their content area, gender, race/ethnicity, age, and teaching experience. Because the EDUCAUSE DIY Survey Kit was designed at the onset of COVID-19 as a customizable survey template to gather feedback from communities, no formal reliability analyses have been conducted for this instrument (EDUCAUSE, 2020).

Constant Comparison Analysis

A constant comparison analysis was conducted using responses to the open-ended survey question, "What has been the biggest challenge with remote teaching?" This was done to see what themes emerged about the challenges of remote learning to better understand teachers' experiences of remote teaching. Constant comparison analysis was selected to analyze responses, as this method allows for the creation of overarching themes that emerge from the data (Corbin & Strauss, 2014).

Two of the authors coded these responses. This was done by first developing codes independently using 30 responses and then coming together to create codes from the independent coding and resolve any coding disputes. After this first meeting, both coders then independently coded 40 additional responses and compared their results. At this point, intercoder reliability was assessed; percent agreement (Miles & Huberman, 1994) was 64% and the average of Cohen's (1988) kappa for each code used was 0.80. The coders then met again to resolve discrepancies between codes and reach agreement about the use of codes. Then both coders independently coded 60 additional responses and compared their results. After this batch, percent agreement was 79% and the average of Cohen's kappa for each code used was 0.81. Although Miles and Huberman (1994) recommend reaching 80% agreement, the researchers felt that sufficient intercoder reliability had been achieved since kappa levels of 0.81 and above are considered "near perfect" agreement (Landis & Koch, 1977). Because Cohen's (1988) kappa considers the probability of reaching agreement by chance, this intercoder reliability statistic is thought to be more useful than simple percent agreement (Cohen, 1960; Hallgren, 2012; Lombard et al., 2002). After this, the remaining responses were divided between the two coders and coded independently.

After codes were developed and all responses coded, data were analyzed for the whole group of respondents and separately for elementary and secondary teachers to provide answers to the research questions.

Results

Several overarching themes related to the challenges of remote teaching emerged from the constant comparison analysis. These themes are discussed more in-depth, along with specific quotes to exemplify each theme and the underlying codes. Differences are also discussed by education level (elementary versus secondary). The overall frequency of codes can be found in Table 1.

Table 1
Frequency of All Codes, Overall and by Education Level

	Total	**Elementary**	**Secondary**	**Difference**	**Effect size (φ)**
Issues with engagement, participation, or attendance	30.1%	24.6%	34.1%	9.5%*	0.10
Lack of student motivation or accountability	7.9%	5.6%	9.7%	4.1%	
Loss of relationship/connection with students/people in general	20.7%	21.4%	20.2%	-1.3%	
Difficultly adjusting curriculum or teaching practice to a remote setting OR remote learning isn't working as well	12.9%	16.7%	10.2%	-6.4%*	0.10
Difficulties with communication or providing feedback (with students, parents, other staff)	9.9%	11.9%	8.5%	-3.4%	
Difficulty accessing technology/internet teachers	0.7%	0.8%	0.6%	-0.2%	
Difficulty using the available technology—teachers	3.6%	4.8%	2.8%	-1.9%	
Difficulty accessing technology/internet—students and families	3.3%	4.4%	2.6%	-1.8%	
Difficulty using the available technology—students and families	3.0%	4.0%	2.3%	-1.7%	
The varying attitudes, abilities, and resources of some parents regarding remote learning	5.6%	10.7%	2.0%	-8.7%***	0.19
Concern about students with specific needs (e.g., students on IEPs, students with attention issues, etc.)	4.3%	5.2%	3.7%	-1.5%	
Juggling home and work responsibilities, work/home boundary issues	6.0%	7.9%	4.5%	-3.4%	
Additional teaching responsibilities/increased workload	4.6%	5.2%	4.3%	-0.9%	
Feeling helpless, unsupported, and/or lost in my teaching, feeling ineffective	3.0%	1.2%	4.3%	3.1%*	0.09

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Challenges with Student Engagement and Motivation

Many teachers struggled with issues related to students engaging. Teachers struggled with several different types of engagement, such as attendance, participation, and putting in effort. The frequency of codes pertaining to engagement can be found in Table 2.

Table 2
Frequency of Codes Related to Student Engagement, Overall and by Education Level

	Issues with engagement, participation, or attendance		**Lack of student motivation or accountability**	
	Frequency	**% of *n***	**Frequency**	**% of *n***
Total (n = 604)	182	30.1%	48	7.9%
Secondary (n = 352)	120	34.1%	34	9.7%
Elementary (n = 252)	62	24.6%	14	5.6%
Difference between Secondary and Elementary		9.5%*		4.1%

*$p < 0.05$, $\varphi = 0.10$

The most common challenge that teachers discussed was the struggle to get students to attend class and engage during class. This was seen in 182 (30.1%) of the responses. Teachers struggled to reach all of their students and to get all of their students to participate during class. For example, one teacher stated, "Connecting with students online. I hardly ever see my students even though I am available online every single day. I don't have the same relationship with them through a screen that I had in the classroom." Teachers often discussed providing students with opportunities to engage or get additional support but felt like students did not take advantage of these opportunities.

Some teachers also noted that students weren't able to engage, sometimes due to technological issues, other times because they didn't have an adult to help them get online. For instance, one teacher stated that their biggest challenge was, "getting little kids involved—they need support from parents and really can only review learning, we are having a hard time teaching them something novel." A higher percentage of secondary teachers (34.1%) reported that student engagement was a challenge than elementary teachers (24.6%). A chi-square test of association revealed that this difference was statistically significant (χ^2 (1, 604) = 6.23, $p < 0.05$) with an effect size of $\varphi = 0.10$, which is considered small (Cohen, 1988).

Forty-eight teachers (7.9%) brought up the challenge that students seemed to lack motivation, often attributing this to a lack of proper accountability structures to enforce engagement and participation. For example, one teacher described their biggest challenge:

> Lack of student participation which I believe is in part driven by the fact that their grades cannot go down. If they are happy with their grade, then why do anything. Education is not happening for a large number of our students, and we are abdicating our responsibility to educate our students.

Due to the context of the pandemic, many requirements were loosened or removed, leading to some students not feeling the motivation to attend class or complete assignments. This challenge was also more prevalent at the secondary level, as 9.7% of secondary teachers mentioned it, compared to 5.6% of elementary teachers. A chi-square test of association approached statistical significance (χ^2 (1, 604) = 3.38, p = 0.066), so it is not clear if this difference between secondary and elementary teachers is due to chance or not.

Challenges with Teaching in a Remote Format

Another common type of challenge that teachers discussed was the challenge of teaching in a remote format. These challenges included struggling to adjust curriculum to a remote setting, feeling disconnected from students and colleagues, and struggling to communicate remotely with students, families, and other staff. The frequency of codes related to remote teaching can be found in Table 3.

Table 3
Frequency of Codes Related to Remote Teaching, Overall and by Education Level

	Loss of relationship or connection with students/people in general		**Difficulty adjusting curriculum or teaching practice to a remote setting OR remote learning isn't working as well**		**Difficulties with communication or providing feedback (with students, parents, other staff)**	
	Frequency	% of *n*	Frequency	% of *n*	Frequency	% of *n*
Total (*n* = 604)	125	20.7%	78	12.9%	60	9.9%
Secondary (*n* = 352)	71	20.2%	36	10.2%	30	8.5%
Elementary (*n* = 252)	54	21.4%	42	16.7%	30	11.9%
Differences between Secondary and Elementary		-1.2%		-6.5%*		-3.4%

*$p < 0.05$, $\varphi = 0.10$

A little over 20% of teachers struggled with feeling disconnected from other people. This most often was in reference to feeling disconnected from students, but sometimes referred to other school staff. For example, one teacher stated that their biggest challenge was, "missing the personal connection/worrying about students' mental health." Another teacher more broadly described struggling with feeling disconnected:

> The disconnection. As we all kind of knew inherently before about how talking on social media is not truly the same as talking in person (I don't actually have social media accounts). Now many of us are truly realizing that whether you tend to be more introverted or extroverted . . . we are social beings. I hate being stuck in one place and not getting to make my lessons involve some movement and excitement . . . I miss the effervescence of a classroom of kids working together. This is incredibly disconnected and the learning doesn't feel as authentic to them most of the time.

Teachers felt like the relationship part of teaching was missing from their work and that they were no longer connected to their students and colleagues in the same way. This challenge was brought up fairly consistently by elementary (21.4%) and secondary (20.2%) teachers. A chi-square test of association suggests that no true difference between elementary and secondary teachers exists in regard to experiencing this challenge ($\chi^2(1, 604) = 0.142$, $p = 0.707$).

Seventy-eight teachers (12.9%) discussed the challenge of adjusting their lessons to remote teaching. Many teachers felt like it wasn't working as well as in-person teaching and that they could not do the same activities and assignments. For example, when describing their biggest challenge, one teacher stated, "Missing the daily hands-on work with my kindergarteners. I am unable to provide instant feedback to guide their learning and development. Loss of direct instruction with writing, small motor skills, social emotional skills, peer relations for students." Another teacher stated, "Figuring out how to adapt my lessons for online learning and figuring out what platform would work best to post my lessons. We were given lots of options from the district but had to explore each on our own and create it from scratch." Struggling to use the online technology to simulate in-person assignments was a challenge for teachers, particularly when they did not feel well supported to use these the provided platforms.

This challenge was discussed slightly more for elementary (16.7%) than secondary (10.2%). A chi-square test of association revealed that this difference was statistically significant (χ^2 (1, 604) = 5.415, $p < 0.05$), which indicates that teaching elementary remotely may be more difficult to do remotely.

Another challenge related to remote teaching was the struggle of communicating with others, most notably families and students. This challenge was brought up by 60 (9.9%) teachers. Many teachers struggled to reach all families and students despite using a range of techniques. For example, one teacher stated, "[I] have to do more written interaction—emails, post responses, phone calls. [It takes] more time than . . . in person to do." They also felt like this was more time consuming, as they had to spend more time trying to contact families than during in-person learning.

Communicating feedback to students was also more difficult. One teacher described this challenge by stating, "Communication with my students is MUCH harder. In the classroom, if a student isn't understanding, I can just walk over and help them. Now, many things get in the way of communication and helping foster understanding." Rather than being able to give quick, in-the-moment feedback, teachers were resorting to emails and assignment comments that students may or may not see. Challenges with communication were brought up slightly more by elementary (11.9%) than secondary (8.5%); however, a chi-square test of association was not statistically significant (χ^2 (1, 604) = 1.878, $p = 0.171$), so this observed difference between elementary teachers and secondary teachers may be due to chance.

Some teachers discussed struggles with technology, such as accessing the internet or using available technology. Although it might be anticipated that technology difficulties would be one of the more common challenges, it was brought up less frequently than many of the other challenges. The frequency of codes related to technology can be found in Table 4.

Table 4
Frequency of Codes Related to Technology, Overall and by Education Level

	Difficulty accessing technology/ internet—teachers		**Difficulty using the available technology—teachers**		**Difficulty accessing technology/ internet—students and families**		**Difficulty using the available technology—students and families**	
	Frequency	% of *n*	Frequency	% of *n*	Frequency	% of *n*	Frequency	% of *n*
Total (n = 604)	4	0.7%	22	3.6%	20	3.3%	18	3.0%
Secondary (n = 352)	2	0.6%	10	2.8%	9	2.6%	8	2.3%
Elementary (n = 252)	2	0.8%	12	4.8%	11	4.4%	10	4.0%
		-0.2%		-2%		-1.8%		-1.7%

Some teachers struggled to use the available technology to do remote teaching. Twenty-two teachers (3.6%) described challenges related to using online platforms to effectively design and implement remote lessons. For example, one teacher stated, “Adequate knowledge of, training with, and time for the programs and software that could make this easier or more beneficial. Especially related to student engagement.” Teachers felt like they needed additional trainings and professional development with the programs available to them. A higher percentage of elementary teachers (4.8%) discussed this challenge than secondary (2.8%), but once again, a chi-square test of association was not statistically significant (χ^2 (1, 604) = 1.544, p = 0.214), suggesting that this difference may be due to chance. A less common challenge for teachers was accessing the internet, with only four teachers (0.7%) reporting that this was a challenge for them.

Conversely, twenty teachers (3.3%) reported that students or families struggled to access the internet, often having unreliable internet or no internet at all. Eighteen teachers (3%) reported that students or families struggled to use the available technology. They may have had reliable internet but did not know how to use the devices and software necessary for remote learning.

Challenges with Student Resources and Supports

Teachers also struggled with the challenge of supporting students given their available resources. Teaching remotely allowed teachers to see inequities in the available supports that students have at home. The frequency of codes related to student supports and resources can be found in Table 5.

Table 5
Frequency of Codes Related to Student Resources, Overall and by Education Level

	The varying attitudes, abilities, and resources of some parents regarding remote learning		**Concern about students with specific needs (e.g., students on IEPs, students with attention issues, etc.)**	
	Frequency	**% of *n***	**Frequency**	**% of *n***
Total (n = 604)	34	5.6%	26	4.3%
Secondary (n = 352)	7	2.0%	13	3.7%
Elementary (n = 252)	27	10.7%	13	5.2%
Difference between Secondary and Elementary		-8.7%***		-1.5%

***$p < 0.001$, φ = 0.19

Thirty-four teachers (5.6%) discussed the challenge of parents' attitudes about remote learning and their ability to support their children in remote learning. For example, one teacher stated, "Not all parents have the time to monitor/support kids. Parents are not teachers and can get frustrated when they don't know how to best help." This quote demonstrates one way in which parents differ in their ability to help students, as some parents are able to spend most of the day helping their child stay on task with remote learning, while other parents have to work and are unable to monitor their child. Teachers also felt frustrated by seeing these inequities in parental support. For instance, one teacher stated, "The attitude of parents regarding remote learning. Some of them take it very seriously and helped their child at the beginning with the technology so now the student is adept at running it while other parents can't even get their 1st or 2nd grade student out of bed to 'come to school.'" This challenge was brought up much more by elementary teachers (10.7%) when compared to secondary (2.0%). Further, a chi-square test of association revealed that this difference was statistically significant (χ^2 (1, 604) = 21.049, $p < 0.001$) with an effect size of φ = 0.19, which is considered small to moderate (Cohen, 1988).

Teachers were also concerned about supporting students with specific learning needs, such as students on individualized learning plans (IEPs) or students with attention issues. This challenge was discussed by 26 (4.3%) teachers. For example, one teacher stated, "I teach SPED and English Language Development. My students require responsive instruction, both academic and social/emotional. I have found this to be very challenging to do effectively in a remote setting." Teachers struggled to provide the necessary supports and accommodations in the remote format. This challenge was discussed by a slightly higher percentage of elementary teachers (5.2%) than secondary (3.7%), but a chi-square test of association was not statistically significant (χ^2 (1, 604) = 0.766, p = 0.382).

Challenges with Increased Stress and Work

Some teachers reported challenges related to increased workloads and feeling more stressed and less supported in doing their work. This was exacerbated by having children to take care of as well. The frequency of codes related to these challenges can be found in Table 6.

Table 6
Frequency of Codes Related to Teacher Stress and Work, Overall and by Education Level

	Juggling home and work responsibilities, work/home boundary issues		**Additional teaching responsibilities/increased workload**		**Feeling helpless, unsupported, and/or lost in teaching, feeling ineffective**	
	Frequency	**% of *n***	**Frequency**	**% of *n***	**Frequency**	**% of *n***
Total (*n* = 604)	36	6.0%	28	4.6%	18	3.0%
Secondary (*n* = 352)	16	4.5%	15	4.3%	15	4.3%
Elementary (*n* = 252)	20	7.9%	13	5.2%	3	1.2%
Difference between Secondary and Elementary		-3.4%		-0.9%		3.1%*

*$p < 0.05$, $\varphi = 0.09$

Thirty-six teachers (6%) discussed the challenge of trying to balance both work and family responsibilities. With boundaries between work and home life blurred by the switch to working from home, some teachers struggled to create new boundaries. For example, one teacher stated, “Balance of personal and professional life. Stepping away from the ‘office.’” Teachers also struggled with trying to manage their own childcare while remote teaching. One teacher stated, “Juggling my life as a mom and a graduate student with my teaching responsibilities. The lines are completely blurred, and I have zero ‘home life’ without work. It’s impossible to sustain this model.” This challenge was brought up slightly more by elementary (7.9%) than secondary (4.5%). A chi-square test of association approached statistical significance (χ^2 (1, 604) = 3.013, p = 0.083), so it is unclear if a true difference exists between elementary and secondary teachers in regard to experiencing this challenge, or whether that observed difference is due to chance.

Another challenge that was discussed was the increased workload of teaching remotely. This was brought up by 28 teachers (4.6%). These teachers felt like they were working longer hours and had more to do because of remote teaching. For example, one teacher stated, “The up-keep is never ending. There are always lessons to make/post and papers to score/give feedback on. I collect WAY more work since that’s the only way to keep track of attendance.” Another teacher described that their biggest challenge was, “Supporting my students and their families’ health, safety, and wellbeing while still being asked to teach full time. They’re two full time jobs.” For some teachers, shifting to remote teaching from home created double the work for them because of additional childcare responsibilities. A similar proportion of elementary (5.2%) and secondary (4.3%) teachers discussed this challenge, and a chi-square test of association confirmed that no statistically significant difference exists between groups (χ^2 (1, 604) = 0.268, p = 0.605).

Eighteen teachers (3%) brought up that they were feeling lost or unsupported in their teaching. For example, one teacher stated, “I’ve never taken a remote course and I’ve never seen one, even though I have taken all year long full Saturday courses on integrating technology into the learning process. I have no idea if what I’m doing is OK. I’m on my own out here.” Some teachers felt like their teaching was ineffective and that they didn't have the proper supports and resources to create more impactful lessons. Most of the teachers that reported this challenge were at the secondary level, with 4.3% of secondary teachers discussing this challenge compared to 1.2% of elementary teachers. A chi-square test of association revealed that this difference was statistically significant (χ^2 (1, 604) = 4.790, $p < 0.05$) with an effect size of φ = 0.09, which is considered small (Cohen, 1988).

Discussion

The purpose of this study was to investigate challenges teachers faced while remote teaching during the spring of 2020 and whether those challenges were experienced differently by elementary and secondary teachers. This information is important for identifying necessary supports for all teachers, as well as grade-level specific supports. As the pandemic continues, and schools continue to switch between in-person, hybrid, and remote learning, information about how best to support teachers during remote teaching continues to be important.

Overall, teachers reported several challenges across grade levels, including lack of student engagement, attendance, and participation; an overall feeling of disconnect from their students and colleagues; lack of knowledge and/or skill as to how to transfer the curriculum online; a lack of support and resources for students at home; issues with using and accessing technology; and blurred lines between home and work, many of which support findings from earlier research. These issues are highlighted in the following paragraphs.

Student engagement has been found to be lower in remote settings, with teachers struggling more to motivate and engage students online than during in-person learning (De Paepe, Zhu, & DePryck, 2018). This is a challenge that has been reported by online instructors as well (Larkin et al., 2016). Additional supports may be needed at the district and school-level to better support teachers in reaching out to students and increasing engagement. This might look like creating stronger systems for contacting students and families to identify barriers to engagement and better understand students' circumstances. These systems also need to utilize staff members across the school or at the district central office level in order to prevent teachers from feeling overwhelmed by reaching out to students. These supports are needed more at the secondary level, where this challenge was more prevalent for teachers.

Teachers also struggled with feeling disconnected from other people, and their students in particular. Research on teaching motivation has found that teachers often choose this profession because of their desire to work with children and develop meaningful relationships with their students (Lachlan et al., 2020; Watt & Richardson, 2007). A USA Today/Ipsos poll also found that teachers reported not feeling the same connection to their students when teaching remotely (Lardieri, 2020). Larkin et al. (2016) also found that online teachers experience this challenge as well. These findings indicate that teaching remotely may not provide the same opportunities for connection and relationship building as in-person teaching. More strategies may be needed to help teachers build new connections and maintain existing relationships, both with students as well as their families. Virtual home visits or family phone calls may be one way for teachers to continue to work with families and build relationships. However, not all families may have the technology necessary to be able to do virtual visits, which supports the previously mentioned implication that more training sessions are needed for families.

Teachers also struggled to adjust their curriculum to the remote setting, finding it difficult to create the same experiences online that they could in the classroom. Successful online courses are designed as online courses rather than simply face-to-face courses that are delivered online

(Bryson & Andres, 2020), which was not a luxury available to teachers in spring 2020. Courses with hands-on components, such as lab experiments or field experiences, present additional challenges for teachers and students (Barton, 2020; Kelley, 2020). Although longer attention spans and more experience with technology tools may seem to work to the benefit of older students in remote learning settings, this study found that teachers complained of older students' engagement and participation more than younger students. This may be impacted by the adolescents' significantly reduced social interactions with friends, as well as having more autonomy and control over their learning, as student engagement tends to decrease in secondary grades even during non-pandemic times (Hafen et al., 2012). For older students, engagement is likely less dependent on parent involvement, and they also may have additional responsibilities and commitments that could interfere with school (Hafen et al., 2012).

For elementary teachers, adapting the curriculum to the remote/online format and garnering parental support for their students were among the most commonly cited challenges they faced. Other research has found that adapting lessons is harder for younger students as well (Anderson & Hira, 2020). These findings indicate that teachers need additional support in adjusting their curriculum to the online format, or in designing for a remote/blended environment rather than attempting to adjust in-person lessons. Since most teachers were operating from a mindset of adapting and adjusting curriculum rather than creating new lessons, their lessons were likely not as effective as they would have been if intentionally designed for the online format (Pulham & Graham, 2019). This was more prevalent for elementary grades, where teachers struggled more to adapt curriculum to work with younger students remotely. This may suggest that elementary teachers need more professional development and training resources to be able to provide the same quality of educational experiences to their students during remote learning that they did during in-person learning. These findings also have policy implications; additional funding could ensure that schools and districts are able to provide teachers with adequate professional development to better be able to plan lessons for the remote/blended learning formats.

Another challenge that was more common among elementary teachers was the varying attitudes and supports of parents in regard to remote learning. Fewer secondary teachers reported issues getting parents invested in remote learning or in motivating parents to get their children to participate. This is likely connected to secondary students being more autonomous (Hafen et al., 2012), as parent involvement would be less of an issue when students take on more responsibility for their learning. Disparities in parent attitudes and resources were also a challenge for many teachers, but more so elementary teachers. This indicates that teachers may need training related to handling differences in attitudes and knowledge about remote learning among parents. This also connects to the ACE framework and differences in students' available personal supports (Borup et al., 2020). Attitudes about remote learning may have impacted how parents and family members supported their students, leading to additional challenges for teachers. Districts need to provide more consistent expectations related to remote learning for families so that teachers are not tasked with creating and upholding these expectations. Family training sessions are also needed in multiple languages so that families are able to access the correct technology to be able to support their students while remote learning. At the policy level, additional funding is needed to ensure that families are provided with the proper devices and infrastructure (such as adequate training and WiFi hotspots) to be able to support their students' learning.

Teachers also reported struggling to juggle home and work responsibilities while remote teaching. This aligns with past research on online teaching, which found that online teachers struggled to separate work and home when the physical boundaries were erased (Knott, 2014). More recent research has also found that teachers reported increased workload and feeling a loss of control at work, which could impact home life as well (MacIntyre et al., 2020). This indicates that teachers may need stronger boundaries and expectations between work and home, which may need to be set at the school or district administration to create clear guidelines for teachers, students, and families around teachers' schedules and communication expectations.

Technology issues were reported by some teachers but were not as common as might be expected given that many teachers and students may not have used the technology and devices before (Blagg & Luetmer, 2020). This may have been because the survey specifically asked about technology issues earlier in the survey and teachers therefore did not feel the need to bring them up again in their open-ended responses (see Leech, Gullett, Howland Cummings, & Haug, 2020).

Limitations

The current study had several limitations, including primarily the ability to generalize results based on the sample. The response rate was low as a result of the survey being distributed during a pandemic. While it was an adequate size given the circumstances, it may not have contained the full range of teacher experiences. It is possible that only those who felt strongly about remote teaching took the survey, or that those who were most overwhelmed by remote teaching did not have the time or energy to take the survey. This study also did not control for challenges that teachers may have faced prior to remote teaching.

Future Research

Additional research is needed on the support that teachers need while remote teaching. While the current study looked at differences by grade level, differences by content area should also be explored to better understand whether specific subjects are more difficult for teachers to teach remotely. With hybrid learning and in-person learning with COVID restrictions continuing to be necessary in schools as the pandemic continues, research is also needed regarding teachers' experiences switching nimbly among teaching formats.

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References

Adams, K. S., & Christenson, S. L. (2000). Trust and family-school relationship examination of parent-teacher differences in elementary and secondary grades. *Journal of School Psychology, 38*(5), 477–497. https://doi.org/10.1016/S0022-4405(00)00048-0

Alvarez, D. (2010). "I had to teach hard": Traumatic conditions and teachers in post-Katrina classrooms. *The High School Journal*, *94*(1), 28–39. https://doi.org/10.1353/hsj.2010.0007

American Federation of Teachers (2017). *2017 educator quality of work life survey.* American Federation of Teachers.

Anderson, E., & Hira, A. (2020). Loss of brick-and-mortar schooling: How elementary educators respond. *Information and Learning Sciences*, *121*(5/6), 411–418. https://doi.org/10.1108/ILS-04-2020-0085

Arnesen, K. T., Hveem, J., Short, C. R., West, R., & Barbour, M. K. (2019). K–12 online learning journal articles: Trends from two decades of scholarship. *Distance Education, 40*(1), 32–53. https://doi.org/10.1080/01587919.2018.1553566

Barbour, M. K. (2007). Teacher and developer perceptions of effective web-based design for secondary school students. *Journal of Distance Education*, *21*(3), 93–114.

Barbour, M. K. (2013). The landscape of K–12 online learning: Examining what is known. In M. G. Moore (Ed.), *Handbook of distance education* (3rd ed.) (pp. 574–593). Routledge.

Barbour, M. K., & Reeves, T. C. (2009). The reality of virtual schools: A review of the literature. *Computers & Education*, *52*(2), 402–416. https://doi.org/10.1016/j.compedu.2008.09.009

Barton, D. C. (2020). Impacts of the COVID-19 pandemic on field instruction and remote teaching alternatives: Results from a survey of instructors. *Ecology and Evolution, 10*(22), 12499–12507. https://doi.org/10.1002/ece3.6628

Berge, Z. L., & Clark, T. (2005). *Virtual schools: Planning for success.* Teachers College Press.

Bernhard, H. C. (2016). Investigating burnout among elementary and secondary school music educators: A replication. *Contributions to Music Education, 41,* 145–156.

Blagg, K., & Luetmer, G. (2020, April 28). Even before the pandemic, students with limited technology access lagged behind their peers. *Urban Institute*. https://www.urban.org/urban-wire/even-pandemic-students-limited-technology-access-lagged-behind-their-peers

Borup, J., Graham, C. R., West, R. E., Archambault, L., & Spring, K. J. (2020). Academic Communities of Engagement: An expansive lens for examining support structures in blended and online learning. *Educational Technology Research and Development*, *68*(2), 807–832. https://doi.org/10.1007/s11423-020-09744-x

Borup, J., Graham, C. R., & Drysdale, J. S. (2014). The nature of teacher engagement at an online high school. *British Journal of Educational Technology.* https://doi.org/10.1111/bjet.12089

Bryson, J. R., & Andres, L. (2020). Covid-19 and rapid adoption and improvisation of online teaching: Curating resources for extensive versus intensive online learning experiences. *Journal of Geography in Higher Education, 44*(4), 608–623. https://doi.org/10.1080/03098265.2020.1807478

Bullough, R. V. (1987). First-year teaching: A case study. *Teachers College Record, 89*(2), 219–237.

Burke, R. (1996). Predicting teacher burnout over time: Effects of work stress, social support, and self-doubts on burnout and its consequences. *Anxiety, Stress, and Coping: An International Journal*, *9*(3), 261–275. https://doi.org/10.1080/10615809608249406

Cavanaugh, C., Gillan, K. J., Bosnick, J., Hess, M., & Scott, H. (2005). *Succeeding at the gateway: Secondary algebra learning in the virtual school.* University of North Florida.

Chen, K., Chen, Y., Ling, Y., & Linn, J. (2020). The individual experience of online chemistry teacher education in China: Coping with COVID-19 pandemic. *Journal of Chemistry Education*, *97*(9), 3265–3270. https://doi.org/10.1021/acs.jchemed.0c00581

Chen, T., Peng, L., Yin, X., Rong, J., Yang, J., & Cong, G. (2020). Analysis of user satisfaction with online education platforms in China during the COVID-19 pandemic. *Healthcare, 8*(3), 200. https://doi.org/10.3390/healthcare8030200

Clark, T. (2013). The evolution of K–12 distance education and virtual schools. In M. G. Moore (Eds.), *Handbook of distance education* (3rd ed.) (pp. 555–573). Routledge.

Coates, T., & Thoressen, C. (1978). Teacher anxiety: A review with recommendations. *Review of Educational Research, 52*(2), 159–184. https://doi.org/10.3102/00346543046002159

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*, 37–46. https://doi.org/10.1177/001316446002000104

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.

Conrad, D., & Kellar-Guenther, Y. (2006). Compassion fatigue, burnout, and compassion satisfaction among Colorado child protection workers. *Child Abuse and Neglect*, *30*(10), 1071–1080. https://doi.org/10.1016/j.chiabu.2006.03.009

Cooze, M., & Barbour, M. K. (2005). Learning styles: A focus upon e-learning practices and pedagogy and their implications for success in secondary high school students in Newfoundland and Labrador. *Malaysian Online Journal of Instructional Technology, 2*(1).

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage.

De Paepe, L., Zhu, C., & Depryck, K. (2018). Online language teaching: Teacher perceptions of effective communication tools, required skills and challenges of online teaching. *Journal of Interactive Learning Research, 29*(1), 129–142.

DiPietro, M., Ferdig, R. E., Black, E. W., & Preston, M. (2008). Best practices in teaching K–12 online: Lessons learned from Michigan Virtual School teachers. *Journal of Interactive Online Learning, 7*(1), 10–35.

EDUCAUSE. (2020). *EDUCAUSE DIY Survey Kit: Remote Work and Learning Experiences.* https://er.educause.edu/blogs/2020/4/educause-diy-survey-kit-remote-work-and-learning-experiences

Epps, E. G., & Smith, S. F. (1984). The middle school years. In W. A. Collins (Ed.), *Development during middle childhood the years from six to twelve.* National Academies Press. https://www.ncbi.nlm.nih.gov/books/NBK216779/

Ferdig, R. E., Cavanaugh, C., DiPietro, M., Black, E., & Dawson, K. (2009). Virtual schooling standards and best practices for teacher education. *Journal of Technology and Teacher Education*, *17,* 479–503.

Gallup. (2013). *State of America's schools report.* Gallup.

Gonzalez, L. E., Brown, M. S., & Slate, J. R. (2008). Teachers who left the teaching profession: A qualitative understanding. *The Qualitative Report, 13*(1), 1–11.

Hafen, C. A., Allen, J. P., Mikami, A. Y., Gregory, A., Hamre, B., & Pianta, R. C. (2012). The pivotal role of adolescent autonomy in secondary school classrooms. *Journal of Youth Adolescence*, *41*(3), 245–255. https://doi.org/10.1007/s10964-011-9739-2

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology*, *8*, 23–34. https://doi.org/10.20982/tqmp.08.1.p023

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*(2), 377–381. doi:10.1016/j.jbi.2008.08.010

Heim, J. (2020, October 6). Pandemic teaching, in their words. *The Washington Post*. https://www.washingtonpost.com/education/2020/10/06/teacher-pandemic-essays/?arc404=true

Herold, B. (2020, March 27). The scramble to move America's schools online. *Education Week.* https://www.edweek.org/ew/articles/2020/03/26/the-scramble-to-move-americas-schools-online.html

Howard, P., & Howard, J. (2012). Pandemic and pedagogy: Elementary school teachers' experience of H1N1 influenza in the classroom. *Phenomenology & Practice*, *6*(1), 18–35. https://doi.org/10.29173/pandpr19852

Hu, M., Arnesen, K., Barbour, M. K., & Leary, H. (2019). A newcomer's lens: A look at K–12 online and blended learning in the *Journal of Online Learning Research*. *Journal of Online Learning Research*, *5*(2), 123–144.

Ingersoll, R., & Perda, D. (2014). *How high is teacher turnover and is it a problem?* Consortium for Policy Research in Education.

Kelley, E. (2020). Reflections on three different high school chemistry formats during COVID–19 remote learning. *Journal of Chemistry Education.* https://doi.org/10.1021/acs.jchemed.0c00814

Knott, H. E. (2014). *"You can get lost in here": The struggle for student-teacher rapport and work-life balance for online teachers* [Unpublished doctoral dissertation]. Roosevelt University.

Lachlan, L., Kimmel, L., Mizrav, E. & Holdheide, L. (2020). *Advancing quality teaching for all schools: Examining the impact of COVID-19 on the teaching workforce.* Center on Great Teachers & Leaders at the American Institutes for Research. https://gtlcenter.org/sites/default/files/Examining_Impact_COVID-19_Workforce.pdf

Larkin, I., Brantley-Dias, L., & Lokey-Vega, A. (2016). Job satisfaction, organizational commitment, and turnover intention of online teachers in the K–12 setting. *Online Learning*, *20*(3). https://doi.org/10.24059/olj.v20i3.986

Landis, J. R., & Koch, G. G. (1977). An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. *Biometrics*, *33*(2), 363–74. https://doi.org/10.2307/2529786

Lardieri, A. (2020). 1-in-5 teachers unlikely to return to schools if reopened in the fall, poll finds. *U.S. News and World Report.* https://www.usnews.com/news/education-news/articles/2020-05-26/1-in-5-teachers-unlikely-to-return-to-schools-ifreopened-in-the-fall-poll-finds

Lavian, R. H. (2012). The impact of organizational climate on burnout among homeroom teachers and special education teachers (full classes/individual pupils) in mainstream schools. *Teachers and Teaching: Theory and Practice, 18*, 233–247. https://doi.org/10.1080/13540602.2012.632272

Leachman, M., Albares, N., Masterson, K., & Wallace, M. (2016). Most states have cut school funding, and some continue cutting. *Center on Budget and Policy Priorities*. https://www.cbpp.org/sites/default/files/atoms/files/12-10-15sfp.pdf

Leech, N. L., Benzel, E., Gullett, S., & Haug, C. A. (2020). *Teachers' perceptions of work life during the pandemic of COVID-19: Validating the use of professional quality of life scale.* Manuscript submitted for publication.

Leech, N. L., Gullett, S., Howland Cummings, M., & Haug, C. A. (2020). Challenges of remote teaching for K–12 teachers during COVID-19. *Journal of Educational Leadership in Action, 7*(1).

Leech, N. L., & Onwuegbuzie, A. J., 2009. A typology of mixed methods research designs. *Quality & Quantity, 43*(2), 265–275. doi.org/10.1007/s11135-007-9105-3.

Lieberman, M. (2020, July 22). COVID-19 and remote learning: How to make it work. *Edweek*. https://www.edweek.org/ew/issues/reopening-schools/covid-19-remote-learning-how-to-make-it.html

Lincove, J. A., Barrett, N., & Strunk, K. O. (2017). *Did the teachers dismissed after Hurricane Katrina return to public education?* Education Research Alliance for New Orleans. https://educationresearchalliancenola.org/files/publications/053117-Lincove-Barrett-Strunk-Did-the-Teachers-Dismissed-after-Hurricane-Katrina-Returnto-Public-Education.pdf

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2002). Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human Communication Research*, *28*, 587–604. https://doi.org/10.1111/j.1468-2958.2002.tb00826.x

MacIntyre, P. D., Gregersen, T., & Mercer, S. (2020). Language teachers' coping strategies during the COVID-19 conversion to online teaching: Correlations with stress, wellbeing and negative emotions. *System, 94*, 102352. https://doi.org/10.1016/j.system.2020.102352

Marcus-Quinn, A., & Hourigan, T. (Eds.). (2016). *Handbook on digital learning for K–12 schools*. Springer, Cham.

McLeod, S., Hughes, J. E., Brown, R., Choi, J., & Maeda, Y. (2005). *Algebra achievement in virtual and traditional schools.* Learning Point Associates.

Meyers, T. W., & Cornille, T. A. (2002). The trauma of working with traumatized children. In C. R. Figley (Ed.), *Treating compassion fatigue* (pp. 39–56). Brunner-Routledge.

Midgley, C., Anderman, E., & Hicks, L. (1995). Differences between elementary and middle school teachers and students: A goal theory approach. *The Journal of Early Adolescence*, *15*(1), 90–113. https://doi.org/10.1177/0272431695015001006

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* Sage.

Mupinga, D. M. (2005). Distance education in high schools: Benefits, challenges, and suggestions. *The Clearing House, 78*(3), 105–108. https://doi.org/10.3200/TCHS.78.3.105-109

Organisation for Economic Co-operation and Development (2019). *Education at a glance 2019: OECD indicators.* OECD Publishing.

Pulham, E., & Graham, C. R. (2018). Comparing K–12 online and blended teaching competencies: A literature review. *Distance Education*, *39*(3), 411–432. https://doi.org/10.1080/01587919.2018.1476840

Rae, S. (2020, April 23). Teachers and students describe a remote-learning life. *The New York Times.* https://www.nytimes.com/2020/04/23/education/learning/coronavirus-teachers-students-remote-learning.html

Raes, A., Vanneste, P., Pieters, M., Windey, I., Noortgate, W. V. D., & Depaepe, F. (2020). Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. *Computers & Education*, *142*, 1–16. https://doi.org/10.1016/j.compedu.2019.103682

Richards, K. A. R., Levesque-Bristol, C., Templin, T. J., & Graber, K. C. (2016). The impact of resilience on role stressors and burnout in elementary and secondary teachers. *Social Psychology of Education*, *19*, 511–536. https://doi.org/10.1007/s11218-016-9346-x

Shank, D. B., & Cotten, S. R. (2013). Does technology empower urban youth? The relationship of technology use to self-efficacy. *Computers & Education, 70*, 184–193. http://doi: 10.1016/j.compedu.2013.08.018

Shin, H., Noh, H., Jang, Y., Park, Y. M., & Lee, S. M. (2013). A longitudinal examination of the relationship between teacher burnout and depression. *Journal of Employment Counseling, 50*(3), 124–137. https://doi.org/10.1002/j.2161-1920.2013.00031.x

Stamm, B. H. (2010). *The concise ProQOL manual* (2nd ed.). www.ProQOL.org

Trust, T., & Whalen, J. (2020). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. *Journal of Technology and Teacher Education*, *28*(2), 189–199.

Watt, H. M., & Richardson, P. W. (2007). Motivational factors influencing teaching as a career choice: Development and validation of the FIT-Choice scale. *The Journal of Experimental Education, 75*(3), 167–202. https:doi.org/10.3200/JEXE.75.3.167-202

Wedemeyer, C. A. (1981). *Learning at the back door: Reflections on the non-traditional learning in the lifespan.* University of Wisconsin Press.

Yao, J., Rao, J., Jiang, T., & Xiong, C. (2020). What role should teachers play in online teaching during the COVID-19 pandemic? Evidence from China. *Science Insight Education Front, 5*(2), 517–524. https://doi.org/10.15354/sief.20.ar035

Yavuz, M. (2009). An investigation of burn-out levels of teachers working in elementary and secondary educational institutions and their attitudes to classroom management. *Educational Research and Reviews, 4*, 642–649.

Cheating on Unproctored Online Exams: Prevalence, Mitigation Measures, and Effects on Exam Performance

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Abstract
As online courses become increasingly common at the college level, an ongoing concern is how to ensure academic integrity in the online environment. One area that has received particular attention is that of preventing cheating during unproctored online exams. In this study, we examine students' behavior during unproctored exams taken in an online introductory biology course. A feature of the learning management platform used for the course gave us the ability to detect cheating behavior involving students leaving the test page and viewing other material on their computers. This allowed us to determine what proportion of students cheated and examine the efficacy of various measures to mitigate cheating. We also explored the relationship between cheating behavior and exam performance. We found that 70% of students were observed cheating, and most of those who cheated did so on the majority of test questions. Appealing to students' honesty or requiring them to pledge their honesty were found to be ineffective at curbing cheating. However, when students received a warning that we had technology that could detect cheating, coupled with threats of harsh penalties, cheating behavior dropped to 15% of students. Unexpectedly, we did not find evidence that students' exam performance changed when their cheating behavior changed, indicating that this common form of cheating might not be as effective as students, or their instructors believe it to be.

Keywords: cheating, online exams, undergraduate, proctor, academic honesty

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Ensuring post-secondary students' academic integrity is a long-standing concern of colleges and universities. With the proliferation of online resources and online coursework, maintaining high standards for academic honesty has become increasingly complex (Spaulding, 2009). The information and communication technologies that have enabled online education are boons in many respects, but they have also given students new and powerful means to engage in dishonest behavior (Dyer et al., 2020; Stogner et al., 2013; Watson & Sottile, 2010).

Student behavior during online unproctored testing is an area of particular concern for college faculty (McNabb & Olmstead, 2009)—a concern made even more relevant by the COVID-19 pandemic when unproctored online tests became the norm. In a recent survey conducted by Wiley (2020), 93% of instructors indicated a belief that students were more likely to cheat on online unproctored tests than on proctored tests. Those concerns are supported by a growing body of empirical work that has found evidence of cheating during unproctored online exams (Alessio et al., 2017, 2018; Fask et al., 2014; Hylton et al., 2016). Many instructors and institutions are therefore turning toward technologies such as Lockdown Browser (Respondus, 2020a) or webcam-based monitoring services that enable remote proctoring (e.g., Respondus, 2020b). However, those technologies come with substantial drawbacks in that they are both costly and invasive (Flaherty, 2020).

The present study examines the problem of cheating during unproctored online exams in the context of an undergraduate introductory biology course. We investigate the prevalence of cheating on the exams in the course and the extent to which various non-invasive measures inhibited cheating. A unique aspect of this study is that we were able to detect whether, during an exam, students navigated away from the test webpage and viewed other pages or documents open on the desktop. Viewing unauthorized materials is a particularly common form of cheating (Stephens et al., 2007), and we were able to determine how different mitigation strategies affected the prevalence of that cheating behavior. We also explore how cheating behaviors are associated with test performance. We address the following research questions:

1) What percentage of students exhibit cheating behaviors when taking tests in an unproctored environment?
2) What percentage of students exhibit cheating behaviors when (a) an appeal is made to their conscience to uphold academic integrity, (b) they have to sign an honesty pledge, or (c) are told they are being surveilled?
3) How are cheating behaviors related to test performance?

Literature Review

Studying students' cheating behavior during tests is inherently difficult. Direct observational evidence for student cheating is often difficult to obtain, and students have good reason not to admit to cheating, even on anonymous surveys (Kervliet & Sigmunn, 1999). Surveys of students in online courses have not always indicated that online environments lead to more cheating than face-to-face ones, although there is some evidence that students are more likely to consult unauthorized materials during online exams (Grijalva et al., 2006; Stephens et al., 2007; Stuber-McEwen et al., 2009; Watson & Sottile, 2010). A recent survey by Dyer, Pettyjohn, and Saladin (2020) highlights that concern and also raises the importance of proctors during exams. They examined student reports of cheating behavior in proctored and unproctored settings, as well as students' beliefs about the acceptability of various dishonest behaviors. Notably, they found that students viewed certain dishonest behaviors, including looking up answers in unauthorized materials, as *more acceptable* in unproctored settings. Many students seemed to believe that a lack of a proctor meant that the instructor was not serious about certain resources being "off limits."

Although surveys of students can be informative, investigations of cheating that go beyond self-reports are essential. In an unproctored online setting, directly observing student cheating behavior is naturally quite challenging, barring the use of surreptitious monitoring (Kervliet & Sigmunn, 1999). Researchers who have investigated this phenomenon have therefore typically used student exam scores as an indicator of possible cheating behavior. If exam scores for students taking online unproctored exams are higher than those for students in proctored settings, then cheating is inferred.

Hollister and Berenson (2009) compared exam performance between two sections of the same course in which the only difference was that students in one section took exams in-person with proctors whereas the other took the exams online without a proctor. After controlling for a variety of covariates, they found no differences between the performances of the two sections. Beck (2014) similarly found that while variables such as students' GPA was predictive of test scores, the presence of proctors was not. However, a carefully controlled study by Fask, Englander, and Wang (2014) reached the opposite conclusion. They reasoned that in order to compare an in-person proctored exam with an online unproctored exam, the test setting (classroom versus home) also needs to be considered in order to discern the proctor effect. After controlling for setting, Fask, Englander, and Wang found evidence of elevated scores among students in the unproctored group, which they attributed to cheating behavior.

In recent years, technologies have been developed that enable online exams to be proctored even when taken from home. Typically, these technologies involve using webcams and/or screen-sharing to monitor student behavior during an online exam (Dunn et al., 2010; Flaherty, 2020; Grajek, 2020). Recent studies have investigated the impact of those technologies on student exam performance in online courses. Hylton, Levy, and Dringus (2016) randomly assigned students in an online course to an unproctored or webcam-based proctoring condition during exams. They found that students in the unproctored group had elevated exam scores and also took longer to complete their exams. The same findings were obtained in a sequence of studies by Alessio et al. (2017, 2018), who also studied the effects of webcam-based proctoring on the exam performance of online students.

The above studies suggest that webcam-based proctoring technologies are effective in reducing cheating behavior, but there remain multiple unresolved issues. Hylton, Levy, and Dringus (2016) as well as Alessio et al. (2017, 2018) found that students took longer to complete unproctored exams, but the extent to which that finding is indicative of cheating is not clear. Hylton, Levy, and Dringus (2016) point out the ambiguous role of test time and argue for its further study. This is particularly important because tightly limiting students' time to complete online exams is often suggested as a method of curtailing cheating (e.g., Cluskey et al., 2011). In addition, even if webcam-based proctoring technologies inhibit cheating, they are costly for institutions to implement and are disliked by students due to their invasiveness (Flaherty, 2020; Grajek, 2020). That invasiveness itself might reduce student test performance by making students nervous and uncomfortable (Hylton et al., 2016). Finally, the research on student behavior during online exams does not indicate how widespread cheating behavior is. Although studies have found elevated test performance *on average* during unproctored exams, what is unclear is what *proportion* of students are driving that elevation.

Overall, if a goal is to curtail student cheating during online exams, webcam-based proctoring is potentially effective but heavy-handed. Given the proliferation of online courses, the phenomenon of cheating needs to be better understood before costly technologies are deployed. At the same time, it is worth investigating whether less costly and less invasive options might also be effective in curtailing cheating behavior. As noted above, one common suggestion is to limit the amount of time students have to complete online exams (Cluskey et al., 2011; McGee, 2013). Another low-cost option is to have students pledge their adherence to academic honesty at the beginning of each online exam. Prior studies suggest that honesty is promoted by requiring participants to make affirmations of their honesty prior to engaging in tasks where cheating is likely to occur (e.g., Mazar et al., 2008).

Contribution of the Present Study

Many of the studies reviewed above rely on the assumption that elevated test scores (and in some cases, test times) are indicative of cheating. On its face, that is a reasonable assumption, but it treats student behavior in aggregate and as a black box, one that we aim to open up in the present study. In this study, we examine the test-taking behavior and performance of students in an undergraduate online biology course who completed exams without a proctor. We were able to detect the test-taking behavior of individual students using an Action Log created by the learning management software used in the course: Canvas (Instructure, 2020). The most likely way for students to cheat in an unproctored setting is to search the internet or view electronic notes on their computer. The Action Log provides data on when a student leaves the test page and examines other material.

We use the Action Log data to illuminate several important issues. First, we examine the prevalence of dishonest student behavior after several different non-invasive measures were implemented to attempt to curtail it. These measures were non-invasive in that they did not involve webcam-based monitoring of student behavior, nor the installation of any specific software. Second, we examine how students' engagement in cheating behaviors was related to their test performance. Because we are able to examine students' behavior at the individual level, we can more effectively investigate that relationship by not relying on aggregate performance.

Methods

Context

This study examines an online undergraduate introductory biology course at a large research university located in the Midwestern United States. The study was motivated by the university's response to the COVID-19 pandemic in the spring of 2020. Midway through that semester, students were sent home to complete their courses. At the beginning of that semester, students enrolled in the online biology course took their exams in the university testing center with a proctor present. After the students went home, all exams were taken on their own, without a proctor. We were naturally concerned about the possibility of cheating during those unproctored exams, and we noticed a marked increase in students' test scores after they were sent home. To more carefully investigate that phenomenon, we designed the present study to take place during the online course that ran during summer of 2020.

The biology course has been taught by the second author completely online for many years. It is an introductory-level course required for many science majors and the first of a two-course sequence. In summer 2020, 66 students completed the course, 23% of whom were freshmen, 37% sophomores, 28% juniors and 12% seniors. The course is taught completely asynchronously. The lecture materials in the course consist of presntation slides with voice-over narration. The text portion of the slides is compiled into lecture notes that are electronically provided to the students along with portable document files of all the presentation slides.

The course has 8 exams, all of which are delivered within the Canvas Learning Management System (Instructure, 2020). The summer course runs for 12 weeks and there are 4 testing deadlines, occurring every 3 weeks. The first 2 exams must be done by the first deadline, the second two exams by the second deadline, and so on. Each pair of tests remains open for the entire 3 week period. Each exam has 20 questions drawn from a bank of over 100 questions and includes a mixture of multiple-choice and short-answer questions. Short-answer questions require students to input a few words or sentences in a text box. The multiple-choice questions are machine graded; the short-answer questions are graded by a teaching assistant. Although the mix of multiple-choice and short-answer questions varies by exam, on average less than 10% the questions are short-answer.

Exam Conditions

Under normal circumstances, the exams in the course are taken at a university testing center with a proctor present or, if the student is not on campus, with an approved proctor present. During the summer of 2020, students took all of their exams from home without a proctor. Given our concerns about potential cheating, we decided to try several measures to limit cheating behavior.

For the first exam, we split the course into two equal-sized groups using random assignment. One group (the “Appeal” group) was sent the following message at the beginning of the course, and the message was included as a header on the first exams:

> It is important for the integrity of this course, the meaningfulness of grades, and fairness to other students that you do not use notes or any other materials while taking these tests.

The other group (the “Pledge” group) was required to respond true/false to a statement at the beginning of the first exam. The statement was: “I have not used notes or any other material while taking this test.” For Exams 2 to 4, all students were assigned to the “Pledge” condition.

Second, to see if more restrictive time limits on tests could curb cheating, we imposed tight time constraints on the first two exams for all students. For Exams 1 and 2 in summer 2020, we set the time equal to the historical mean for proctored tests plus one standard deviation, for a time limit of 20 minutes. For Exams 3 and 4, we loosened the time restriction; the time limit was set equal to the historical mean plus 2.5 standard deviations, or 30 minutes for Exam 3 and 40 minutes for Exam 4.

Midway through the semester, after Exams 1 to 4 were completed, we found that none of our measures were effective at curbing cheating behaviors. We therefore instituted a third approach for the remaining four tests: a stronger warning coupled with a notification of surveillance. All students were sent the following message:

> This is a warning that due to concerns about students cheating on tests we now have the capability of monitoring student activity while taking tests. If I detect suspicious behavior on any of the remaining tests, I will have to take administrative action.
>
> REPLY TO THIS E-MAIL TO LET ME KNOW YOU UNDERSTAND THIS WARNING.

That message was then placed as a header on every test (minus the third statement requesting a reply via email). Importantly, the statement was deliberately vague about how students were being monitored. Students may have thought that they were being observed via their webcam or some other unknown means. We reasoned that if students knew exactly how they were being monitored (and how they were not), they might simply cheat in ways that they knew we could not detect. By using vague language, we hoped to reduce cheating in general rather than just one specific means of cheating. In addition, for students whose Action Logs still showed cheating behavior on Tests 5 and 6, the instructor sent the following email message:

> [Student name], I noticed that you have had other web pages open when you are taking exams. You must have just the test webpage open and remain on that page while you are taking an exam. If you are accessing notes on other pages during the test, I can't be certain of the tests' validity. If I see evidence of this on the remaining exams, I will be forced to give you zeros.

Data Collection

The data collected for the present study include students' scores on the eight exams, times to complete each of the exams, and Action Logs of students' behavior on the exams, described more extensively below. All data were anonymized by the instructor before analysis.

Characterizing Student Behavior

When an online exam is completed within Canvas, an Action Log is created that records a student's activity during an exam. It creates a time stamp when a student answers a question as well as when a student leaves the test page to view another page. A detailed guide describing the data produced by the Action Logs and how we interpreted them is included in the supplemental materials. The Action Logs provide an indication of cheating because the most likely way for a student to cheat is to consult disallowed materials on their computer (such as a website or the lecture notes that they were provided). Doing so, however, would require that the student navigate away from the exam page, which would be recorded in the Action Log. Of course, not all cases of leaving the test page are necessarily instances of cheating; a student might, for instance, be answering an email or responding to a social media message. Repeated instances of leaving the test page, however, are unlikely to be so benign.

Operationally, we defined an instance of "cheating on an exam question" as occurring when the Action Log indicated that a student had left the exam page prior to answering that question. If there were no instances of leaving the test page between a student answering a question and having answered the previous one, then we defined that as a non-instance of cheating. The vast majority of exam questions were multiple-choice, but some tests had one or more short-answer questions that required students to type a few words or sentences into a text box on the test page. We excluded short-answer questions from analysis because certain web browsers create false instances of leaving the test page when students type into a text box.

For each exam taken by each student, we determined the "Extent of Cheating" that occurred on the exam. To do this, we calculated the proportion of the multiple-choice exam questions that were answered (i.e., not skipped) by the student and that were categorized as instances of cheating. An Extent of Cheating of 0.50, for instance, would indicate that the student had cheated on half of the multiple-choice questions that they answered on the exam.

For each exam taken by a student, we then categorized the *exam as a whole* as an instance of "cheating" or "not cheating" based on the Extent of Cheating present on the exam. If the Extent of Cheating was a proportion of 0.15 or greater, then that exam was scored as cheated. We chose that cutoff point to avoid potential false positives caused by a student leaving the test page once or twice for reasons other than cheating. An Extent of Cheating of 0.15 or greater would indicate that the student left the exam page for more than on 3 out of the 20 questions. As described below, this cutoff value led to extremely few borderline cases; exams categorized as instances of cheating almost universally showed Extents of Cheating far greater than 0.15.

Standardization of Test Scores

To address our research questions, we needed to make comparisons between different exams within the course, which were not necessarily of equal difficulty. To enable those comparisons, we converted students' raw test scores to standardized ones. To do that, we first calculated the average exam score and standard deviation for exams taken during three previous semesters of running the course (all with proctored exams). We used those historical data to provide an estimate of the degree of difficulty for each exam. We then converted students' exam scores for the summer 2020 section to Z scores based on the historical means and standard deviations.

Results

Prevalence of Cheating

Table 1 summarizes the testing conditions for each of the exams as well as the prevalence of cheating behaviors on each one. In the sections that follow, we discuss how the different testing conditions affected rates of cheating. Worth noting at the outset, however, are the very high rates of cheating that occurred during the first four exams.

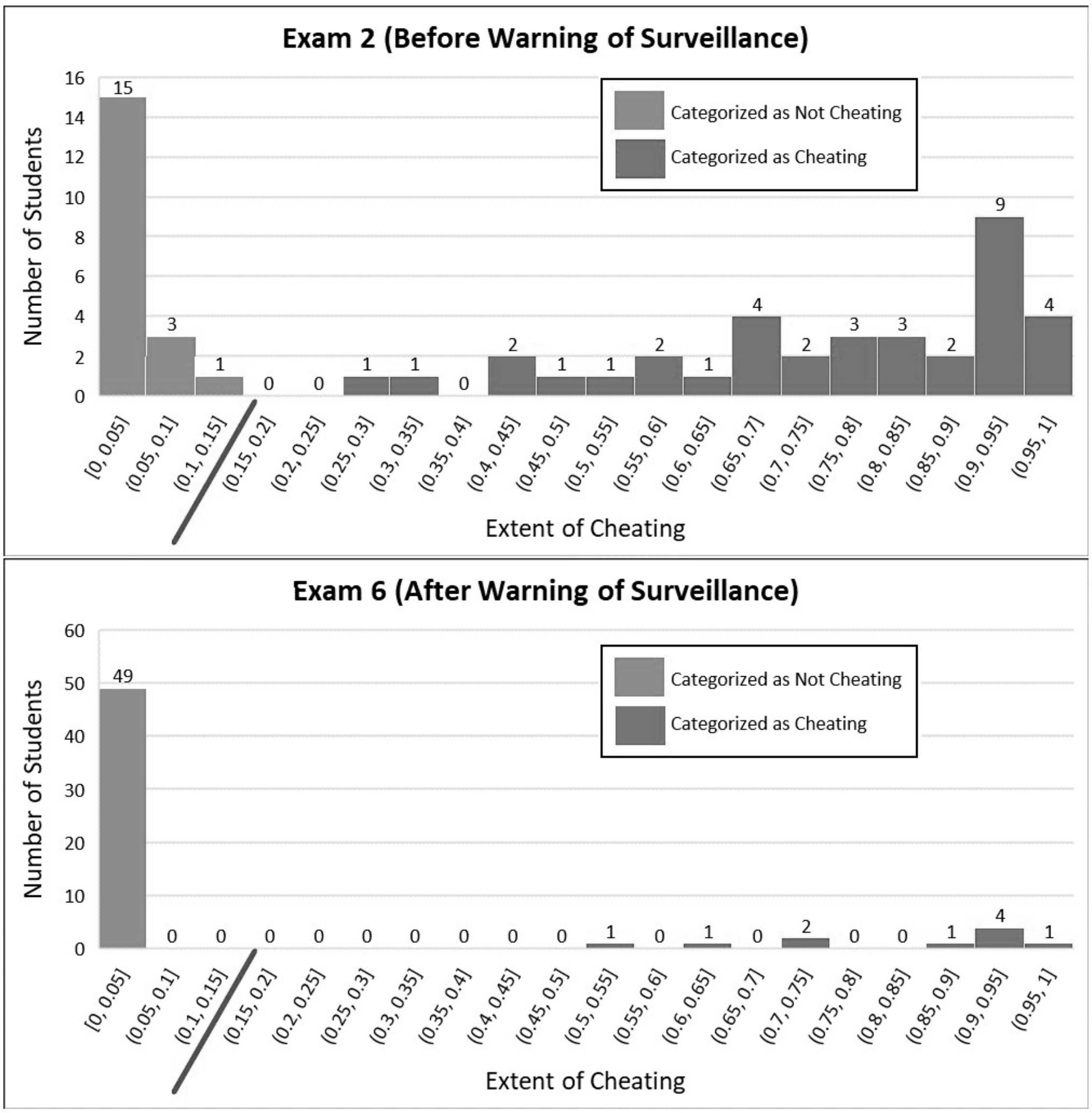
Table 1
Frequency and Extent of Cheating Behavior

Testing Conditions			n	Students Engaging in Cheating Behavior (%)	Average Extent of Cheating [a]
Exam 1	Restricted Time	Appeal Group	31	68	0.69
		Pledge Group	30	70	0.77
Exam 2		Honesty Pledge	62	69	0.75
Exam 3	Less Restricted Time	Honesty Pledge	61	67	0.79
Exam 4			61	72	0.71
Exam 5		Surveillance Warning	59	20	0.71
Exam 6			59	17	0.81
Exam 7		Surveillance Warning + Emails	60	10	0.50
Exam 8			60	12	0.72

Extent of Cheating is defined as the proportion of multiple-choice questions on which a student cheated. Average Extent of Cheating is calculated using data only from students who engaged in cheating behavior.

On each exam, approximately 70% of students were engaged in cheating. Moreover, when students *did* cheat, they tended to do so a great deal. Figure 1 shows the distribution of the extent of cheating on Exam 2 and Exam 6, which are representative of exams with high rates of cheating and low rates of cheating, respectively. While five of the students who cheated on Exam 2 did so on less than half of the questions, most students did so on the majority of the questions, and 15 students cheated on 90% or more of the questions. Although relatively few students cheated on Exam 6, those who did showed a similar pattern in that they tended to cheat on most of the questions rather than just a few.

Figure 1
Extent of Cheating on Two Representative Online Exams



Note. Extent of Cheating is defined as the proportion of multiple-choice exam questions for which there was evidence of cheating. The cutoff point (marked by the red line) for categorization was defined as an Extent of Cheating of 0.15.

Effects of Mitigation Measures on Cheating Behaviors

Appeal versus Pledge of Honesty

As can be seen in Table 1, the rates of cheating as well as the extent of cheating were high for both the Appeal and Pledge groups. Between the two groups, there was a small apparent difference between the proportion of students who cheated and a slightly larger apparent difference in the extent of cheating. To test whether those differences are statistically significant, we first used a Z-test to compare the percentage of students who cheated across the two groups; the Z-test is appropriate here as it allows for the comparison of proportions. The results of that test indicate that the small difference between the two groups is not statistically significant ($Z = 0.169$, $p = .865$). To examine whether the different extent of cheating between the Appeal and Pledge conditions was statistically significant, we used an independent-samples t-test. The t-test was appropriate in this case given that we were comparing mean values (extent of cheating) rather than proportions. We found no statistically significant difference in the extent of cheating between the groups ($t(41) = 1.02$, $p = .318$). In sum, neither an appeal nor honesty pledge appears to be particularly effective at curbing student engagement in cheating behavior. Because we found no statistically significant differences between the two conditions, data from these two groups were combined for all the analyses that follow.

Time Limits

Table 2 provides summary statistics for the time taken on the first four exams. As a point of comparison, we also include historical exam times taken from the previous three semesters of the course. As shown in Table 2, the first two exams had a relatively tight time restriction, which was then relaxed for Exams 3 and 4. After the time limits were relaxed, there is an apparent increase in exam times for summer 2020 students. To investigate whether that increase was statistically significant, we used a paired-samples t-test to compare students' time taken on Exam 2 and Exam 3. We used a paired test here because we were comparing students' time taken on Exam 2 to their own times to complete Exam 3 (paired tests are used in many subsequent analyses for the same reason). The results of that test indicate that, on average, students took longer to complete Exam 3 than they did to complete Exam 2 ($t(64) = 5.649$, $p < .0001$). The increase is unlikely to be attributable to the relative lengths of the exams; as seen in the historical data, students have generally taken less time, not more, on Exam 3 versus Exam 2.

As time limits were relaxed, we investigated whether the percentage of students who cheated changed from Exam 2 to Exam 3. As shown in Table 1, there is a small apparent difference in the proportion of students who cheated on those two exams. We used a Z-test to compare those two proportions but found that the difference was not statistically significant ($Z = -0.234$, $p = .810$). Among students who cheated, the extent of cheating also did not significantly change when time constraints were relaxed. For students who cheated on both exams, we compared their extent of cheating on Exam 2 and Exam 3 using a paired-samples t-test but found no statistically significant difference ($t(41) = 0.723$, $p = .474$).

Given that students took more time on Exam 3, we wondered whether it was the students who were cheating who were using that additional time, perhaps to cheat more intensively on each question. However, we did not find that to be the case. We used a between-samples t-test to compare how much *additional* time was used on Exam 3 versus Exam 2 between those who cheated and those who did not; we found no statistically significant difference ($t(55) = 1.470$, $p = .147$). In sum, we have no evidence that time limits have any meaningful effect on cheating behaviors. An additional analysis of the relationship between exam times and cheating behaviors can be found in the supplemental materials; that analysis provides further support for the results described here.

Table 2
Time Taken on Exams for Current and Past Sections

	Historical Exam Times (Proctored)				Summer 2020 Exam Times			
	n	Limit (min)	Mean (min)	SD (min)	n	Limit (min)	Mean (min)	SD (min)
Exam 1	131	30	13.68	7.17	65	**20**	17.82	2.69
Exam 2	129	30	13.30	7.30	65	**20**	17.86	3.02
Exam 3	129	30	11.92	7.33	66	30	20.54	5.98
Exam 4	132	40	17.72	9.14	66	40	23.62	7.75

Note. More restrictive time limits are noted in **bold**.

Warning of Surveillance

After the first four exams, all students were issued a warning on each of the remaining exams stating that they were being surveilled and that any dishonest behavior would result in disciplinary action. Evident in Table 1 is a large apparent reduction in cheating behavior after Exam 4, dropping from 72% on Exam 4 to 20% on Exam 5. To determine whether that reduction was statistically significant, we used McNemar's X^2 Test, which allowed us to compare the proportion of students who *changed* their behavior from Exam 4 to Exam 5. The results of that test indicate that the change in behavior was statistically significant (McNemar's $X^2 = 31.03$, $p < .0001$). Importantly, this finding provides strong evidence that the behaviors observed in the Action Logs are, in fact, indicative of cheating; no other apparent explanation exists for the sharp reduction in the behavior as a result of the warning. Interestingly, among students who continued to engage in cheating behaviors after the warning, we saw no change in the *extent* of cheating from Exam 4 to Exam 5.

After Exam 6, students still engaging in cheating behavior were sent a personal communication notifying them that their behavior had been detected and that they would not receive credit if they continued to engage in that behavior. Four students ceased engaging in cheating behaviors after receiving the personal communication following Exam 6, and another two who continued to cheat on Exam 7 ceased engaging in cheating behavior after a follow-up email. Three students continued to engage in cheating behavior through Exam 8 despite the personal warning emails. Personal communications therefore did seem to further reduce cheating behaviors but not fully extinguish it. Interestingly, three students who had previously ceased cheating after Exam 5 re-engaged in cheating on Exam 8. Although occurring only in a small number of students, this finding does raise the possibility that students might stop taking warnings of surveillance seriously over time, thus requiring personal messages to reinforce the warning.

Interactions Between Cheating Behavior and Exam Scores

Table 3 provides summary statistics for the historical test score data as well as raw and standardized scores for the summer 2020 section of the course. Test scores and standard deviations are reported as percentages of total possible points on the exam. Unless otherwise noted, all of the analyses that follow use the standardized scores rather than the raw values.

Table 3
Summary of Exam Scores

	Historical Exam Scores (Proctored)			Summer 2020 Exam Scores		
	n	Mean (%)	SD (%)	n	Mean (%)	SD (%)
Exam 1	131	66.49	17.28	65	78.85	12.01
Exam 2	129	62.25	20.29	65	74.42	14.80
Exam 3	129	63.02	19.59	66	83.41	13.88
Exam 4	132	69.33	18.21	66	82.99	12.54
Exam 5	129	64.64	19.28	63	75.47	16.02
Exam 6	127	61.54	18.14	63	70.16	19.77
Exam 7	121	68.84	19.72	64	79.52	14.87
Exam 8	123	75.81	17.57	64	81.80	11.70

		Summer 2020 Standardized Scores		
	Summer 2020 Testing Conditions	n	Mean	SD
Exam 1	Restricted Time + Appeal/Pledge	65	0.71	0.70
Exam 2	Restricted Time + Pledge	65	0.60	0.73
Exam 3	Pledge	66	1.04	0.71
Exam 4	Pledge	66	0.75	0.69
Exam 5	Warning of Surveillance	63	0.56	0.83
Exam 6	Warning of Surveillance	63	0.48	1.09
Exam 7	Warning of Surveillance + Email	64	0.54	0.75
Exam 8	Warning of Surveillance + Email	64	0.34	0.67

Note. Non-standardized exam scores and standard deviations are expressed as a percentage of possible points earned on the exam, with 100% representing the highest possible score.

Cheating was prevalent on Exams 1 to 4, and students' scores on those exams were also higher than historical averages. Compared to past iterations of the course, students were on average scoring 0.78 standard deviation units above the historical mean for those exams. A one-sample t-test confirmed that the higher test scores were significantly higher than the historical means ($t(64) = 12.165$, $p < .00001$). As described above, when a warning of surveillance was issued beginning with Exam 5, we found that the prevalence of cheating declined dramatically. If cheating were responsible for the elevated test performance seen in Exams 1 to 4, then the cessation of cheating should coincide with a decline in test performance. Indeed, we did find that average test scores declined along with the prevalence of cheating. When we compared average standardized exam scores on Exams 3 and 4 versus Exams 5 and 6, a paired-samples t-test indicated a statistically significant decrease in scores ($t(61) = -3.54$, $p = .0008$, 95% CI for difference = (-0.547, -0.254)).

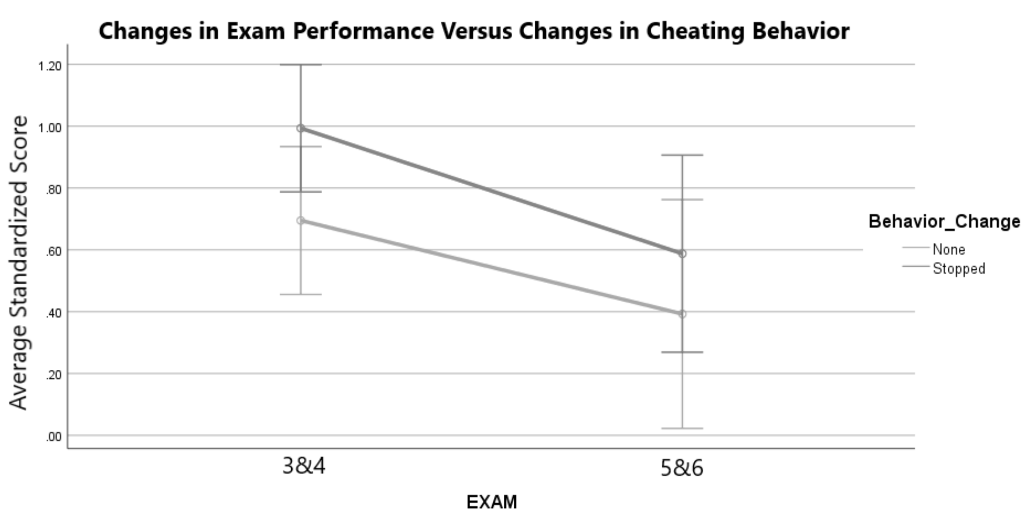
However, the overall changes in exam scores represent aggregate-level comparisons, and a more nuanced view can be obtained by examining differences between students who did and did not engage in cheating behaviors. We would expect to observe the reduction in exam scores primarily for students who *stopped cheating.* We would not expect a reduction in exam scores for students who *never* engaged in cheating or those who *continued* to cheat. To test that conjecture, we conducted a mixed two-way ANOVA. That ANOVA model allows one to compare how a response variable of interest (in this case, exam scores) is related to multiple interacting factors (in this case, cheating behavior as well as changes in the test conditions).

The response variable in the ANOVA model was standardized exam score for a targeted set of exams. The within-subjects factor (EXAM) had two categorical levels, corresponding to the two pairs of exams that were of interest: Exams 3 and 4 (on which students made an honesty pledge) versus Exams 5 and 6 (where students were given a warning of surveillance). We focused on pairs of exams for several reasons. First, the exams within each pair had identical testing conditions; a student's average performance within each pair therefore provides a reasonable estimate of their performance under those conditions. Second, students were given testing deadlines for pairs of exams rather than individual ones. The possibility therefore exists that students allocated less time and effort on the second of any pair of exams due to the way that they managed their time. By averaging across exam pairs, any effect from that possibility is controlled.

The between-subjects factor (BEHAVIOR CHANGE) had two categorical levels, corresponding to whether a student showed a marked change in cheating behavior between the two pair of exams. Students were categorized as "none" for this variable if they never cheated on Exams 3 to 6 or if they cheated on all of those exams. Students were categorized as "stopped" if they had cheated on both Exams 3 and 4 but did not cheat on either Exams 5 or 6. The ANOVA analysis included data from 54 students for whom we had complete sets of behavioral and performance data. Of those students, 23 showed no change in behavior and 31 stopped cheating. No assumptions of the ANOVA model were found to be violated; a null result was found for Levene's test for equality of error variances for mean scores on Exams 3 and 4 (p = .162) as well as Exams 5 and 6 (p = .377).

Contrary to our expectations, no statistically significant interaction was found between the BEHAVIOR factor and the EXAM factor ($F_{(1,52)} = 0.382$, $p = .539$, partial $\eta^2 = .007$). A large and statistically significant main effect was found for EXAM ($F_{(1,52)} = 17.903$, $p < .001$, partial $\eta^2 = .256$) but not for BEHAVIOR CHANGE ($F_{(1,52)} = 1.741$, $p = .193$, partial $\eta^2 = .032$). These results are illustrated by the interaction plot in Figure 2. In sum, they indicate that the exam scores for all students, regardless of whether they always cheated, never cheated or stopped cheating, declined similarly between Exams 3 and 4, before the warning, and Exams 5 and 6, after the warning. Because the exam scores have been standardized, that score reduction cannot be attributed to changes in exam difficulty. The reduction in scores across all students is therefore both an unexpected and puzzling result.

Figure 2
Interaction Plot for the EXAM and BEHAVIOR CHANGE factors (Error bars represent 95% confidence intervals)



Discussion

Two of our research goals were to determine the prevalence of cheating during unproctored online exams and the effects of various interventions on reducing cheating behaviors. In the absence of warnings of surveillance, we found cheating behaviors to be widespread. Neither appealing to students' academic integrity nor requiring an honesty pledge were found to be effective, as approximately 70% of students were observed cheating under either condition. It is possible that cheating was even more widespread than what we report here, as we were only able to detect a certain type of cheating behavior. In addition to detecting a high prevalence of cheating, we also found that when students did cheat, they did so on the majority of questions on a given exam rather than just one or two.

The pervasiveness of cheating during unproctored exams is sobering. Previous studies that found evidence of cheating (e.g., Alessio et al., 2017; Fask et al., 2014; Hylton et al., 2016) relied on aggregate measures and so could not estimate the prevalence of cheating. Unfortunately, our results indicate that cheating is the norm rather than the exception. One possible reason for our findings is that the type of cheating investigated here (using unauthorized sources to look up answers) is seen by students as relatively acceptable (Dyer et al., 2020). Students might not regard looking up answers as a "serious" or even "real" form of cheating, unlike other forms such as copying a peer's work or having a peer take a test in their stead. Another possible reason why consulting unauthorized materials on a computer is so common is that it is simply easy to do. Navigating away from a test page to search through notes or the internet requires little premeditation and little investment in time (we found no evidence that students who cheated took any longer on the exams). It is, in most respects, a completely natural impulse when using a computer. Our results would indicate that most students do not suppress that impulse unless they believe that their behavior is being monitored.

Whatever the reason for the pervasiveness of cheating, it is clearly a serious problem and not simply an unfounded worry. Our finding could be used to argue for the necessity of proctoring technologies, but we also found that cheating behaviors could be substantially reduced using far less invasive, costly, or cumbersome methods. Although we were unable to completely eliminate cheating behaviors, we found that warning students who continued to cheat that their cheating had been detected was highly effective in further reducing cheating.

We emphasize that we could only detect a certain type of cheating behavior. When students stopped engaging in that specific behavior, they might very well have switched to some other form of cheating that we could not detect. For instance, they could have consulted printed materials or materials on a different device. Although we cannot rule out that possibility, we think it unlikely. As noted above, we suspect that consulting unauthorized material on a computer is so common because it is both easy to do and consistent with typical computer usage. In contrast, shifting to an undetectable cheating method would require deliberate planning and preparation. Although some number of students might make the effort to cheat in those ways, we suspect that the proportion of students would be far less than the three-quarters who we detected cheating in this study. Additionally, the warning sent to students was nonspecific in that they did not know what kinds of behaviors we could and could not observe. Students can only shift to undetectable cheating methods if they know what is and is not detectable.

Warning students that they are being surveilled and that serious consequences await those who are detected cheating is effective, but we also emphasize that the warning requires follow-up. We found several instances of students who stopped engaging in cheating behaviors after receiving the warning only to re-engage in those behaviors on later exams. We also found that a small number of students continued to cheat even after being warned and being sent follow-up emails that their behaviors had been detected. In practical terms, this means that surveillance warnings should not be bluffs. Although a bluff might curb cheating in the short run, it is not likely to yield long-term results. Of course, this requires that instructors have access to something like an Action Log that can actually detect cheating.

Complicating all of the above are our findings regarding the interaction between cheating behaviors and exam scores. An intuitive assumption regarding cheating, particularly looking up answers during an exam, is that it will lead to students earning higher scores. However, we found no evidence that cheating behaviors were associated with elevated test scores. When warnings of surveillance were issued to students, rates of cheating declined substantially, and we did find a corresponding decline in test scores. Yet our analyses revealed that the exam scores of *all* students declined, including scores for students who never cheated and those who continued to cheat.

Several possible explanations exist for our unexpected results. One is that students in the *never cheating* category were actually cheating a different way, such as by looking at printed notes or textbook. Because our warning was not specific as to the way in which we were monitoring student behavior, it is possible that those students thought they were being surveilled and stopped that behavior. Thus, their categorization as *never cheaters* might not have been accurate. More puzzling is that students who continued to cheat also showed a decline in exam scores. The fact that *never cheaters* and *always cheaters* both declined in their scores raises the possibility that the surveillance warning itself could have affected performance. A well-documented effect is that the level of nervousness of students when taking a test depresses test scores (Cassady & Johnsen, 2002). By issuing a warning to all students this may have increased the level of anxiety during test-taking, which would have lowered all students' scores. This is a possibility that has been suggested by previous researchers in relation to proctoring technologies (Hylton, Levy, & Dringus, 2016) and is one that warrants further study.

The fact that we were not able to find any link between cheating behaviors and exam performance suggests that cheating, at least of the sort examined here, might be far less effective in improving test scores than it is often assumed to be. For instance, we saw many examples where students cheated on nearly every exam question (see Figure 1), yet those students were not consistently answering every question correctly. That indicates finding the correct answer to a question may not be easily accomplished with a brief search of the lecture notes or an internet search. This phenomenon warrants further inquiry. A deeper analysis might reveal whether certain types of question are more resistant to cheating than others, or whether some students are more effective cheaters than others. Yet if cheating does not account for the higher test scores of students compared to historical means when 70% were cheating, what does? It is, of course, possible that the students in this particular study were simply atypical (perhaps higher achieving than past students). It is also possible that the testing environment at home might partially contribute to elevated performance, as previous research has suggested (Fask et al., 2014). Future studies should investigate that possibility.

If the kind of cheating examined in this study (consulting unauthorized materials during an exam) does not necessarily lead to elevated performance, is it still a behavior worthy of concern? Instructors might take some comfort in knowing that if their students cheat in this way (and, our results indicate, odds are good that they will), it will not necessarily lead to artificially inflated grades. However, the fact that this form of cheating is not terribly effective does not make it any more ethical. Violations of stated testing procedures should be and are likely to be concerning for most instructors, regardless of how those violations affect students' overall grades.

One option that instructors have is to simply change their stated testing procedures and allow students to consult whatever materials they think would be beneficial. Another would be to use draconian surveillance technologies to more closely monitor students. Although those technologies might suppress cheating, our results indicate that less invasive approaches are also effective. Appealing to students' honesty or having them sign pledges is unlikely to change students' behavior, but if a warning is given to students that leads them to believe that they are being monitored, cheating is less likely to occur. Provided that the belief does not erode over time, we suggest that taking this approach is an effective way at reducing cheating during unproctored online exams. At the same time, we caution that surveillance measures might negatively impact student performance by provoking anxiety, which would affect *all* students, not just those who cheat. Colleges and universities should keep that caution in mind before investing time and resources into remote proctoring technologies.

Declarations

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References

Alessio, H. M., Malay, N., Maurer, K., Bailer, A. J., & Rubin, B. (2017). Examining the effect of proctoring on online test scores. *Online Learning*, *21*(1), 146–161. http://dx.doi.org/10.24059/olj.v21i1.885

Alessio, H. M., Malay, N., Maurer, K., Bailer, A. J., & Rubin, B. (2018). Interaction of proctoring and student major on online test performance. *International Review of Research in Open and Distributed Learning*, *19*(5). https://doi.org/10.19173/irrodl.v19i5.3698

Beck, V. (2014). Testing a model to predict online cheating—Much ado about nothing. *Active Learning in Higher Education*, *15*(1), 65–75. https://doi.org/10.1177/1469787413514646

Cassady, J. C., & Johnson, R. E. (2002). Cognitive test anxiety and academic performance. *Contemporary Educational Psychology*, *27*(2), 270–295. https://doi.org/10.1006/ceps.2001.1094

Cluskey, G. R., Ehlen, C. R., & Raiborn, M. H. (2011). Thwarting online exam cheating without proctor supervision. *Journal of Academic and Business Ethics, 4*(1).

Dunn, T. P., Meine, M. F., & McCarley, J. (2010). The remote proctor: An innovative technological solution for online course integrity. *International Journal of Technology, Knowledge & Society*, *6*(1), 1–8.

Dyer, J. M., Pettyjohn, H. C., & Saladin, S. (2020). Academic dishonesty and testing: How student beliefs and test setting impact decisions to cheat. *Journal of the National College Testing Association*, *4*(1), 1–30.

Fask, A., Englander, F., & Wang, Z. (2014). Do online exams facilitate cheating? An experiment designed to separate possible cheating from the effect of the online test taking environment. *Journal of Academic Ethics*, *12*(2), 101–112. https://doi.org/10.1007/s10805-014-9207-1

Flaherty, C. (2020, May 11). Big proctor. *Inside HigherEd*. https://www.insidehighered.com/news/2020/05/11/online-proctoring-surging-during-covid-19

Grajek, S. (2020, April 10). EDUCAUSE COVID-19 QuickPoll Results: Grading and Proctoring. *EDUCAUSE Review*. https://er.educause.edu/blogs/2020/4/educause-covid-19-quickpoll-results-grading-and-proctoring#fn2

Grijalva, T., Nowell, C., & Kerkvliet, J. (2006). Academic honesty and online courses. *College Student Journal*, *40*(1), 180–185.

Harmon, O. R., & Lambrinos, J. (2008). Are online exams an invitation to cheat? *Journal of Economic Education*, *39*(2), 116–125. https://doi.org/10.3200/JECE.39.2.116-125

Hollister, K. K., & Berenson, M. L. (2009). Proctored versus unproctored online exams: Studying the impact of exam environment on student performance. *Decision Sciences Journal of Innovative Education*, *7*(1), 271–294. https://doi.org/10.1111/j.1540-4609.2008.00220.x

Hylton, K., Levy, Y., & Dringus, L. P. (2016). Utilizing webcam-based proctoring to deter misconduct in online exams. *Computers & Education*, *92*, 53–63. https://doi.org/10.1016/j.compedu.2015.10.002

Instructure. (2020). *Canvas Learning Management System* [software]. https://www.instructure.com/canvas/

Kerkvliet, J., & Sigmun, C. L. (1999). Can we control cheating in the classroom? *Journal of Economic Education*, *30*(4), 331–351.

Mazar, N., Amir, O., & Ariely, D. (2008). The dishonesty of honest people: A theory of self-concept maintenance. *Journal of Marketing Research*, *45*(6), 633–644. https://doi.org/10.1509/jmkr.45.6.633

McGee, P. (2013). Supporting academic honesty in online courses. *Journal of Educators Online, 10*(1), 1–31. https://www.learntechlib.org/p/114388/

McNabb, L., & Olmstead, A. (2009). Communities of integrity in online courses: Faculty member beliefs and strategies. *Journal of Online Learning and Teaching, 5*(2), 208–23.

Respondus. (2020a). *Lockdown Browser* [software]. https://web.respondus.com/he/lockdownbrowser/

Respondus. (2020b). *Respondus Monitor* [software]. https://web.respondus.com/he/monitor/

Stephens, J. M., Young, M. F., & Calabrese, T. (2007). Does moral judgment go offline when students are online? A comparative analysis of undergraduates' beliefs and behaviors related to conventional and digital cheating. *Ethics & Behavior, 17*(3), 233–54. https://doi.org/10.1080/10508420701519197

Stogner, J., Miller, B., & Marcum, C. (2013). Learning to e-cheat: A criminological test of internet facilitated academic cheating. *Journal of Criminal Justice Education, 24*(2), 175–199. https://doi.org/10.1080/10511253.2012.693516

Stuber-McEwen, D., Wiseley, P., and Hoggatt, S. (2009). Point, click, and cheat: Frequency and type of academic dishonesty in the virtual classroom. *Online Journal of Distance Learning Administration, 12*(3), 1–10.

Watson, G. R., & Sottile, J. (2010). Cheating in the digital age: Do students cheat more in online courses? *Online Journal of Distance Learning Administration*, *13*(1), 1–13.

Wiley. (2020, July 22). *Academic integrity in the age of online learning*. https://read.uberflip.com/i/1272071-academic-integrity-in-the-age-of-online-learning/0?

Relationships between Connectedness, Performance Proficiency, Satisfaction, and Online Learning Continuance

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Abstract
Maintaining momentum is vital in terms of how soon students can complete a program, especially for those who are in the early stage of taking online courses. This study attempted to extend the existing literature by examining the influence of online students' perceived sense of connectedness, performance proficiency, and satisfaction on their intentions to continue an online learning course. A quantitative survey approach was adopted to test our hypothesized structural model. Three hundred and sixty-nine students who had taken fewer than three fully online courses participated in this study. The results revealed that three out of four testing hypotheses were all supported at the 0.01 significance level, and one of the path coefficients indicated that online students' confidence in their ability or competency to perform academic tasks did not directly influence their intention to take future online courses. Instead, the influence of performance proficiency on online learning continuance intention was mediated through the factor of satisfaction. In addition, satisfaction was found to have a significantly direct impact on online learning continuance intention, suggesting that when students taking online courses are satisfied with their online learning experience, the likelihood for them to continue taking other online courses is higher.

Keywords: Online learning continuance intention; online student connectedness; performance proficiency; satisfaction

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Online learning continues to grow regardless of disciplines, educational levels, public or private institutions, etc., and more efforts have been dedicated to ensuring the quality of online courses and programs over the last decade across the United States. With more than 6.3 million higher education students in the United States who have taken at least one online course in 2016, representing 31.6% of all students (Seaman et al., 2018), growing concerns and challenges are emerging. Low retention rates in online courses and low persistence rates in online programs are two serious problems. Learners benefit from the flexibility and convenience of technology-enhanced online learning environments; however, at the same time, students could possibly feel that they are isolated from the learning community due to lack of communication and interaction. This becomes an obstacle for their successful learning. Students may withdraw from online courses at any time for a variety of reasons and at any level of their learning process (Bawa, 2016).

Academic momentum was included in educational research as a perspective on university achievement in explaining degree completion and non-completion (Adelman, 2006; Attewell et al., 2012; Zhang, 2019). Martin et al. (2013) noted that initial academic course load and progress and early achievement were strongly associated with degree completion. Furthermore, their study findings indicated that prior knowledge and experience and ongoing study experiences have an effect on academic momentum. Due to this aspect, students' continuance usage intention of online learning environments and/or continuance intention toward e-learning system have been thoroughly discussed and studied over the past two decades (Abdullatif & Velázquez-Iturbide, 2020; Dağhan & Akkoyunlu, 2016; Panigrahi et al., 2018). According to Lin (2012), the continuance intention of using information system (IS) is defined as "the continued usage of IS by adopters, where a continuance decision follows an initial acceptance decision" (p. 500). Prior studies on e-learning continuance intention emphasized investigating online student's adoption/performance expectation (Uğur & Turan, 2018), perceived value (Chiu et al., 2005; Dağhan & Akkoyunlu, 2016), and perceived usability (Al-Fraihat et al., 2020; Al-Samarraie et al., 2018; Lew et al., 2019) towards online learning services/programs. These factors are also principal indicators for online learning success and continuance in higher education (McGill et al., 2014). However, these studies have ignored the direct or indirect effect of online students' learning experience, learning satisfaction, and their feelings regarding sense of learning community on their online learning continuance intention (OLCI). It is also essential to indicate what dynamic components of online learning experiences can have an impact on students' learning satisfaction. Little evidence has been drawn from investigating students' OLCI in the aspects of their perceived quality of the online learning experience and learning community, but understanding this intention is pivotal to the consistent improvement of active and learner-oriented online instructions.

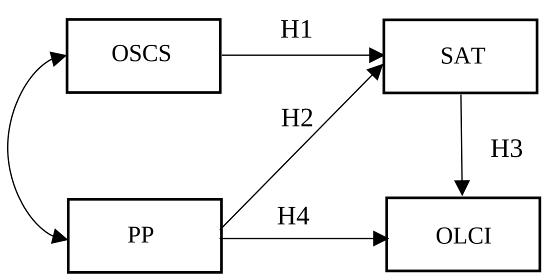
In terms of online courses and programs, it is essential to ensure their quality and effectiveness; thus, online students can have better learning experiences and therefore are likely to enroll in more online courses in subsequent semesters. Trespalacios and Lowenthal (2019) conducted a program evaluation study that investigated graduates' perceptions and what they like and dislike about their coursework in a fully online educational technology program. Their research included students' learning satisfaction and sense of community as two fundamental indicators of program outcomes and graduates' perceptions regarding program quality. The findings concluded that students' satisfaction is an essential element for students to remain in online programs; in addition, students enjoy hands-on courses involving constructive learning activities and thus, they can experience quality interactions and sense of community.

A sense of community plays a critical role in the success of online learning and course completion (Shea et al., 2005). According to Hart (2012), online students who perceive a strong social presence and a sense of connectedness will be the ones who are interactively involved and persistent in their learning. This is because students with stronger senses of connectedness can experience quality engagement that can foster their higher levels of thinking and they "tend to possess greater perceived levels of cognitive learning" (Rovai, 2002b, p. 330).

Satisfaction (SAT) is another factor that has been used extensively in educational studies for explaining students' perceived learning experience (Eom & Ashill, 2016; Kuo et al., 2013; Weidlich & Bastiaens, 2018), persistence (Bornschlegl & Cashman, 2018; Joo et al., 2013; Lee & Choi, 2013; Yang et al., 2017) and success (Yang et al., 2017). Moreover, it is found to be an agent for online learning acceptance (Lin et al., 2016) and an important element that has a positive association with persistence in online learning contexts (Joo et al., 2013; Lee & Choi, 2013). In the present study, satisfaction is defined as "Students are pleased with their experiences in learning online" (Moore, 2005, p. 4).

Momentum of persistently taking courses is vital in terms of how soon students can complete a program. Chiu et al. (2005) stated that users' acceptance/adoption after their initial use of e-learning service is the important determinant of their e-learning success that will further lead to an extension of the continuance intention in using e-learning services for longer terms. Thus, indicating the factors associated with successful course or program completion is essential, especially for students who are in the early stage of taking online courses. In this respect, this study attempted to extend the existing literature by examining the influence of online students' perceived sense of connectedness (OSCS), performance proficiency (PP), and satisfaction (SAT) on their online learning continuance intention (OLCI). A structural model (see Figure 1) that integrated the aforementioned factors was proposed and tested in order to elucidate the relationships among these variables.

Figure 1
Hypothetical Relationships



Theoretical Foundation and Hypotheses Development

Online Student Connectedness

Hagerty et al. (1993) defined the occurrence of connectedness as "… when a person is actively involved with another person, object, group, or environment, and that involvement promotes a sense of comfort, well-being, and anxiety-reduction" (p. 293). A sense of community or connectedness in an online context is vital for students to perceive feelings of "cohesion, spirit, trust, and interdependence" (Rovai, 2002a, p. 206) and students would possess shared expectations and commit to shared learning goals. Contrarily, when there is a lack of sense of connectedness among peers in an online course, students can have less motivation in participating in the knowledge sharing process (Ergün & Avcı, 2018) and would have limited opportunities for help-seeking (Kizilcec et al., 2017). Moreover, lack of connectedness is a contributing factor that hinders student persistence, which can diminish a student's motivation in learning. Students with a lower level of sense of belonging in an online course tend to disconnect themselves from interacting and engaging with peers, especially for students who are in their early stage as online learners. For the purpose of better understanding and measuring overall levels of online students' connectedness, Bolliger and Inan (2012) developed and validated the Online Student Connectedness Survey (OSCS). They defined connectedness as "the sense of belonging and acceptance. It refers to a person's belief that a relationship exists between him or her and at least one other individual" (Bolliger & Inan, 2012, p. 43). The survey consists of four subscales: comfort, community, facilitation, and interaction and collaboration.

Online Student Connectedness, Performance Proficiency, and Satisfaction

According to Rovai (2002b), a sense of community is fundamental for students to build inter-relationships and to sustain their positive learning experience, that will lead them to "possess greater perceived levels of cognitive learning" (p. 330). One of the most consistent findings within the connectedness literature is the end result of students' improved engagement and persistence in learning/academic achievement (Maddrell et al., 2017; Martin & Bolliger, 2018). When online students feel connected with instructors/facilitators and peers in the learning community, they are more likely to communicate openly and interact effectively, which encourages them to engage in cognitive and higher-order learning (Redmond et al., 2018). These behaviors will then lead to higher satisfaction, which in turn is associated with persistence and continuance intention. In addition, a learning community can facilitate meaningful and positive collaboration that will improve students' proficiency (Wu et al., 2017). One of the benefits of online learning is that students can communicate and ask for feedback from instructor/peers asynchronously using computer-mediated interactive tools. In this co-learning environment, it is important for students to enhance their interrelationships with peers and interactively exchange knowledge. Those who are socially accepted and supported by others may achieve higher performance proficiency (Ainin et al., 2015).

Empirical evidence from previous research suggested the notion that connectedness had positive influences on students' learning satisfaction (Abedine et al., 2010). Precisely, students in an online learning environment who feel a strong sense of connectedness are more likely to perceive positive learning satisfaction (Reinhart, 2010). Moreover, the correlational results from LaBarbera's (2013) study indicated that there was a positive and significant relationship between perceived connectedness and overall satisfaction with the course (r = .575, p =.01). Thus, we proposed the following hypothesis:

H1. There is a positive and significant relationship between online student connectedness and satisfaction.

In the recent decade, as the paradigm shifts from teacher-centered to learner-centered teaching with the rapid development of information and communications technology (ICT), online learners are responsible for their own learning in such self-directed and autonomous online environments and are required to prepare for proficient computer and internet competency. Since online learning is learner-centered and students are encouraged to learn autonomously, individuals' learning motivation and self-directed learning competencies can result in higher efficacy beliefs on learning performance. In order to perform well in online learning environments, students must interact with instructor, peers, and content (Kuo et al., 2013) using technology-enhanced tools. For students who are confident about computer/Internet, communication, and self-regulated learning skills, they can concentrate more on their learning and knowledge acquiring process and further to develop desires for learning autonomy. Those attributes in learning play significant roles in determining students' satisfaction (Cidral et al., 2018; Jan, 2015; Kauffman, 2015; Li, 2019). In addition, the more students believe learning via online environment can improve their abilities and performance, the more they feel satisfied with their online learning experience (Wu et al., 2010). Performance proficiency refers to how well an individual can perform the tasks that require him/her to master knowledge, skills, and abilities (Chao et al., 1994; Yu et al., 2010). Students' ability to perform tasks and solve problems may have an impact on students' intention with online learning (Yu et al., 2010). Eom and Ashill (2016) underlay the vital role of the process in online course design which will contribute to producing learning outcomes. The purposeful and the meaningful instructional design process can facilitate instructional discourse, shape constructive knowledge exchanges among students, and affect students' performance proficiency, which in turn affect their affective reactions to online learning satisfaction. More recently, Chu et al. (2021) added that students' perceived learning outcomes contribute heavily to students' satisfaction and is the key to retaining positive learning attitudes.

Zhou (2017) investigated the factors that influenced students' online collaborative learning experiences in massive open online courses (MOOCs) and found that students' performance proficiency had a positive and significant influence on their satisfaction with MOOCs. That is, the more students believed that MOOCs could improve their performance, the higher chances that they were satisfied with MOOCs. Findings from Baber's (2020) cross-country study indicated that students who had higher perceived learning outcome would be more satisfied in their online learning experience. Accordingly, we proposed the following hypothesis:

H2. There is a positive and significant relationship between performance proficiency and satisfaction.

Online Learning Continuance Intention

Students' learning satisfaction has been identified as another perspective of students' perceived learning and learning outcomes. In addition, it has been identified as a predominant factor in association with learning motivation (Seiver & Troja, 2014; Todorova & Karamanska, 2015; Yau et al., 2015), engagement (Hewson, 2018; Pelletier et al., 2017), and online learning success (Al-Samarraie et al., 2018; Goh et al., 2017). Notably, user satisfaction was considered an essential variable and it was often found to have a mediating effect between other continuation factors (such as confirmation, perceived usefulness, flow experience, human-computer interaction, and service quality) and user intention on system continuous usage. In the online learning context, findings from Al-Samarraie et al.'s (2018), Chen et al.'s (2018) and Zhou's (2017) studies revealed that satisfaction is strongly linked with online learning continuance intention. For instance, Alraimi et al. (2015) studied factors that enhanced users' intention to continue using MOOCs and the findings revealed that user satisfaction ($\beta = .0179$, $p < 0.05$) was a strong predictor for users' continuance intention in MOOCs. Therefore, the following hypothesis was proposed:

H3. There is a positive and significant relationship between satisfaction and online learning continuance intention.

Zhou (2017) explored factors that influenced students' continuance intention in MOOCs in mainland China. He hypothesized that students' performance proficiency positively influenced their satisfaction with MOOCs. The results indicated that the effect of performance proficiency on students' continuance intention was significant. That is, the more students felt that they were able to gain required knowledge or skills with MOOCs, the higher possibility that they would choose to continue learning with MOOCs in the future. Thus, we proposed the following hypothesis:

H4. There is a positive and significant relationship between performance proficiency and online learning continuance intention.

Methods

Participants

Participants in this study were 369 students who had only taken fewer than three fully online courses in a southern university. Of the participating students, 72.6% (*n* = 268) were female, and 27.4% (*n* = 101) were male (see Table 1). Ninety-nine participants (26.8%) were in their junior year and the majority of respondents (*n* = 110, 29.8%) reported being in the 20–24 age range.

Table 1
Demographic Information of Participants (N = 369)

Gender	
Female	268 (72.6%)
Male	101 (27.4%)
Age	
Under 20	96 (26.0%)
20-24	110 (29.8%)
25-29	49 (13.3%)
30-39	55 (14.9%)
40-49	45 (12.2%)
Over 50	14 (3.8%)
Class Level	
Freshman	86 (23.3%)
Sophomore	92 (24.9%)
Junior	99 (26.8%)
Senior	32 (8.7%)
Graduate Students	60 (16.3%)

Instrument and Procedure

The researchers adopted a quantitative survey approach to test the hypotheses. Data collection was carried out via EvaluationKit (an online course evaluation solution that has been implemented in the university) three weeks prior to the final week. Participants were invited to complete the following four surveys.

Online Student Connectedness Survey (OSCS)

This 25-item (5-point Likert scale) instrument was developed and validated by Bolliger and Inan (2012) to measure perceptions of connectedness of students enrolled in online programs in higher education. To assess the internal consistency of each set of scale and subscale, Cronbach's alpha (α) is used. The OSCS consists of four subscales: (a) comfort:8 items; for example, "I feel comfortable asking other students in online courses for help"; α = .944; (b) community:6 items; for example, "I feel emotionally attached to other students in my online courses"; α = .957; (c) facilitation:6 items; for example, "Instructors promote collaboration between students in my online courses"; α = .903; (d) interaction and collaboration:5 items; for example, "I collaborate with other students in my online courses"; α = .946.

Performance Proficiency (PP)

Performance proficiency was measured by four survey items (5-point Likert scale) that were adopted from Chao et al. (1994). The items are, for example, "I am confident about the adequacy of my academic skills and abilities" and "I have performed academically as well as I anticipated I would." In this study, Cronbach's Alpha of .875 indicated an acceptable internal consistency.

Satisfaction (SAT)

Students' online learning satisfaction was measured by 3 items of a 5-point Likert scale survey (α = .909) developed by the researchers. Three survey items are "The online course(s) that I have taken this semester provided me with a valuable learning experience," "I would advise other students to take online courses," and "After all, my attitude toward online learning is positive."

Online Learning Continuance Intention (OLCI)

This 4-item (5-point Likert scale, α = .957) survey was adopted from Alraimi et al. (2015) and modified to reflect the online learning context. Example survey items are, "I intend to continue taking online learning courses in the future" and "I will keep taking online learning courses as regularly as I do now."

Table 2 summarizes the information of the four instruments used in this study, including number of survey items, reliability of surveys, and results of descriptive statistics (mean and standard deviation).

Table 2

Descriptive Statistics and Reliability Information of Each Scale (N = 369)

Constructs	**# of items**	**Cronbach**	**Mean**	**SD**
Online Student Connectedness (OSCS)	25	.960	3.484	.781
Performance Proficiency (PP)	4	.875	4.280	.596
Satisfaction (SAT)	3	.909	4.080	.888
Online Learning Continuance Intention (OLCI)	4	.957	4.064	.967

In terms of data analysis, a multivariate correlational analysis was performed to test the degree of the relationships between online student connectedness, performance proficiency, and online learning continuance intention of the online students. Next, a path analysis was conducted using IBM SPSS AMOS 24.0 to examine the proposed hypothetical model.

Results

Correlational Findings

Multivariate correlational analysis was performed, and Pearson correlation coefficients were calculated to investigate the relationships between Performance Proficiency, Satisfaction, and four subscales in online student connectedness. First, the results of the descriptive analysis indicated that Comfort had the highest mean score (M = 4.06, SD = .69) among four *OSCS* subscales. In contrast, students reported the lowest means score (M = 2.80, SD = 1.16) on *Community* (see Table 3). The results also revealed that all tested variables are correlated with each other significantly with Pearson correlation coefficients(r) ranging from r = .17 *to* r = .77 (p < .01).

The results revealed that the Performance Proficiency (PP) had the strongest correlation with online students' Satisfaction (r = .60, p < .01). Moreover, in terms of four *OSCS* subscales, Comfort and *Facilitation* had strong correlations with PP (r = .59 and r = .46, respectively) and Satisfaction (r = .49 and r = .50, respectively). Contrarily, weak correlations are found between Community, Interaction and Collaboration, Performance Proficiency, and Satisfaction ranging from r = .17 *to* r = .22.

Table 3
Intercorrelations of Online Students' Performance Proficiency, Satisfaction, and Four OSCS Subscales

Variable	1	2	3	4	5	6	Mean	SD
1. PP	—	.60**	.59**	.18**	.49**	.22**	4.06	.97
2. SAT		—	.46**	.17**	.50**	.22**	4.28	.60
3. CFT			—	.42**	.64**	.46**	4.06	.69
4. COM				—	.62**	.77**	2.80	1.16
5. FAC					—	.64**	3.74	.86
6. INT						—	3.09	1.16

Note. N = 369, ** p < .01
Abbreviations: PP, Performance Proficiency; SAT, Satisfaction; CFT, Comfort; COM, Community; FAC, Facilitation; INT, Interaction and Collaboration.

Goodness of Fit Indices of the Research Model

Path model fit tests were done in AMOS and the results of the path analysis indicated good model fit χ^2 (1, N = 369) = 1.387, p > .05, and the χ^2/df ratio is 1.387; RMSEA = .032, NFI = .998, NFI= .998, NNFI = .997, CFI = .999, GFI = .998, AGFI = .959 (Hu & Bentler, 1999) as shown in Table 4.

Table 4
Goodness of Fit Indices of the Research Model

Fit Index	Criteria for acceptable fit	Model Value
χ^2/df	$0 \leq \chi^2/df \leq 3$	1.387
RMSEA	0 ≤ RMSEA ≤ 0.08	0.032
NFI	0.90 ≤ NFI ≤ 1.00	0.998
NNFI	0.90 ≤ NNFI ≤ 1.00	0.997
CFI	0.90 ≤ CFI ≤ 1.00	0.999
GFI	0.90 ≤ GFI ≤ 1.00	0.998
AGFI	0.90 ≤ AGFI ≤ 1.00	0.981

The Final Structural Model

The final form of the path model is presented in Fig. 2 with results of four path coefficients and percentages of the variances in explaining two endogenous variables (satisfaction and online learning continuance intention). Except for H4 (PP → OLCI, $\beta = .035$, $p > 0.05$), all other three testing hypotheses were supported at the 0.01 significance level (See Table 5 for more details). Furthermore, the path connecting OSCS and Performance Proficiency appears to be a strong and significant correlation indicated by the result ($\beta = .425$, $p < 0.01$).

In terms of online students' satisfaction, the path coefficients indicated median and significant correlations with online student Connectedness ($\beta = .162$, $p < 0.01$) and Performance Proficiency ($\beta = .530$, $p < 0.01$). In addition, of the variance seen in the Satisfaction, 38% ($R^2 = .38$) is explained by these two exogenous variables.

In terms of online learning continuance intention, the path coefficient indicated median and significant correlation with satisfaction ($\beta = .836$, $p < 0.01$). However, no significant relationship was found between Performance Proficiency and Online Learning Continuance Intention ($\beta = .035$, $p = .30$). In addition, of the variance seen in the Online Learning Continuance Intention, 73% ($R^2 = .73$) was explained by Satisfaction and Performance Proficiency.

Figure 2
Final Form of the Path Model

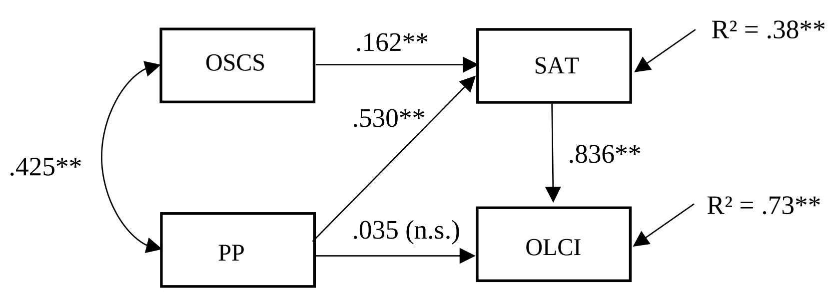


Table 5
Standardized Path Coefficients

Hypothesis	Path	Path Coefficient	Supported?
H1	OSCS → SAT	.162**	Supported
H2	PP → SAT	.530**	Supported
H3	SAT→ OLCI	.836**	Supported
H4	PP → OLCI	.053	Not supported

Note. ** $p < .01$

Discussion and Implications

In this study, we examined the relationships among online student connectedness, performance proficiency, satisfaction, and online learning continuance intention. Based on the multivariate correlational analysis, positive correlations were found between performance proficiency, satisfaction, and four subscales of online student connectedness. Online students' perceived performance proficiency and satisfaction of online learning were positively related to their intention to continue with online learning.

According to the path analysis performed in this study, the results of this study support most of our hypotheses. Online student connectedness was found to have a significant impact on students' satisfaction with online learning. Online students who possessed more of the sense of community experienced more interaction and collaboration with peers and the instructor, which resulted in more satisfied and meaningful online learning experiences. This result supports the suggestion of previous researchers that students need to be socially and academically integrated in distance learning environments to achieve meaningful learning experiences (Kanuka & Jugdev, 2006; McClannon et al., 2018; Shin, 2003). Feeling connected to peers and others is important for online students to perceive trust and interdependence (Rovai, 2002a) and to develop higher-order thinking in reflective practice learning (Demmans Epp et al., 2017; Tang & Lam, 2014) that will lead students to be more persistent in their learning. The path analysis also supports the hypothesis that the positive effect of performance proficiency on satisfaction of online students. That is, online students who perceive better of their proficiency are more likely to have a satisfied online learning experience. Students' confidence in applying the skills or abilities to perform academic related tasks is critical to satisfaction in online learning (Kuo et al., 2013).

As indicated in the study of Yu et al. (2010) and Wu et al. (2017), performance proficiency plays an important role in students' online learning or online social networking experiences. However, performance proficiency did not have a significantly direct impact on online learning continuance intention in the proposed path model of this study. This result indicates that online students' confidence in their ability or competency to perform academic tasks does not directly influence their intention to take future online courses. Instead, the influence of performance proficiency on online learning continuance intention is mediated through the factor of satisfaction.

Satisfaction was found to have a significantly direct impact on online learning continuance intention, which supports our hypothesis in this study. When students who take online courses are satisfied with their online learning experience; chances are higher for them to continue taking other online courses, as well as for them to remain in online programs

(Trespalacios & Lowenthal, 2019). Despite the sense of connectedness, building initial caring and supportive relationships between students and instructors would facilitate a more open and harmonious learning climate. This will potentially prevent students from having learning anxiety and alleviate their negative emotions (Jiang & Koo, 2020) that can further have influence on student satisfaction. As indicated in many previous studies, satisfaction was found to have a positive correlation with continuance intention in e-learning or online learning settings (Alraimi et al., 2015; Guo et al., 2016; Lin, 2012; Zhou, 2017). In addition, the significant and direct impact of satisfaction on continuance intention in online learning, which has been demonstrated in previous studies (Chen et al., 2018; Lin, 2012; Zhou, 2017), was further confirmed by this study. Dai et al. (2020) pointed out that satisfaction is an emotional response to a usage experience and is past-orientated. As the sample in this study were students who had taken fewer than three fully online courses and had limited prior learning experience, "satisfaction" plays a dominant role in predicting continuance intention. The serial and strong links among online student connectedness, satisfaction, and continuance intention are pivotal messages to instructors and institutional administrators; they must be prudent to integrate interactive teaching strategies that can facilitate online learning community, and to continue evaluating and ensuring course quality to maintain students' high levels of learning satisfaction.

Implications and Recommendations

The COVID-19 pandemic has forced educational institutions to make and support emergency transition to online learning contexts (Cortes, 2020; Essa et al., 2020; Henriksen et al., 2020). This rapid change in the unexpected transition also brings the challenges to students in their learning, especially for those who have limited online learning experiences, those who least prefer online learning, or those who are not ready to learn in a self-regulated online learning environment. Although this study was not conducted during the COVID-19 pandemic, the participants of this study had taken fewer than three fully online courses. Thus, the research findings bring practical values and implications in terms of examining a structured model that consists of vital factors in students' online learning continuance intention. First, this study contributes to the body of research on online learning connectedness and extends the existing literature by providing evidence regarding the relationships between online students' perceived sense of connectedness, performance proficiency, and satisfaction on their online learning continuance intention.

Next, the results of the study emphasize the importance of keeping students satisfied with online learning and to further enhance their intention to continue to take online classes. Online learning has been around for a while and it is even more popular now because of all the remote teaching/learning due to the COVID-19 pandemic. The possible "new normal" might lead to more requests for offering online classes in higher education institutions. This makes it more important for instructors to utilize appropriate teaching strategies to help students achieve learning outcomes and continue to take online classes. Units that support instructional technologies and pedagogies are encouraged to consistently assist faculty to complete a certification course in preparation for them to teach online courses (Gurley, 2018) and provide trainings that help them learn and implement innovative ways of active teaching. Furthermore, we recommend that instructors create an online learning environment that facilitates learning community and connects students to satisfactory online learning experiences through the following ways: a) develop initial course activities (e.g., ice-breaking activity, concept mapping, goals setting) to encourage the development of trust; b) provide a learning environment where students feel comfortable asking questions and interacting with their peers and the instructor; c) design activities for open communication and trust; use peer review for relationship building and knowledge sharing; d) promote online interaction and collaboration through activities/group projects/discussion; e) use authentic content and process scaffolds to support discourse behaviors; f) include streaming video clips to effectively demonstrate procedures and help students visualize concepts; g) provide constructive feedback and positively encourage students to increase their confidence; and h) make the class a learning community where students have trust in one another and the instructor.

Conclusion

The findings of this study suggest that students are more satisfied when they perceive they are learning, and they are more likely to learn when they are satisfied with their learning experiences. Those contribute to students' persistence in online programs (Yang et al., 2017). We believe students will continue to take online classes when they are satisfied with their learning experiences and feel connected with peers in an active and collaborative online learning environment. The four subscales (comfort, community, facilitation, interaction/collaboration) of Online Student Connectedness Survey are correlated to one another, and they all are also correlated to students' satisfaction though in different degree (ranging from $r = .17$ *to* $r = .50$). With those four factors in mind, instructors could build an online learning environment that fosters learning communities and brings satisfactory online learning experiences to students, thus strengthening student intention to continue to take online classes.

While most of the hypotheses in the study are supported by the data and analysis, we have identified some limitations of the study. In this study, participants' prior online learning experiences might have had some impact on their responses to the survey. The survey was sent out three weeks prior to finals week and online students would not be able to respond to the survey based on their complete experience of taking one online class, even before they knew their grades. Also, the participants were from different courses taught by different instructors. Different instructors had different ways of teaching online classes, which might have had an impact on the survey responses. For future investigation, researchers could consider two separate groups: first-time online students and repeat online students. Also, researchers could use participants from same or similar fields and same instructor for several semesters. In addition, the relationships of performance proficiency and online learning continuance intention could be tested again using the data collected from the suggested participants above because of the lack of studies in this area. Of course, in addition to those the current study investigated, there are many other factors that impact the relationships and dynamics of connectedness, performance proficiency, satisfaction, online learning continuance intention in online learning. Those factors, though not covered in the current study, can be topics for future studies.

Declarations

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References

Abdullatif, H., & Velázquez-Iturbide, J. Á. (2020). Relationship between motivations, personality traits and intention to continue using MOOCs. *Education and Information Technologies*, *25*(5), 4417-4435. https://doi.org/10.1007/s10639-020-10161-z

Abedin, B., Daneshgar, F., & D'Ambra, J. (2010). Underlying factors of sense of community in asynchronous computer supported collaborative learning environments. *Journal of Online Learning and Teaching*, *6*(3). http://jolt.merlot.org/vol6no3/abedin_0910.htm

Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college.* Washington, DC: Department of Education. http://www2.ed.gov/rschstat/research/pubs/toolboxrevisit/toolbox.pdf

Ainin, S., Naqshbandi, M. M., Moghavvemi, S., & Jaafar, N. I. (2015). Facebook usage, socialization and academic performance. *Computers & Education*, *83*, 64-73. https://doi.org/10.1016/j.compedu.2014.12.018.

Al-Fraihat, D., Joy, M., & Sinclair, J. (2020). Evaluating E-learning systems success: An empirical study. *Computers in Human Behavior*, *102*, 67-86. https://doi.org/10.1016/j.chb.2019.08.004

Alraimi, k., Zo, H., & Ciganek, A. (2015). Understanding the MOOCs continuance: The role of openness and reputation. *Computers & Education*, *80*, 28-38. https://doi.org/10.1016/j.compedu.2014.08.006

Al-Samarraie, H., Teng, B. K., Alzahrani, A. I., & Alalwan, N. (2018). E-learning continuance satisfaction in higher education: a unified perspective from instructors and students. *Studies in Higher Education*, *4*(11), 2003-2019. https://doi.org/10.1080/03075079.2017.1298088

Attewell, P., Heil, S., & Reisel, L. (2012). What is academic momentum? And does it matter? *Educational Evaluation and Policy Analysis*, *34*(1), 27–44. https://doi.org/10.3102/0162373711421958

Baber, H. (2020). Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of COVID-19. *Journal of Education and E-Learning Research*, *7*(3), 285-292. https://doi.org/*10.20448/journal.509.2020.73.285.292*

Bawa, P. (2016). Retention in online courses: Exploring issues and solutions-A literature review. *Sage Open*, *6*(1), 1-11. https://doi.org/10.1177/2158244015621777

Bolliger, D. U., & Inan, F. A. (2012). Development and validation of the online student connectedness survey (OSCS). *International Review of Research in Open & Distance Learning*, *13*(3), 41-65. https://doi.org/10.19173/irrodl.v13i3.1171

Bornschlegl, M., & Cashman, D. (2018). Improving distance student retention through satisfaction and authentic experiences. *International Journal of Online Pedagogy and Course Design (IJOPCD)*, *8*(3), 60-77. https://doi.org/10.4018/IJOPCD.2018070105

Chao, G. T., O'Leary-Kelly, A. M., Wolf, S., Klein, H. J., & Gardner, P. D. (1994). Organizational socialization: its content and consequences. *Journal of Applied Psychology*, *79*(5), 730–743.

Chen, C. C., Lee, C. H., & Hsiao, K. L. (2018). Comparing the determinants of non-MOOC and MOOC continuance intention in Taiwan: Effects of interactivity and openness. *Library Hi Tech*, *36*(4), 705-719. https://doi.org/10.1108/LHT-11-2016-0129

Chiu, C.-M., Hsu, M.-H., Sun, S.-Y., Lin, T.-C., & Sun, P.-C. (2005). Usability, quality, value and e-learning continuance decisions. *Computers & Education*, *45*(4), 399-416. http://dx.doi.org/10.1016/j.compedu.2004.06.001

Chu, A. M., Liu, C. K., So, M. K., & Lam, B. S. (2021). Factors for sustainable online learning in higher education during the COVID-19 pandemic. *Sustainability, 13*(9), 5038. https://doi.org/10.3390/su13095038

Cidral, W. A., Oliveira, T., Di Felice, M., & Aparicio, M. (2018). E-learning success determinants: Brazilian empirical study. *Computers & Education*, *122*, 273-290. https://doi.org/10.1016/j.compedu.2017.12.001

Cortes, S. T. (2020). Flexible learning as an instructional modality in environmental science course during COVID-19. *Aquademia, 4*(2), ep20024. https://doi.org/10.29333/aquademia/8444

Dağhan, G., & Akkoyunlu, B. (2016). Modeling the continuance usage intention of online learning environments. *Computers in Human Behavior*, *60*, 198-211. https://doi.org/10.1016/j.chb.2016.02.066

Dai, H. M., Teo, T., & Rappa, N. A. (2020). Understanding continuance intention among MOOC participants: The role of habit and MOOC performance. *Computers in Human Behavior*, *112*, 106455. https://doi.org/10.1016/j.chb.2020.106455

Demmans Epp, C., Phirangee, K., & Hewitt, J. (2017). Student actions and community in online courses: The roles played by course length and facilitation method. *Online Learning, 21*(4), 53-77. http://dx.doi.org/10.24059/olj.v21i4.1269

Eom, S. B., & Ashill, N. (2016). The determinants of students' perceived learning outcomes and satisfaction in university online education: An update. *Decision Sciences Journal of Innovative Education*, *14*(2), 185-215. https://doi.org/10.1111/dsji.12097

Ergün, E., & Avcı, Ü. (2018). Knowledge sharing self-efficacy, motivation and sense of community as predictors of knowledge receiving and giving behaviors. *Journal of Educational Technology & Society*, *21*(3), 60-73. https://www.jstor.org/stable/26458507

Essa, M. M., Subramanian, K. P., & Jayasuriya, H. P. (2020). COVID-19 impact on undergraduate education: Academicians' perspective. *Journal of Health and Allied Sciences NU*, *10*(03), 138-140. https://doi.org/10.1055/s-0040-1718609

Goh, C., Leong, C., Kasmin, K., Hii, P., & Tan, O. (2017). Students' experiences, learning outcomes and satisfaction in e-learning. *Journal of E-learning and Knowledge Society, 13*(2), 117-128. https://www.learntechlib.org/p/188116/

Guo, Z., Xiao, L., Van Toorn, C., Lai, Y., & Seo, C. (2016). Promoting online learners' continuance intention: An integrated flow framework. *Information & Management*, *53*(2), 279-295. https://doi.org/10.1016/j.im.2015.10.010

Gurley, L.E. (2018). Educators' preparation to teach, perceived teaching presence, and perceived teaching presence behaviors in blended and online learning environments. *Online Learning*, *22*(2), 197-220. http://dx.doi.org/10.24059/olj.v22i2.1255

Hagerty, B. M., Lynch-Sauer, J., Patusky, K. L., & Bouwsema, M. (1993). An emerging theory of human relatedness. *Journal of Nursing Scholarship*, *25*(4), 291-296. https://doi.org/10.1111/j.1547-5069.1993.tb00262.x

Hart, C. (2012). Factors associated with student persistence in an online program of study: a review of the literature. *Journal of Interactive Online Learning*, *11*(1), 19-42.

Henriksen, D., Creely, E., & Henderson, M. (2020). Folk pedagogies for teacher transitions: Approaches to synchronous online learning in the wake of COVID-19. *Journal of Technology and Teacher Education, 28*(2), 201-209. https://www.learntechlib.org/primary/p/216179/

Hewson, E. R. F. (2018). Students' emotional engagement, motivation and behaviour over the life of an online course: Reflections on two market research case studies. *Journal of Interactive Media in Education*, *1*(10), 1–13. https://doi.org/10.5334/jime.472
Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1-55.
Jan, S. K. (2015). The relationships between academic self-efficacy, computer self-efficacy, prior experience, and satisfaction with online learning. *American Journal of Distance Education*, *29*(1), 30-40. https://doi.org/10.1080/08923647.2015.994366
Jiang, M. & Koo, K. (2020). Emotional presence in building an online learning community among non-traditional graduate students. *Online Learning*, *24*(2), 93-111. https://doi.org/10.24059/olj.v24i4.2307
Joo, Y. J., Lim, K. Y., & Kim, J. (2013). Locus of control, self-efficacy, and task value as predictors of learning outcome in an online university context. *Computers & Education*, *62*, 149-158. https://doi.org/10.1016/j.compedu.2012.10.027
Kanuka, H., & Jugdev, K. (2006). Distance education MBA students: An investigation into the use of an orientation course to address academic and social integration issues. *Open Learning*, *21*(2), 153-166.
Kauffman, H. (2015). A review of predictive factors of student success in and satisfaction with online learning. *Research in Learning Technology*, *23*. https://doi.org/10.3402/rlt.v23.26507
Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in Massive Open Online Courses. *Computers & Education*, *104*, 18-33. https://doi.org/10.1016/j.compedu.2016.10.001
Kuo, Y.-C., Walker, A. E., Belland, B. R., & Schroder, K. E. E. (2013). A predictive study of student satisfaction in online education programs. *The International Review of Research in Open and Distributed Learning*, *14*(1), 16-39. https://doi.org/10.19173/irrodl.v14i1.1338
LaBarbera, R. (2013). The relationship between students' perceived sense of connectedness to the instructor and satisfaction in online courses. *Quarterly Review of Distance Education*, *14*(4), 209-220.
Lee, Y., & Choi, J. (2013). A structural equation model of predictors of online learning retention. *The Internet and Higher Education*, *16*, 36-42. https://doi.org/10.1016/j.iheduc.2012.01.005
Lew, S. L., Lau, S. H., & Leow, M. C. (2019). Usability factors predicting continuance of intention to use cloud e-learning application. *Heliyon*, *5*(6), e01788. https://doi.org/10.1016/j.heliyon.2019.e01788
Li, K. (2019). MOOC learners' demographics, self-regulated learning strategy, perceived learning and satisfaction: A structural equation modeling approach. *Computers & Education*, *132*, 16-30. https://doi.org/10.1016/j.compedu.2019.01.003
Lin, W.-S. (2012). Perceived fit and satisfaction on web learning performance: IS continuance intention and task-technology fit perspectives. *International Journal of Human-Computer Studies*, *70*, 498-507. https://doi.org/10.1016/j.ijhcs.2012.01.006
Lin, Y. C., Chung, P., Yeh, R. C., & Chen, Y. C. (2016). An empirical study of college students' learning satisfaction and continuance intention to stick with a blended e-learning environment. *International Journal of Emerging Technologies in Learning*, *11*(2). https://www.learntechlib.org/p/172220/

Maddrell, J. A., Morrison, G. R., & Watson, G. S. (2017). Presence and learning in a community of inquiry. *Distance Education*, *38*(2), 245-258. https://doi.org/10.1080/01587919.2017.1322062

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, *22*(1), 205-222. http://dx.doi.org/10.24059/olj.v22i1.1092

McClannon, T. W., Cheney, A. W., Bolt, L. L., & Terry, K. P. (2018). Predicting sense of presence and sense of community in immersive online learning environments. *Online Learning*, *22*(4), 141-159. http://dx.doi.org/10.24059/olj.v22i4.1510

McGill, T. J., Klobas, J. E., & Renzi, S. (2014). Critical success factors for the continuance of e-learning initiative. *The Internet and Higher Education, 22*, 24-36. https://doi.org/10.1016/j.iheduc.2014.04.001

Moore, J. C. (2005). *The Sloan Consortium Quality Framework and the Five Pillars*. Newburyport, MA: The Sloan Consortium.

Panigrahi, R., Srivastava, P. R., & Sharma, D. (2018). Online learning: Adoption, continuance, and learning outcome—A review of literature. *International Journal of Information Management*, *43*, 1-14. https://doi.org/10.1016/j.ijinfomgt.2018.05.005

Pelletier, C., Rose, J., Russell, M., Guberman, D., Das, K., Bland, J., Bonner, H., & Chambers, C. R. (2017). Connecting student engagement to student satisfaction: A case study at East Carolina University. *Journal of Assessment and Institutional Effectiveness, 6*(2), 123-141. https://doi.org/10.5325/jasseinsteffe.6.2.0123

Redmond, P., Heffernan, A., Abawi, L., Brown, A., & Henderson, R. (2018). An online engagement framework for higher education. *Online Learning*, *22*(1), 183-204. https://dx.doi.org/10.24059/olj.v22i1.1175

Reinhart, J. (2010). Graduate students' communication practices and perceived sense of community. *Quarterly Review of Distance Education*, *11*(4), 223-238.

Rovai, A. P. (2002a). Development of an instrument to measure classroom community. *The Internet and Higher Education*, *5*(3), 197–211. https://doi.org/10.1016/S1096-7516(02)00102-1

Rovai, A. P. (2002b). Sense of community, perceived cognitive learning, and persistence in asynchronous learning networks. *The Internet and Higher Education, 5*(4), 319–332. https://doi.org/10.1016/S1096-7516(02)00130-6

Seaman, J. E., Allen, I. E., & Seaman, J. (2018). *Grade increase: Tracking distance education in the United States*. Babson Survey Research Group and Quahog Research Group, LLC. http://www.onlinelearningsurvey.com/reports/gradeincrease.pdf

Seiver, J. G., & Troja, A. (2014). Satisfaction and success in online learning as a function of the needs for affiliation, autonomy, and mastery. *Distance Education, 35*(1), 90-105. https://doi.org/10.1080/01587919.2014.891427

Shea, P., Li, C. S., Swan, K., & Pickett, A. (2005). Developing learning community in online asynchronous college courses: The role of teaching presence. *Journal of Asynchronous Learning Networks*, *9*(4), 59-82.

Shin, N. (2003). Transactional presence as a critical predictor of success in distance learning. *Distance Education*, *24*(1), 69-86.

Tang, E., & Lam, C. (2014). Building an effective online learning community (OLC) in blog-based teaching portfolios. *The Internet and Higher Education*, *20*, 79-85. https://doi.org/10.1016/j.iheduc.2012.12.002

Todorova, M., & Karamanska, D. (2015). A study of motivation and satisfaction of students in e-learning environment. *Applied Technologies and Innovations, 11*(2), 82-89. http://dx.doi.org/10.15208/ati.2015.09

Trespalacios, J., & Lowenthal, P. (2019). What do they really like? An investigation of students' perceptions of their coursework in a fully online educational technology program. *Australasian Journal of Educational Technology*, *35*(5), 60-78. https://doi.org/10.14742/ajet.4364

Uğur, N. G., & Turan, A. H. (2018). E-learning adoption of academicians: a proposal for an extended model. *Behaviour & Information Technology*, *37*(4), 393-405. https://doi.org/10.1080/0144929X.2018.1437219

Weidlich, J., & Bastiaens, T. J. (2018). Technology matters–the impact of transactional distance on satisfaction in online distance learning. *International Review of Research in Open and Distributed Learning*, *19*(3), 222-242. https://doi.org/10.19173/irrodl.v19i3.3417

Wu, W.-C. V., Chen Hsieh, J. S., & Yang J. C. (2017). Creating an online learning community in a flipped classroom to enhance EFL learners' oral proficiency. *Educational Technology & Society, 20*(2), 142–157. http://www.jstor.org/stable/90002170

Wu, J.-H., Tennyson, R. D., & Hsia, T.-L. (2010). A study of student satisfaction in a blended e-learning system environment. *Computers & Education*, *55*, 155-164. https://doi.org/10.1016/j.compedu.2009.12.012

Yang, D., Baldwin, S., & Snelson, C. (2017). Persistence factors revealed: Students' reflections on completing a fully online program. *Distance Education*, *38*(1), 23-36. https://doi.org/10.1080/01587919.2017.1299561

Yau, H. K., Cheng, A. L. F., & Ho, W. M. (2015). Identify the motivational factors to affect the higher education students to learn using technology. *The Turkish Online Journal of Educational Technology, 14*(2), 89-100.

Yu, A. Y., Tian, S. W., Vogel, D., & Kwok, C. (2010). Can learning be virtually boosted? An investigation of online social networking impacts. *Computers & Education, 55*(4), 1494-1503. https://doi.org/10.1016/j.compedu.2010.06.015

Zhang, Y. L. (2019). Early academic momentum: Factors contributing to community college transfer students' STEM degree attainment. *Journal of College Student Retention: Research, Theory & Practice*. https://doi.org/10.1177/1521025119881130

Zhou, J. (2017). Exploring the factors affecting learners' continuance intention of MOOCs for online collaborative learning: An extended ECM perspective. *Australasian Journal of Educational Technology, 33*(5), 123-135. https://doi.org/10.14742/ajet.2914

Identifying a Gap in the Project Management Approach of the Online Program Management and University Partnership Business Model

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Abstract
As the number of online courses increase in higher education, many higher education institutions outsource online course development to an Online Program Management (OPM) provider because of a lack of budget, staff, and technology. Current research indicates that OPM providers often do not have instructional design (ID) services tailored to a specific university. This research uses a case study to analyze a business partnership between a research university and an OPM provider. The Activity Theory conceptual framework was used to direct inquiry and analysis. Results show a miss of the "Empathize" (first stage of Design Thinking) phase in the project management approach from the OPM provider side, which made the process appear more like a start-up company and caused some faculty to lose motivation about the instructional design process. A complete Design Thinking approach from the OPM provider and the university partner are very important to reap the most benefits from this relationship.

Keywords: OPM-University model, Activity Theory, instructional design project management, Design Thinking, empathize

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Many higher education institutions believe that they must adopt online programs to better serve their constituencies, but making this decision requires faculty to adopt a new mode of teaching. Higher education institutions can build infrastructure to support their online program initiatives, or they can partner with management organizations (Online Program Management Providers [OPMPs]) that offer some or all of the services needed to make online programs successful. These services include marketing, admissions, and instructional design. This paper presents a case study that describes the interactions between the faculty at a research university, an online program management provider (OPM), and one instructional design firm that was outsourced by the OPM. The case exposes the problems that can arise during the instructional design process when none of the organizations practice effective process management.

The case study is rendered through the lens of Engeström's (1999) Activity Theory. The Activity Theory framework is a descriptive meta-theory rather than a predictive theory (Engeström, 2000). Analyzing human activity should not only involve examining the kinds of activities people engage in but also who is engaging in that activity, what their goals and intentions are, what objects or products result from the activity, the rules, and norms that circumscribe that activity, and also the larger community in which the activity occurs. The most appropriate unit of analysis in a system is "activity" (Jonassen & Murphy, 1999). In this paper, the activity is the instructional design process within the context of developing higher education online programs. Online learning uses a different platform, builds communities in different ways, demands different pedagogies, and requires different choices for curriculum as compared to face-to-face courses and programs (Morris & Stommel, 2016). They require more effective teaching principles and practices so that students do not get overwhelmed or experience excessive cognitive load. Many studies show that teaching online requires a different pedagogy and skill set as compared to the traditional classroom (Fetherston, 2001; Hardy & Bower, 2004; Oliver, 2002; Boling et al., 2012). As such, online teachers are faced with new pedagogical issues including student interactions, course content design and delivery, multiple levels of communication, new types of assignments and performance expectations, and different sets of assessments and evaluation techniques (Boling et al., 2012). This necessitates adaptations in teaching practices. A persona change occurs when a faculty member transitions from face-to-face teaching to the online classroom (Phillips, 2008). Use of technology in this field demands a shift from a teaching-centered to a learning-centered paradigm (Boling et al., 2012; Fink, 2013; Fink, 2013a).

The next section of this paper provides more information about instructional design, OPMs, and the relationship between them and higher education institutions. The following section describes the basics of Activity Theory and orients it to this case study. It also describes the data collection process. The penultimate section of the paper presents the data analysis, and the final section summarizes the conclusions and presents the practical and academic implications of the study.

Literature Review

Instructional designers and the instructional design process in higher education

Instructional Designers (IDs) are professionals who support faculty in colleges and universities in the development of online courses through training and consultations (You, 2010; Chittur, 2018). Instructional Design is "a collection of theories and models helping to understand and apply instructional methods that favor learning. Instructional Design as a method or a process helps produce plans and models describing the organization of learning and teaching activities, resources and actors' involvement that compose an Instructional System or a Learning

Environment" (Paquette, 2014, p. 661). IDs are familiar with technological features and learning processes of online course design and can encourage and provide training for their use and adoption. Most faculty seek to work with IDs for technical support and help (You, 2010; Chittur, 2018). Faculty and administrators sometimes think of IDs as technologists and learning management system specialists; however, they are experts in the area of learning design and can play an important role in the design process to advocate an appropriate mix and sequence of student-centered activities in the online course being developed (Chittur, 2018). Use of IDs in converting courses into an online format may cause professors to rethink their roles as teachers and maximize student learning. With the help of IDs, faculty will find themselves shifting focus to learning objectives and designing activities that can help students master those learning objectives (Chittur, 2018).

IDs operate within a community of practice and work with instructors, technologists, academic staff, and other administrative staff in their institution. IDs play a very important role in creating a change among faculty and motivating faculty to implement good teaching design. They should be comfortable with change and should be willing to act as agents of change (Pan et al., 2003), as well as help faculty reassess their knowledge about pedagogy if the interactions between them are successful.

Theoretical models in this field are derived from research based on how people learn and not from the application; hence, they are not grounded in practice (Schwier et al., 2007; Chittur, 2018). The Analyze, Design, Develop, Implement and Evaluate (ADDIE) Model is a commonly used process model for developing instruction in this field (Molenda, 2003). Many instructional design models replicate and extend the concepts of the ADDIE Model (Molenda, 2003). The ADDIE Model was first implemented at Florida State University for the United States Army (Forest, 2014). It is best understood and used as a conceptual framework for instructional designers to organize their activities into categories and to observe and analyze (Bichelmeyer, 2005). Novice or inexperienced instructional designers tend to align more closely to the ADDIE Model or another instructional design model as they begin to work, while more experienced IDs describe their work in broader terms (Schwier et al., 2007). The ADDIE model is a "top-down," behavioristic, and SME-driven approach to instructional design rather than a more collaborative and learner-based approach (Gayeski, 1997). Step-by-step procedures are too linear and time-consuming to work with subject matter experts and the cycle time to develop course materials is very long (Gayeski, 1997). The traditional ADDIE model does not offer any feedback until later in the cycle and so the most critical problems cannot be addressed until then (Gayeski, 1997). Modern implementations tend to integrate an agile model into ADDIE to provide feedback during development and piloting (Peterson, 2003; Campbell, 2014). Therefore, instructional designers follow an iterative approach during the evaluation process to collect feedback on learning designs before releasing the course into final production (Gayeski, 1997).

Instructional Designer and Subject Matter Expert (Faculty) Interaction

Instructional designers require proper interpersonal and communication skills to effectively manage interactions with Subject Matter Experts (SMEs). Successful IDs are those who have collaborative skills to work with faculty and create an atmosphere of mutual respect (Armstrong & Sherman, 1988; Lin & Jacobs, 2008; Chittur, 2018). IDs build rapport with faculty by developing a sense of respect for the professor's teaching style and by limiting the number of suggestions to improve the course design. IDs communication should be managed in a way that the professor or faculty does not feel micromanaged (Chittur, 2018). IDs should not hold themselves out as experts of content matter (Pan et al., 2003; Barczyk et al., 2010).

The relationship between an ID and a faculty member is dependent on mutual respect and trust. Professors are more likely to make changes in pedagogy when they anticipate improved learning outcomes (Chittur, 2018). Faculty members believe that their instructional designers need to have a better understanding of their content areas (You, 2010). Experienced faculty who are new to teaching online can get anxious thinking that they may lose their identity as experts and hence resist teaching online (McQuiggan, 2007).

At times, the interactions between the ID and the faculty member can be difficult and problematic. This can happen especially when the ID tries to emphasize and recommend structure, but the faculty member is focused and used to handling the class session flow through personality and on-the-spot decision-making (Russell, 2015). The relationship between ID and SME is dependent on the strength of their trust in one another (Pan et al., 2003).

Online Program Management (OPM) Providers

Some higher educational administrators outsource the development of their online programs to third-party vendors (Springer, 2018). These third-party vendors are known as "Online Program Management" (OPM) providers (Springer, 2018). Universities need a substantial financial investment to develop their online programs internally (Springer, 2018). OPM providers are for-profit companies that invest some or all of the necessary capital up front to create the infrastructure for an online program, and also provide various services related to online program management for partnering with a college or university in exchange for a percentage of the revenue generated from the program (Springer, 2018). These OPM providers offer help in four core service areas: market/lead generation, enrollment management, student services, and course development and delivery (Springer, 2018).

Colleges and universities need to design and launch higher quality online courses (Riter, 2017). For these universities and colleges, building high-quality offerings and getting thoughtful instructional design support for their institution's faculty from OPM providers is most important (InsideHigherEd.com, 2019). There is a need by most of these higher educational institutions to get selected services on an à la carte basis and pay a fee for that service instead of going with the revenue-sharing bundle or package (Riter, 2017). Most OPM providers do not have economic sources or expertise to tailor the instructional design for a particular institution, program or course. Lack of budget, staff, resources, and familiarity with technology creates operational challenges that make outsourcing the development of online courses and programs to OPMs very appealing. However, most of these OPMs maintain only a small number of instructional design staff and place the main duties and responsibilities of the work on an institution's faculty (Riter, 2017; InsideHigherEd.com, 2019). Most OPM providers do not invest in instructional design because the underlying economic arrangement does not reward or benefit them by tailoring or suiting their approach to a particular college or university (InsideHigherEd.com, 2019).

Faculty of these institutions have a concern about the academic integrity from the commercialization of their intellectual property. Enrollment of students in online programs and not instructional design is of utmost importance for OPM providers as well as the institutions. Online enrollment drives revenue growth for both (Riter, 2017). As a result, most of their resources go into marketing and not into designing highly effective online programs. However, the potential cost of not providing effective course design can be lower completion rates and reduced satisfaction (Bawa, 2016; Hone & Said, 2016; Educause.edu, 2010).

Method

This research follows a qualitative approach using an interpretive case study to help understand the social and cultural contexts within which people live and work. This study focuses on understanding the individuals and organizations involved in instructional design. Human decisions and actions can only be understood in context, and the context helps researchers "explain" why someone acted as they did (Myers, 2013). The researchers carried out detailed analyses of the decisions and actions taken by faculty within the context of a university and its business relationship with an OPM provider. Qualitative research does not base its process on sample size, and as a result, qualitative researchers generalize to theory rather than populations (Myers, 2013).

Sources of Data

This case study included a private research university (herein called RU or R University) that had recently joined a partnership with an OPM to develop and offer online Master's degree programs. The name of the university, the type of online programs, and the name of the OPM provider have been removed to maintain anonymity.

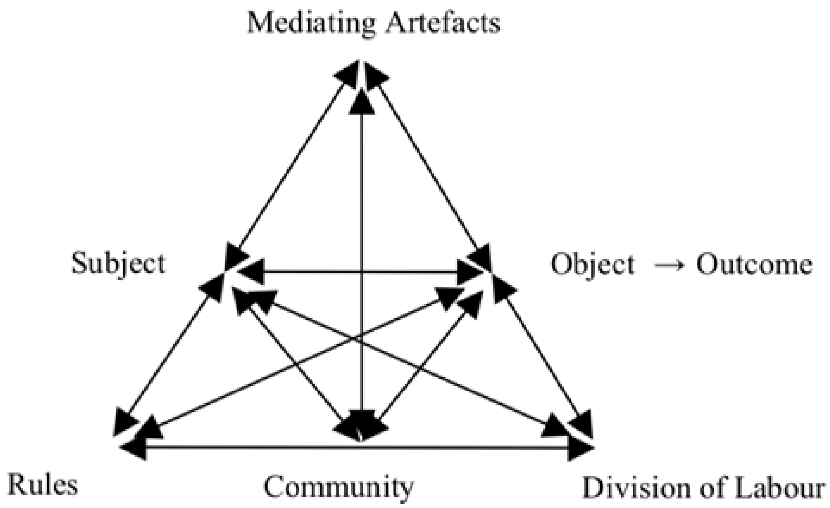
Faculty scheduled to teach in the fall semester codeveloped courses with the assistance of an instructional design firm and a media production firm (outsourced by OPM). These faculty members began receiving training from Faculty Support Services (in-house) provided by OPM. Administrative and technical staff at RU worked with OPM to integrate learning management and student management systems.

Activity Theory

Activity Theory (AT) was used as a framework to describe and analyze the entire work/activity system that involved the RU faculty and community, and OPM. Activity Theory is an umbrella term for a range of social science theories and research originating from Soviet psychologists Lev Vygotsky, Alexei Leont'ev, and Sergei Rubinstein (Cole & Engeström, 1993). Activity Theory is specifically useful in qualitative research methodologies (e.g., ethnography, case study) in providing a method for analyzing and understanding a phenomenon, finding patterns and making inferences across interactions, and describing and presenting phenomena through a built-in language and rhetoric. Activity Theory offers an external perspective on human practices (Arnseth, 2008). An activity cannot be understood or analyzed outside the context of which it occurs (Jonassen & Murphy, 1999). Analyzing human activity should not only involve examining the kinds of activities people engage in but also who is engaging in that activity, what their goals and intentions are, what objects or products result from the activity, the rules and norms that circumscribe that activity, and also the larger community in which the activity occurs. These are all parts of the activity system (Jonassen & Murphy, 1999).

Activity System. The most appropriate unit of analysis in a system is 'activity' (Jonassen & Murphy, 1999). The components of any activity are organized into activity systems (see Figure 1). The production of any activity involves the subject, the object of the activity, the tools (mediating artifacts) that are used in the activity and the actions and operations that affect an outcome (Jonassen & Murphy, 1999). The subject of any activity is the individual involved in the activity or the group of actors engaged in the activity. The object of the activity is the physical or mental product that is created. The object is acted on by the subject and is a representation of the intention that motivates the activity. Tools can be anything that will be used in the transformation of this process. The use of specific kinds of tools will shape the way people (or subjects) act and think. The tools alter the activity and are in turn altered by the activity (Jonassen & Murphy, 1999).

Figure 1
Engeström's (1999) Model of an Activity System

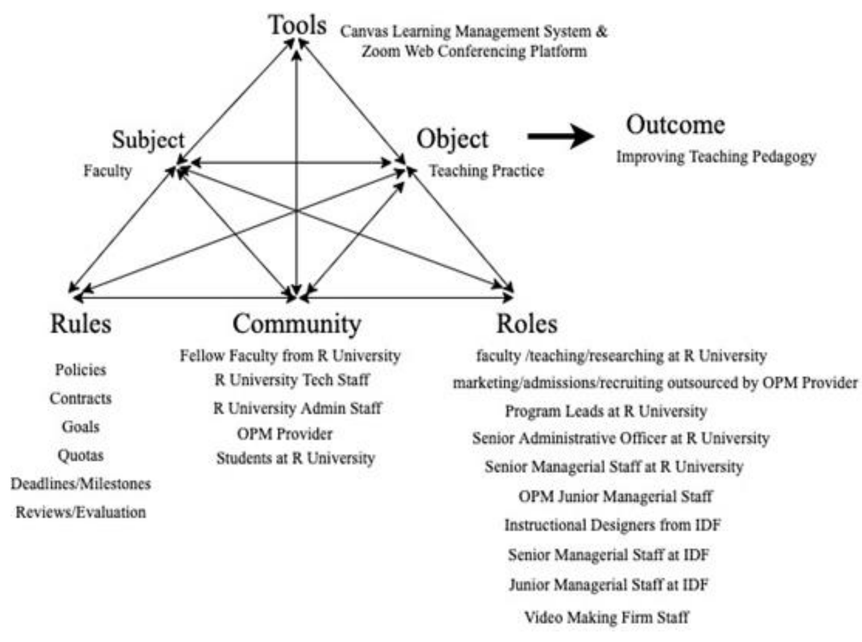


The AT model includes the following vertices moving in a clockwise rotation from mid-left: subject, mediating artefacts (tools), object, division of labor (roles) that influence the subject, community, and rules (Bradford et al., 2011). This model sets the actor and target action (or behavior) within the frame of the key factors having an influence on the actor and target action. Adjusting the model to the case of faculty and their teaching practices when launching online programs via a business relationship, the faculty is the subject with teaching as an object of active learning with an outcome target of new competencies. Teaching here implies anything related to the practice of teaching. It can also be improvements or new skills learned by the faculty member. Examples include a new approach to curriculum design, multimedia (audio or video) instruction, discussion forums, scaffolding, etc. The influences on the instructional process include current faculty roles, such as teaching and/or research, marketing, admissions, recruiting, leads, senior administrative officers, senior managerial staff, program leads, OPM managerial staff, the IDF (Instructional Design Firm) managerial staff, learning leads, and Instructional Designers working to support the object target outcomes (Bradford et al., 2011). Fellow faculty are part of the RU community. The community also includes technical and administrative staff from the RU. Fellow faculty (colleagues of faculty as actors) also impact other faculties as actors in the community section in this model. The community section also includes the students at RU. Students are part of the community in this model because the faculty provides educational experiences for their students. Policies, contracts, goals, quotas, deadlines, milestones, reviews, and evaluations are the rules that influence the faculty approach to teaching design. Finally, Information and Communication Technologies (ICTs), a Learning Management System (LMS), synchronous technologies, and other software that are used are the main tools to support online teaching for faculty and also help them design pedagogy. All kinds of technologies like data management integrations and other support systems from RU, the OPM provider, and the IDF are also part of the "Tools" section, and also impact faculty approaches to teaching design. In this framework, pedagogical knowledge and development gained by faculty can be considered as a mediator to reach the object by the actor (impact on teaching design by faculty). The resulting model incorporates the key actors playing a role to make an impact on faculty approaches to teaching design.

Activity Theory is a powerful framework for analyzing how faculty change their approaches to teaching design when they experience all the activities related to developing and launching online programs with an OPM provider. AT is also very useful because its assumptions are consonant with those that impact teaching design, faculty training and support, instructional designer and faculty interaction, pressure from the college community, student feedback and evaluation, faculty and technology interaction, policies and contracts with regards to R University and the OPM provider, the amount of time involved in designing online courses, and peer pressure (competing with other faculty members).

According to Bradford et al. (2011), activity theory can be used as a framework for an organization to self-evaluate its "Technology-enhanced learning" (TEL) or online learning practices. "The purpose of such a framework is to permit organizations a method by which they may examine their support for sustained innovation" (Bradford et al., 2011, p. 163). AT will support analysis in this case study by observing faculty and the community, roles, tools, and rules all the way from the start when faculty received training on course development and shifted to some on-ground teaching, and how the partnership between the two organizations managed the process. Figure 2 shows how this model fits into this case study situation.

Figure 2
Activity System Context for the RU and OPM Business Partnership



Research Design

The key informants were RU faculty members, RU staff, OPM staff, and instructional designers from the outsourced Instructional Design Firm (IDF). The first author had professional contact with one of the Program Leads of the online programs at R University who acted as gatekeeper. The Program Lead contacted the upper-level management of R University and the OPM provider managers to get the required permissions and formalize the study. The upper-level management of R University and the OPM provider managers granted permission because they felt that this study was important to understand how the relationship affects faculty professional development. The Program Lead sent out an email to all faculty who were going to participate in developing or teaching online courses and was able to motivate all colleagues to participate. An email was sent to all faculty by the first author as a follow-up informing them about the project and inviting them to participate in an interview. Out of 16 faculty members involved, 15 agreed to participate. The Program Lead also sent out an email to the OPM provider managers to motivate them to participate in this study. The first author followed up with one senior manager of the OPM provider and two junior managers who were overseeing the instructional design process to participate and schedule time for interviews. There was only one senior manager and two junior managers overseeing the process with this university. The OPM provider had outsourced their instructional design services with another firm. The Program Lead also communicated with this instructional design firm and encouraged them to participate. Upon their agreement, the researcher followed up with the junior instructional design manager to participate and schedule an interview. There was only one junior instructional design manager from this outsourced IDF overseeing the process. The first author communicated with this junior instructional design manager to connect with all the instructional designers involved with faculty. Four out of five instructional designers agreed to participate in this study. The first author sent an email to these four instructional designers as a follow-up to participate in this study and schedule an interview.

Data collection procedures. Interviews, participant observation, and documents were the primary sources of data collection. See Appendix A for interview questions. Meetings between the faculty and instructional OPM staff were observed. Canvas course blueprints and university web pages were used as documents to verify data. The study was considered as “Exempt” by the RU Institutional Review Board.

Data analysis. The objectives of this study were met through a rigorous interpretive analysis process guided by Activity Theory. The first step involved the preparation of the data for analysis and becoming familiar with the data. The recorded interviews were transcribed. Analysis of the interview data was concurrent with the ongoing data gathering. After reading and reviewing the interviews several times, the researcher could begin to identify patterns. During the initial phase and the middle phase of the analysis, the researcher communicated with many participants to follow up on additional data as more patterns and insights were found.

The initial coding was done using Strauss and Corbin’s (1994) coding method. An effort was made to uncover prominent themes in the experiences of faculty as well as how they are being influenced by each “role,” “rule,” “technical tool,” and everyone in the “community.” Looking at each of the vertices of the Activity Theory model, the researcher uncovered prominent themes in the project management process during this launch of online programs. Activity Theory complements how to explain the dynamic of the social and collaborative work environment. For this study, data triangulation was used for the instructional design process and some parts of the instructional delivery process of the online programs.

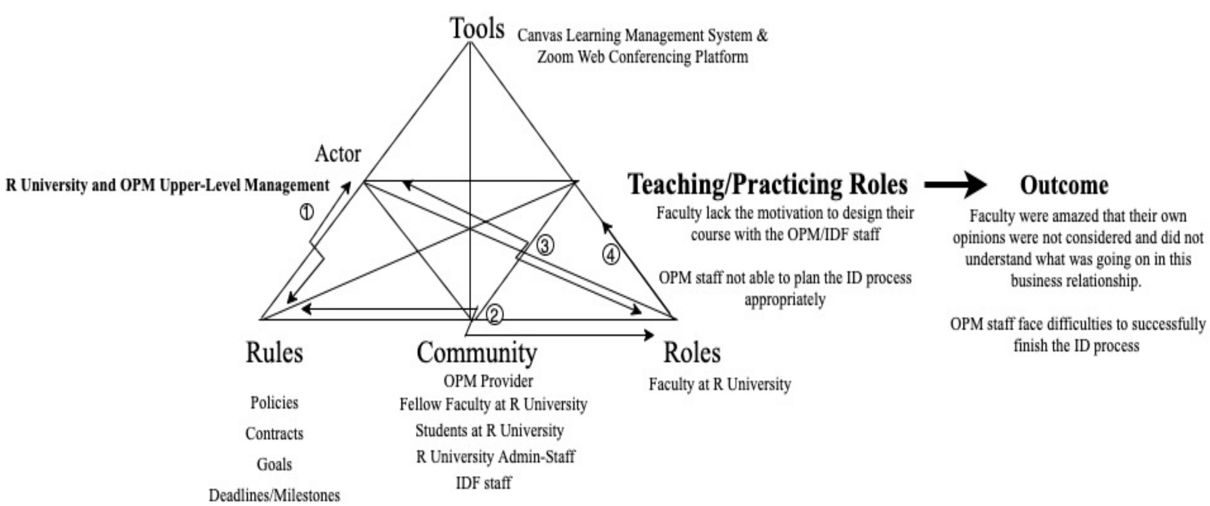
Results

The result of using the Case Study and Activity Theory method is a recognition that the project planning process the OPM team used included flaws that resulted in a number of tensions that were quite varied. There are many approaches to assist with the planning and management of projects; for example, the Design Thinking approach that is used in a variety of fields when it comes to managing projects involving many firms just like in the case here (Scheer, Noweski, &

Meinel, 2012; Cassim, 2013; Koh, Chai, & Wong, 2016). The most commonly followed instructional design project management approach is the ADDIE Model (Gayeski, 1997). Step-by-step procedures of the ADDIE model are too linear and time-consuming and the cycle time to develop course materials is very long (Gayeski, 1997). IDs tend to follow an iterative approach during the evaluation process to collect feedback on learning designs before releasing the course into final production (Gayeski, 1997). They tend to integrate an agile model into ADDIE to provide feedback during development and piloting (Peterson, 2003; Campbell, 2014). One example of an agile instructional design methodology is the Successive Approximation Model (SAM) process.

For this business partnership, the project management approach the OPM team used, or as was perceived by the faculty working with their respective IDs and other OPM managers, seems to have missed two initial parts of structured project management: in the case of Design Thinking, the first two phases, “Empathize” and “Define,” appear to be missing in the planning steps of the leadership team’s project management planning. For the ADDIE or Agile models, the first two parts of these project management approaches, “Analyze” and “Design,” also appear to be de-emphasized or missing. These two phases regardless of any project management approach used have been taken for granted by both RU and the OPM. This project planning or communication misalignment emerged as a result of this case study using Activity Theory analysis. Due to this misalignment, faculty were very frustrated and were not able to understand why they had to follow upper-level management decisions without even considering their opinion in this process. Figure 3 shows the flow of tension as bidirectional as faculty do not understand the decisions made by the upper-level management staff in this business partnership and their opinions were not taken into consideration. This figure shows the result pertaining to what was found.

Figure 3
Activity System Context for OPM/RU Incomplete Project Management Approach



Faculty are bound by a rule, i.e., a contract between RU and OPM (IDF outsourced) and a contract between themselves and RU. This is represented by arrow 2 and arrow 1, respectively.

Arrow 1 in Figure 3 represents the contract. Arrow 2 represents faculty bound with the contract between themselves and RU. Both arrow 1 and arrow 3 are two-sided to present the roles as they are influencing these players in the activity system. The actors (subject) for this activity are RU and OPM upper-level management, and faculty in this activity system play the "Role." The upper-level management were unable to first understand their faculty audience clearly before bringing in IDF and starting the instructional design process. There was no set of formal surveys, interviews, observations, or focus groups of faculty when this business relationship was considered. This led to lack of motivation among faculty as they did not understand why certain things were already decided without asking their opinions.

Arrow 3 represents frustration among faculty as they do not understand the policies and the reasoning behind decisions made for this business relationship. There was a mutual conflict between the RU faculty, and RU and OPM upper-level management, who were involved in managing and organizing this partnership. Hence, Arrow 3 is bidirectional. Arrow 4 is unidirectional representing the faculty's approach to their teaching and outcomes due to lack of proper planning. The impact on faculty pedagogical knowledge and development is that they lack the motivation to design their course with the OPM/IDF staff. As a result, the outcome was that faculty were surprised that their own opinions were not considered and they did not understand what was going on in this business relationship. As such, the OPM staff were not able to plan the ID process appropriately. The outcome for faculty is that OPM staff faced difficulties to successfully finish the ID process because of the lack of understanding their faculty audience prior to beginning the process for this partnership.

OPM provided options for two instructional design firms before starting the ID process. These firms did presentations, and RU faculty and staff selected IDF because they considered its approach better compared to the other instructional design firm. According to the Senior Administrative Officer at RU:

> Yeah, so OPM got IDF and another company called ABC. They had narrowed down those two as the best options for us. They then did a day of demo, with our faculty and our administration and so we got to meet with them, talk to them about how they approached what they did. … the instructional designers were also present. And so they gave us demos on how they build some courses and what they could do for us and how they approach what they do. And the faculty chose IDF.

All faculty were invited to come to these presentations and help to decide, but not all of them were able to come. All of the program leads did attend.

There were issues in the quality and skill-set of the IDF instructional design staff. They did not bring an instructional design firm that was tailored to fit the needs of RU. OPM staff missed on the "Empathize" and "Design" phases of this process. They did not understand the RU faculty in terms of their background, what they like to teach, and their assumptions about pedagogy and technology in teaching. RU upper-level management missed on the "Empathize" phase because they did not understand the background and needs of their faculty audience. There were no formal meetings, surveys, discussions, or interviews that would help to understand faculty needs and wants. No faculty personas were developed. Many decisions were not communicated to the faculty effectively. The quotes below show how some faculty were amazed that their own opinions were not considered and/or they did not understand the details of the partnership.

One faculty member felt that they should have been consulted about marketing as expressed in the following.

> A lot of OPM staff would come to campus and talk to us about ... how they were going to … you know I will give you an example. We realized that the target market after the first semester of advertising was probably the wrong target market. We are going after older people, and we wanted to shift towards millennials. … if I would have caught it earlier I could have said certain things and instead at these meetings I am presented almost finished products you know … And I said wait a minute … don't you think it should have a little bit of this…they said we didn't really think of that…you know that kind of thing. So, if you have a meeting just for the sake of it and you are showing what you are doing without collecting input from your faculty who were on the frontlines, especially if they are marketing people, then you are not using your time well.

This faculty member also complained that OPM people appeared disjointed and without any kind of substance during their annual meetings, and also stated that they should have allowed all faculty to express their opinions and have them express how the process should have gone. This faculty member complained that the instructional designers did not even open their minds to first listen to what the faculty had to say.

Another faculty member was concerned that decisions like the timings for synchronous classes were all taken by the leadership of OPM. Upon being asked if there were any meetings among all faculty within their program to make any decisions or communicate important things, this faculty member mentioned there were none of these.

> No I don't think so. There have been very few meetings where all faculty have been together with all the people you just mentioned.

Yet another faculty member corroborated this concern.

> Very informally. Like over lunch break and how things are going and so on. But no formal meetings or anything like that.

Upon being asked if the upper-level management took any survey, yet another faculty member stated that they were not aware of one.

> I have never participated in anything like that. Quite the opposite of that. I want to be able to modify the pieces of my courses as I see fit. You know I actually have those skills. I know how to build webpages. I know how to write code. You know it's not that Canvas is rocket science. It's sort of really just basic stuff … So you know….I am kind of cynical. I think that OPM views [it] as their course.

Some instructional designers complained that there were no set procedures and guidelines provided by the OPM side. According to one ID, they were not even provided any background of the faculty they would be working with and that they had to search on their own on social media.

> Yes. The briefings mainly on the faculty background were left to us to kind of research from their bio page or from LinkedIn or something like that. We certainly were alerted to the prestigious background of [RU] and that these certainly were experts in their field. And that ultimately if the faculty said that they wanted something done a certain way then that's the way we were going to do it. … So I think the relationship from the beginning was very clunky and very awkward because as I said I worked for IDF not OPM and so it would be like talking to your boss's boss is going over your boss to talk to someone. And so that relationship wasn't very clear.

This ID added:

> But certainly they did not have things in place in order to hire someone else to do what their vision was. I will say that. Whatever their vision was, they did not have the tools in place that would enable a clear path to work with faculty.

According to a junior managerial staff member of IDF, RU was one of their first projects along with three other universities. This means IDF never worked with OPM earlier. OPM was, in effect, testing this firm with RU. This junior manager also said that expectations were unclear for both IDs and faculty and things got better in the second build.

> … maybe for the first set of courses, the expectations were not set as clearly with the faculty or with the ID's. I don't think it was clear how many hours the faculty were expected to put in. And I don't know if the faculty knew that.

As mentioned earlier, OPM did not first study and understand the faculty before beginning the term 1 build. IDF and OPM were not even aware of faculty schedules and vacation plans. The junior manager also noted that they were unprepared. They did not know what course examples to show to faculty due to the lack of proper understanding of needs and expectations of faculty.

> … [as] we were developing the first set of courses there were still decisions being made about how things will be built in Canvas, what the homepage will look like, like all of those things were still being decided. So I think there was rework. But … most of the rework impact [was] on the ID and not much the faculty, I hope.

IDF was asked to match the instructional designers with faculty based on their subject matter expertise. No other information about faculty personas was given to IDF. A junior manager with OPM noted that:

> … we asked IDF to find people who have expertise in certain areas to try and enhance it. Of course, we can't guarantee that we can find instructional designers with expertise in certain content areas, but we do push for that. And then, we are not involved in the vetting of instructional designers …
> This junior manager also mentioned they did not start anything until the kickoff meeting.

The kickoff meeting was the first time when all the OPM staff, IDF staff, and faculty met for the ID process to start.

> It's just really hard to match people, you know, when they don't know each other and when you haven't. Like for example, we hadn't met a lot of the faculty until the kickoff and the problem we ran into is at the kickoff meeting, what do you start building? You have to have the IDs assigned so they can start working together. And so there's that lack of your, you kind of, you're doing your best to assign the instructional designers with very little information.

OPM staff was not well prepared to present to faculty with course examples and multimedia. The OPM junior manager considered this meeting as their training. Another OPM junior manager also mentioned that when they first joined, faculty were trying to understand what this process meant for them and lacked the knowledge and skills to complete the process. This shows that the assumptions of what faculty already know about pedagogy and technology had not been clarified.

> So, I definitely say the gaps were in organizational understanding and organizational effectiveness and then of course the knowledge and skills both from the SME's, meaning the faculty who are building, and some of the ways in which leadership were able to help them.

The training for faculty by OPM staff was not handled properly. OPM staff considered the faculty orientation as a training session. For the orientation, faculty were told how to work with their ID without first clarifying their current assumptions and knowledge. There was no formal training designed when they started working with RU faculty, but it was in process.

One of the main goals for RU from this business relationship was to help faculty grow in their online teaching knowledge and practice. Based on the interviews with faculty, IDF staff and OPM staff, there were no formal data collection procedures to first understand what the faculty knows, what they do, their plans for the course build, their personality characteristics, and so on. In other words, OPM did not first "Empathize" with the faculty. At most, OPM acquired the basic information about the faculty, in general, from the management staff at RU. The upper-level management of RU also did not first understand their own faculty and hence was not able to communicate this information properly to the OPM staff. This lack of empathy meant that the IDF staff, outsourced by OPM, was also not able to get enough information about the faculty with whom they would be working.

By not addressing the "Empathize" phase of the Design Thinking project management approach, OPM was not able to correctly address the "Design Phase." The result was that the partnership felt like a startup company without having all the procedures and guidelines in place. Some faculty considered this process to be disorganized and they lacked the motivation to participate fully in the ID process.

Discussion

This study is one effort to understand the project process management between a university and an OPM provider. Based on the analysis and interpretations of this study of a newly formed business relationship between an OPM provider and a research university to develop online programs, while there was an opportunity for faculty professional development, some management decisions seem to have limited the expected results. This was because OPM and R University did not take enough time to understand faculty motivations, why the faculty were participating in this process, what their current knowledge and experience with regards to online teaching were, what their personal circumstances were, and so forth.

The upper-level management for all sides of this partnership did not consider the importance of the “Empathize” and “Define” phases in the Design Thinking Process. “Empathize” will help managers to understand the faculty audience. This could be done via a questionnaire, interviews or focus groups to build faculty personas that would be used to potentially differentiate the training and instructional design processes, and also match the ID staff accordingly. In addition to demographics, this step should ask faculty for their goals from participating in this process; their intentions to participate in this process, their schedule, and the amount of time that they could give to this instructional design process based on their other personal and professional responsibilities; their background in pedagogy and technology; their physical, social, and technological environment; and so on. In other words, the “Empathize” phase of the Design Thinking Process could have helped to facilitate the “Define” phase which would have identified the core needs of the faculty at RU and hence helped to improve the instructional design process for all stakeholders. Faculty can have a positive influence if all things are properly planned. According to the literature review, most OPM providers do not invest in instructional design because the underlying economic arrangement does not reward or benefit them by tailoring or suiting their approach to a particular college or university (InsideHigherEd.com, 2019). Enrollment of students in these online programs and not instructional design is of utmost importance for OPM providers, as well as the higher educational institutions. Online enrollment drives revenue growth for both (Riter, 2017). As a result, most of their resources go into marketing and not into designing highly effective online programs. However, the potential cost of losing the effectiveness of course design can be lower completion rates and reduced satisfaction (Bawa, 2016; Hone & Said, 2016; Educause.edu, 2010). Thus, this study shows that there are some glitches in the partnership process management where a lot of information was not communicated to the faculty, and the faculty needs and background were not considered. This study showed that the OPM partnership model may not consider tailoring the instructional design needs to the specific university environment.

In terms of limitations, this research is only based on one case study at a research university in the United States. There is a possibility that the interview answers from OPM staff and IDF were biased due to the fear of not wanting to give out any information that has a negative impact on their own organization. There were also time constraints as it was not possible to follow the partnership through more than two terms and the programs for this study were only for Master’s degrees

Implications for Practice

OPM Provider Managers. OPM providers play a very important role in offering the best instructional design services to faculty at their partner university. Every university faculty audience is different. An OPM provider should first analyze individual faculty backgrounds before assigning a specific instructional design firm to the respective university. OPM managers should be very careful in the selection of ID firms. They should look into ID firms’ strategies, mission, and instructional designers’ skill sets, instructional designers’ background and how the ID firm hires its instructional designers (permanent or contract positions). OPM providers and their partner universities should carefully check the experience and skills of these instructional designers and analyze if they could fit into the OPM-University Model.

OPM provider managers should meet the instructional designers before aligning them with the faculty and communicate and train them on what the OPM's strategy is and how things will work. Training and communication of strategies for IDs will be very important. When outsourcing the instructional design firm, it is important to communicate strategies, resources, and planning of activities before jumping straight to the meetings with faculty of the university involved. This research showed that there were serious concerns regarding the coordination of the OPM staff and IDF staff especially in the very beginning, namely the term 1 build. During a new relationship, OPM managers should be very careful regarding coordination between staff from both the OPM provider and the IDF, and plan ahead to avoid errors and misunderstandings that can have a deep impact on faculty motivations to participate in this process.

In the study reported here, there were transitions in positions of the junior managerial staff of OPM as well as several transitions of IDs and some ID managers at IDF. These transitions within a single term build can create a negative impression on faculty perspectives of the OPM provider and IDF management and planning. OPM providers should make sure, to the extent possible, that the same people work for all the staff positions until the entire term build is over.

OPM providers should clarify with the university administrators regarding details of their faculty. OPM administrators should collect faculty data from the university they work with via surveys, interviews, focus groups, and observations. They should try to develop faculty personas for the respective universities with which they work. This faculty data collection should include faculty job title; major responsibilities; demographics; goals and tasks; their physical, social, and technological environment; and their personality characteristics. They should also share this data with the instructional design firm, if outsourced.

Higher Education Administrators. Higher Education administrators play a very important role in the online program management partnership model. They should communicate effectively and clearly all the design decisions through events and meetings regarding the timings, hours required, number of weeks, implementations, organizations involved, and the goals for each and every stage, not only with the program leads, but also with all the faculty involved in teaching online. They should also provide incentives so that faculty participate in such events and meetings. If communication is only done with the program leads, it can be misinterpreted when it is communicated to all the respective faculty by their program lead. Lack of proper communication makes it difficult for faculty to understand why they are doing certain things a certain way or why they are doing those things at all.

All the efforts involved in an online program initiative should be merged with the strategy of the university. This intention should also be properly communicated to all the faculty who are participating. This will help the faculty to get to know the reason why this online initiative is going to help their university. This was one part of the communication process for which RU was successful.

College administrators should also first try to understand the characteristics of faculty who will teach online. They should try to "Empathize" with their faculty by understanding what their faculty audience needs and demands are, how much time and how many resources they have access to, and where their faculty currently stand in terms of their pedagogy and technological knowledge. They should also consider faculty who participate in the instructional design process to also teach their course online, or if that is not the case to codesign with a faculty member (e.g., an adjunct) who will be teaching the course online.

Further Research

We encourage other researchers to determine whether Activity Theory can help a budding partnership be successful. Because higher education managers and administrators have significant involvement with online teaching, especially with respect to OPMs, Activity Theory may prove to be a very useful technique to help them analyze and quickly solve problems in online education; for example, problems in relation to faculty schedules, instructional designers and subject matter knowledge, faculty training in pedagogy and technology when getting into online education, etc.

This study shows the importance of the first two phases of a project management approach like Design Thinking (DT). Further research could also explore how DT might provide new knowledge about project management challenges in partnerships. Such studies could further inform the field (ID, private sector-academia, etc.) of opportunities to improve complex projects like this one reported here.

Declarations

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The author(s) assert that approval from an ethics review board (IRB) was obtained, but declined to include the name of the board that reviewed study.

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References

Armstrong, J. B., & Sherman, T. M. (1988). Caveat emptor: How SME's can ensure good ID. *Performance + Instruction*, *27*(4), 13–18. https://doi.org/10.1002/pfi.4170270405

Arnseth, H. C. (2008). Activity theory and situated learning theory: Contrasting views of educational practice. *Pedagogy, Culture & Society*, *16*(3), 289–302. https://doi.org/10.1080/14681360802346663

Barczyk, C., Buckenmeyer, J., & Feldman, L. (2010). Mentoring professors: A model for developing quality online instructors and courses in higher education. *International Journal on E-Learning, 9(1),* 7–26. https://www.editlib.org/p/29273

Bawa, P. (2016). Retention in online Courses: Exploring issues and solutions—A literature review. *SAGE Open*. *6* (1), 1–11. https://doi.org/10.1177/2158244015621777

Bichelmeyer, B. (2005). *The ADDIE model: A metaphor for the lack of clarity in the field of IDT*. Association for Educational Communications and Technology Annual Conference, Chicago, IL. http://www.indiana.edu/~idt/shortpapers/documents/IDTf_Bic.pdf

Boling, E., Hough, M., Krinsky, H., Saleem, H., & Stevens, M. (2012). Cutting the distance in distance education: Perspectives on what promotes positive, online learning experiences. *The Internet and Higher Education*, *15*(2), 118–126. https://doi.org/10.1016/j.iheduc.2011.11.006

Bradford, G., Kehrwald, B., & Dinmore, S. (2011). A framework for evaluating online learning in an ecology of sustainable innovation. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011*. (pp. 162–167).

Breunig, M. (2005). Turning experiential education and critical pedagogy theory into praxis. *Journal of Experiential Education*, *28*(2), 106–122. https://doi.org/10.1177/105382590502800205

Cassim, F. (2013), Hands On, Hearts On, Minds On: Design Thinking Within an Education Context. *International Journal of Art & Design Education*, *32*, 190–202. https://doi.org/10.1111/j.1476-8070.2013.01752.x

Campbell, P. C. (2014). Modifying ADDIE: Incorporating New Technologies in Library Instruction. *Public Services Quarterly*, *10*(2), 138–149.

Chittur, D. (2018). *A phenomenological study of professors and instructional designers during online course development leading to enhanced student-centered pedagogy* [Doctoral Dissertation, Pepperdine University]. ProQuest Dissertations & Theses Global. (2035341879). Retrieved November 20, 2020, from http://ccl.idm.oclc.org/login?url=https://search-proquest-com.ccl.idm.oclc.org/docview/2035341879?accountid=10141

Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (1st ed., pp. 1–46) Cambridge University Press.

Educause.edu. (2010). Enhancing student learning and retention with blended learning class guides. *Educause Review.* https://er.educause.edu/articles/2010/12/enhancing-student-learning-and-retention-with-blended-learning-class-guides

Engeström, Y. (1999). Activity theory and transformation. In Y. Engeström, R. Miettinen, & R. Punamaki (Eds.), *Perspectives on Activity Theory* (pp. 19–38). Cambridge University Press.

Engestrom, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, *43*(7), 960–974. https://doi.org/10.1080/001401300409143

Fetherston, T. (2001). Pedagogical challenges for the World Wide Web. *Educational Technology Review*, *9*(1), 25–32.

Fink, L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses* (2nd ed). Jossey-Bass.

Fink, L. D. (2013a). The current status of faculty development internationally. *International Journal for the Scholarship of Teaching and Learning*, *7*(2), 1–10. https://doi.org/10.20429/ijsotl.2013.070204

Forest, E. (2014). The ADDIE model: Instructional design. *Educational Technology*. http://educationaltechnology.net/the-addie-model-instructional-design/

Gayeski, D. M. (1997). Out-of-the Box instructional design: Moving from assembly-line models to non-linear performance models. dgayeski.com. http://www.dgayeski.com/t&disd.html

Hardy, K., & Bower, B. (2004). Instructional and work life issues for distance learning faculty. *New Directions for Community Colleges*, *2004*(128), 47–54. https://doi.org/10.1002/cc.174

Hone, K. S., & Said, G. R. (2016). Exploring the factors affecting MOOC retention: A survey study. *Computers & Education*, *98*, 157–168. https://doi.org/10.1016/j.compedu.2016.03.016

InsideHigherED.com. (2019). The instructional designer and the OPM conversation | *Inside Higher Ed*. https://www.insidehighered.com/blogs/technology-and-learning/instructional-designer-and-opm-conversation

Jonassen, D. H., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. *Educational Technology Research and Development*, *47*(1), 61–79. https://doi.org/10.1007/bf02299477

Koh, J. H. L. C., Ching, S., & Wong, B.. (2016). *Design thinking for education*. *Conceptions and applications in teaching and learning*. Springer.

Lin, Y., & Jacobs, R. L. (2008). The perceptions of human resource development professionals in Taiwan regarding their working relationships with subject matter experts (SMEs) during the training design process. *Human Resource Development International*, *11*(3), 237–252. https://doi.org/10.1080/13678860802102526

McQuiggan, C. A. (2007). The role of faculty development in online teaching potential to question teaching beliefs and assumptions. *Online Journal of Distance Learning Administration*, *10*(3), 1–13.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement*, *42*(5), 34–37. https://doi.org/10.1002/pfi.4930420508

Morris, S. M., & Stommel, J. (2016, October 27). Why online programs fail, and 5 things we can do about it. *Hybrid Pedagogy*. https://hybridpedagogy.org/why-online-programs-fail-and-5-things-we-can-do-about-it/

Myers, M. D. (2013). *Qualitative research in business and management*. SAGE.

Oliver, R. (2002). Exploring strategies for online teaching and learning. In L. Foster, B. L.Bower, & L. W. Watson (Eds.), *ASHE Reader—Distance education: Teaching and learning in higher education* (pp. 249–257). Pearson Custom.

Pan, C. C., Deets, J., Phillips, W., & Cornell, R. (2003). Pulling tigers' teeth without getting bitten: Instructional designers and faculty. *Quarterly Review of Distance Education*, *4*(3), 289–302. https://www.learntechlib.org/p/97583/.

Paquette, G. (2014). Technology-based instructional design: Evolution and major trends. In D.H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 661–671). Springer.

Peterson, C. (2003). Bringing ADDIE to life: Instructional design at its best. *Journal of Educational Multimedia And Hypermedia*, *12*(3), 227–241. https://www.learntechlib.org/primary/p/2074/.

Phillips, W. O. (2008). *A study of instructor persona in the online environment* [Doctoral dissertation, University of Central Florida] (Order No. 3319267). ProQuest Dissertations & Theses Global. (89210364). http://ccl.idm.oclc.org/login?url=https://search-proquest-com.ccl.idm.oclc.org/docview/89210364?accountid=10141

Riter, P. (2017). Five myths about online program management. *Educause Review.* https://er.educause.edu/articles/2017/3/five-myths-about-online-program-management

Russell, A. (2015). Online teaching as a catalyst for re-examining pedagogical assumptions. *Journal on Excellence in College Teaching, 26*(3), 57–91.

Scheer, A., Noweski, C., & Meinel, C. (2012). Transforming constructivist learning into action: Design thinking in education. *Design and Technology Education*, *17*(3), 8–19. https://eric.ed.gov/?id=EJ996067

Schwier, R. A., Campbell, K., & Kenny, R. F. (2007). Instructional designers' perceptions of their agency: Tales of change and community. In M. Keppell (Ed.), *Instructional design: Case studies in communities of practice* (pp. 1–18). Information Science Publishing.

Springer, S. (2018). One university's experience partnering with an online program management (OPM) provider: A case study. *Online Journal of Distance Learning Administration*, *21*(1). https://www.westga.edu/~distance/ojdla/spring211/springer211.html

Strauss, A., & Corbin, J. (1994). Grounded theory methodology: An overview. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (p. 273–285). Sage Publications, Inc.

You, J. (2010) *A study of faculty members' perceived utilization of best practices in distance learning course design and delivery and the role of instructional designers* [Unpublished doctoral dissertation]. University of Toledo. https://etd.ohiolink.edu/rws_etd/document/get/toledo1279298347/inline

Appendix A

Semi-Structured Interview Questions

Questions were framed based on the activity theory framework adjusted to process.

Faculty (Including Program Leads)

This is an overall list of common questions for faculty. Every interview was different. Many questions pertaining to situation came up during this interview process.

List of Questions:

1. What is your position at R University?
2. How were you brought into this process of online course design and teaching?
3. What are your thoughts and reasons for R University to get into online degree programs?
4. How did you decide which courses to put online or which online degree programs to put online?
5. What changes pertaining to the degree program did you'll go through when moving from residential programs to online programs?
6. What courses do you teach face-to-face and which ones are you going to teach online?
7. Did any of the leadership upper management people put any restrictions on course objectives or program objectives and anything related to the curriculum design process?
8. Anything related to marketing level that made you change your teaching design/practice or objective of program or course level?
9. Can you elaborate your experience on the instructional design process provided to you by OPM and IDF?
10. Online Teaching is completely different than traditional teaching. Online courses require a complete redesign and different pedagogical strategies. Pedagogy behind online teaching is completely different and completely changes compared to face-to-face traditional teaching. So how did the relationship between OPM or the ID's provided by IDF in collaboration with OPM impact changes in your approach to teaching design or pedagogical knowledge and development?
11. Have you ever taught online before?
12. So when you will be developing your future face-to-face or future online courses are you going to take any of their suggestions?
13. Can you elaborate on each of those like any of these strategies you just mentioned?
14. Do you feel there is going to be a bit change with teaching online? Are you nervous? Or Are you excited?
15. When in this design process do you eventually think when you go back to teaching face-to-face class are you going to implement the suggestions provided by the ID's?
16. Which are these strategies?
17. When you have a conversation with your ID's or anyone in the community like upper management, provost, community and say that I think we should change this or that because I think students are going to learn better this and it will be better for them? Say for example you have a discussion with ID do you ever suggest them or ask them to do it this way because you think your students are going to learn better in this way and not that way? Converse that this way of teaching is going to be more effective? Converse with ID, OPM or upper management or community anyone?
18. Has there been any communication with fellow faculty and any strategy they have been using has influenced you?

19. In this process does any admins staff or IT team from R University come into contact during this process?
20. Has there been any strict regulations of anything related to deadlines during the ID process?
21. Are there any deadlines from the upper level management?
22. Does marketing impact anything related decision about courses?
23. Do you have any specific requirements for your teaching practice from the marketing side?
24. Are you using anything related to this to the marketing strategy in your course designs?
25. Has the upper level management set any goals for this program?
26. Are there any specific number of student enrollment that is required?
27. Has the contract between OPM and R University made any impact on the overall online program or any of your teaching practice?
28. Have they forced you to do something related to pedagogy or coursework according to that way or this way or that way?
29. Are you creating all the materials or are the ID' creating it for you?
30. Has any of your research background impacted this to balance between research and preparation for online program?
31. Does your research practice create a conflict with teaching practice?
32. What about anything in relation to yourself and R University has impacted your teaching practice? For example, to save time anyone from upper-level management has come up and say that you have to design your assignments in this way or objectives...and so on ...?
33. Are you happy with the technical tools provided?
34. Were you involved in selecting these technical tools?
35. What is your overall experience with ID's? Can you elaborate on the ID process experience as a whole? And what do you think the university, OPM, and IDF could have done to improve the process?
36. Can you elaborate more on how much technical training were you provided and by whom? And what more was needed? Anything related to Zoom required something more detailed especially that was related to pedagogy? Anything that required more related to Hands-on training right before teaching?
37. Did you have a TA for your course? How helpful was the TA? Please provide very much in detail? Did the TA help in this online course development process?
38. There were no manuals on Canvas or Zoom for students in the blueprint version sent to me on Canvas. Nor did I see any videos training them on how to go about working on Canvas or Zoom. According to Quality Matters, this information is really important. Did this come up in the instructional design process? How important do you think it is for your students? Do you think if you had this technical information on how to use technologies it would be beneficial for your students? Does this impact your teaching?
39. Online and residency classes are bounded which is students cannot interchange, Students have to follow one track either take the whole program face-to-face or take the whole program online- Did this bother you in your teaching or course design?
40. Technical Constraints: Changes to course materials after publishing are fixed from IDF end. So once the course is published and while you are teaching if you want to change anything or face issues on course content you have to create tickets that are to be sent to IDF in a foreign country to fix- Was this an issue in your course design and teaching?

41. Design Decisions—Changes as to what you were teaching in the residential section of the program—1. Synchronous session in the evening at 5–7 pm—2. Only 2 hours live teaching—3. Shorter no of weeks—Did these Design Decisions from R University and OPM impact on your teaching or course design factors?

Instructional Designers

This is an overall list of common questions for IDs. Every interview was different. Many questions pertaining to situation came up during this interview process.

List of Questions:

1. Compared to other faculties you have previously worked with - what were the easy/enjoyable parts of the process, what worked well and why do you think it worked so well.
2. Did you see any growth or a lessening of faculty knowledge about pedagogy and/or motivation to change/improve their teaching? Especially also, did you see any transfer of things learned about online teaching to applications or intentions/interest to apply the same to their face-to-face teaching among faculty?
3. How much did R University and/or OPM help you before they started working with faculty - were there briefings on faculty background, expectations, potential areas of challenges so you had some kind of pre-alert?
4. How much did R University and/or OPM engage with the ID-Faculty interaction - were any interventions or R University/OPM input needed within the ID-faculty development/design process? Or R University/OPM sources of essential information that you had … i.e., in any way was R University / OPM really useful in your work with faculty?
5. Do you have any previous experience where you have worked with faculty WITHOUT there being an institution-OPM partnership model - i.e. where you worked directly within an institution, or work was contracted out from an institution to the ID company - if you have this experience, how does that compare to working with faculty within the umbrella of the institution - OPM partnership. I want to know if this makes a significant difference or not.

OPM Staff

This is an overall list of common questions for faculty. Every interview was different. Many questions pertaining to situation came up during this interview process.

List of Questions

1. Can you tell me first, what is OPM's core model approach for online program management?
2. So how did the R University partnership came up? Did they call you? How did the process really start? Do you remember? Were you part of that?
3. What exactly is your position at OPM?
4. Can you provide the OPM Organizational Chart? Can you elaborate which services are being outsourced and why?
5. So can you elaborate on what exactly belongs to you and what is being outsourced? All the services that you run?
6. Were there any specific number of student enrollment required to, for the program to continue running or?

7. Can you elaborate more on the kind of training services for faculty that are involved in this process?
8. Can you elaborate on the video making services provided by the Video making firm?
9. What relationship does it have with OPM? Why did OPM think that this service was needed?
10. Can you elaborate more the faculty support services for R University provided by the OPM?
11. Can you elaborate on the Student Support Services provided by OPM for R University students?
12. Can you provide details on the kick-off meeting or orientation provided for faculty by the OPM to introduce on the instructional design process?
13. Can you elaborate on the training sessions provided for faculty till now?
14. What more training services are being planned?
15. What role does OPM play when the dynamics between the ID from IDF and faculty from R University do not work well?
16. Is this the first project OPM is working on with IDF? Is R University, IDFs first client from OPM? Or have you'll work with IDF in the past with any other university?
17. What was the most important communication or terms and conditions between OPM and IDF when you confirmed R University as their client to work with them?
18. How deeply does OPM check with the skills of ID's that IDF is providing? Did OPM check with IDF regarding how do they hire ID's? How rigorous are their hiring processes and do their ID's have past experiences working with faculty specifically in higher ed? And most importantly how do they match their ID's with the faculty? Do you'll check all this?
19. What role does OPM play if the dynamics between the ID from IDF and faculty from R University do not work very well?
20. What do you think of this process overall? How has everything been?

A Meta-Analysis on the Community of Inquiry Presences and Learning Outcomes in Online and Blended Learning Environments

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Abstract
The Community of Inquiry (CoI) framework describes three essential presences (i.e., teaching presence, cognitive presence, and social presence) and how these presences interact in providing an educational experience in online and blended learning environments. This meta-analysis examined 19 empirical studies on the CoI Presences (teaching presence, social presence, and cognitive presence) and their correlations with learning outcomes, including actual learning, perceived learning, and satisfaction. It was found that teaching presence and actual learning were moderately positively correlated, (r = .353). There was a weak correlation between cognitive presence and actual learning, (r = .250) and social presence and actual learning, (r = .199). For the correlation between the presences and perceived learning, cognitive presence and perceived learning was found to be strongly correlated, (r = .663), followed by the moderate correlation between social presence and perceived learning (r = .432), and teaching presence and perceived learning, (r = .392). With respect to satisfaction, the correlation between cognitive presence and satisfaction (r = .586), and between teaching presence and satisfaction was strong (r = .510), but the correlation between social presence and satisfaction was moderate (r = .447). The findings have implications for designers and instructors who design and teach online and blended courses to include these presences.

Keywords: Community of Inquiry, teaching presence, cognitive presence, social presence, online learning, blended learning, meta-analysis

Martin, F., Wu, T., Wan, L., Xie, K. (2022). A meta-analysis of the Community of Inquiry presences and learning outcomes in online and blended learning environments. *Online Learning, 26*(1), 325-359. DOI: 10.24059/olj.v26i1.2604

Online and blended learning has increased in the last decade (Seaman et al., 2018), so has the challenges that come with it. Several challenges exist in online learning including student isolation and dropout due to the lack of interaction and engagement (Ali & Smith, 2015; Croft et al., 2010; Xie et al., 2006, 2011). Some online courses are designed to be self-paced without any interaction between students and their instructors and peers. This has resulted in students not being engaged in learning. Research has emphasized the importance of interaction and presence in the online learning environment (Bolliger & Inan, 2012; Bolliger & Martin, 2018). Presence within the context of this study can be explained through the Community of Inquiry (CoI) framework, which suggests three types of presence, including teaching presence, cognitive presence, and social presence, are necessary to develop a deep and meaningful learning experience supported by the educational community (Garrison, 2007). An educational CoI is "a group of individuals who collaboratively engage in purposeful critical discourse and reflection to construct personal meaning and confirm mutual understanding" (Garrison, 2011, p. 2).

The CoI framework created by Garrison et al. (2000; 2001) focuses on the process of learning. It was created consistent with John Dewey's work on community and inquiry where he emphasized that educational experience is a process of reflective inquiry (Dewey, 1933). Building on Dewey's work, the CoI framework was developed focusing on asynchronous online discussions where collaborative learning experience was involved instead of self-paced individual online learning (Garrison, Anderson et al., 2010). Through the CoI framework, this study examines the associations between the three types of presence including, teaching presence, cognitive presence, and social presence, andstudents' actual learning, perceived learning, and satisfaction. Rather than collapsing all learning outcomes together, studies were analyzed for each of the three outcome variables individually. While examining perceived learning and satisfaction has been conducted in other CoI meta-analysis (Caskurlu et al., 2020; Richardson et al., 2017), this study in addition examines actual learning, which is a critical learning outcome.

Community of Inquiry Presences

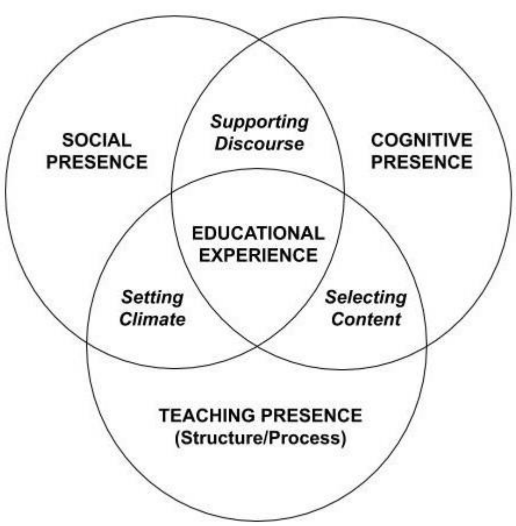
Cognitive presence focuses on students constructing meaning through critical reflection and discourse and is defined as "exploration, construction, resolution, and confirmation of understanding through collaboration and reflection in a Community of Inquiry" (Garrison, 2007, p. 65). This is operationalized through the practical inquiry model where the four phases are triggering event, exploration, integration, and resolution (Garrison et al., 2001). It applies a cycle of inquiry where participants deliberately move from the problem or issue to exploration, integration, and resolution of the problem. Using application-focused discussion questions or collaborative problem solution help the learners in moving to the resolution phase (Fiock, 2020). Cognitive presence focuses on higher-order thinking through collaboration and instructor and peer facilitation with community members during the critical inquiry process (Chen et al., 2019; Galikyan & Admiraal, 2019; Garrison et al., 2001; Gašević et al., 2015). CoI survey-based research revealed students reporting high levels of cognitive presence (Shea & Bidjerano, 2009a), and variation in technology use based on cognitive presence (Kovanović et al., 2017). However, the transcript analysis in asynchronous online discussions revealed low levels of discourse and knowledge construction. While 53.32% of the online discussions focused on exploration, and 26.05% was on integration, only 10.84% of the online discussions focused on trigger and 9.79% on resolution (Kanuka et al., 2007). Research has found positive relationship between cognitive presence and student learning and student satisfaction (Hosler & Arend, 2012; Kang et al., 2014).

Teaching presence focuses on instructor interactions with students and content and was defined by Anderson et al. (2001) as "design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educational worthwhile learning outcomes" (p. 5). This includes moderation and guidance of the inquiry, and involves design and organization, facilitating discourse, and direct instruction. Primary studies have found a positive relationship between teaching presence, and student perceived learning (Arbaugh, 2008; Kranzow, 2013; Shea et al., 2005), and student satisfaction (Abdous & Yen, 2010; Akyol & Garrison, 2008; Shin, 2003).

Social presence examines the human experience of learning and is defined as "the ability of participants to identify with the community, communicate purposefully in a trusting environment, and develop inter-personal relationships by way of projecting their individual personalities." (Garrison, 2009, p. 352). The "social presence" in the CoI framework is multidimensional and includes affective expression, open communication and group cohesion. Social presence has a connection to teaching and learning elements (Garrison, Cleveland-Innes, et al., 2010). Research has shown that social presence can support cognitive engagement in online courses (Xie & Ke, 2011) and also can reduce the presence of social conflict (also known as conflictual presence) in the learning community (Xie et al., 2013, 2017). Social presence was found to have no relationship on learning outcomes (Joo et al., 2011; Shin, 2003) though it was associated with satisfaction (Akyol & Garrison, 2008; Richardson & Swan, 2003; Swan & Shih, 2005).

The CoI framework (Figure 1) discusses the ways in which these presences interact with each other in an online course. Besides the three presences interacting to provide an educational experience, the interaction of social and cognitive presence results in supporting discourse, the interaction of social and teaching presence results in setting the climate.

Figure 1
Community of Inquiry Framework (CoI Framework, 2020)



The interaction of teaching and cognitive presence results in selecting the content (Garrison, Cleveland-Innes et al., 2010; Hosler & Arrend, 2012). Research has found cognitive presence to have strong relationship between teaching and social presence, and teaching presence to significantly predict cognitive presence (Kozan & Richardson, 2014). Research has also found social presence to mediate between teaching and cognitive presence (Shea & Bidjerano, 2009b). Primary studies have found cognitive presence to have stronger relationships with learning and satisfaction in comparison to teaching presence (Akyol & Garrison, 2008) and that cognitive presence is achieved by instructors' skills in fostering teaching presence and students' abilities to establish social presence (Shea & Bidjerano, 2009b).

Community of Inquiry Instrumentation

In order to facilitate research based on the CoI framework, survey instruments have been created and validated in various studies. Among them is the CoI Survey that was initially developed by Arbaugh et al. (2008) and validated by Swan et al. (2008). The CoI survey is currently in its 14th version (CoI, 2020) and has 34 items, of which 13 items focus on teaching presence, 9 items on social presence, and 12 items on cognitive presence. Arbaugh et al. (2008) administered the 34-item CoI survey to students enrolled in graduate-level courses in either Education or Business across four institutions in the United States and Canada. Internal consistency (Cronbach's alpha) with 287 students were reported as .94, .91, and .95 for teaching presence, social presence, and cognitive presence, respectively. Table 1 provides a description of items aligned with the CoI framework for the three presences.

Table 1
CoI Survey Items

Type of Presence	**Number of items**	**Description**
Teaching Presence		
Design and Organization	4 items	Learners describe instructors communicating course topics, course goals, providing instructions to participate in course learning activities and communicating due/dates and time frames for learning activities.
Facilitation	6 items	Learners describe instructor's helpfulness in helping the students learn course topics, understanding of course topics to clarify thinking, engaging the participants in a dialogue, keeping the participants on task, encouraging them to explore new concepts and develop a sense of community among the participants.
Direct Instruction	3 items	Learners describe instructor's guiding discussion on relevant issues, providing feedback to the student based on their strengths and weakness in the course and providing timely feedback.
Social Presence		
Affective Expression	3 items	Learners describe getting to know the other course participants, form distinct impressions of some participants

		and affirming that online or web-based communication supports social interaction.
Open Communication	3 items	Learners describe comfort among the students for conversing in the online medium, participating in discussions and interacting with other course participants.
Group Cohesion	3 items	Learners describe feeling comfortable to disagree with other course participants, feeling one's point of view being acknowledged and affirming that online discussions helping to develop a sense of collaboration.
Cognitive Presence		
Triggering Event	3 items	Learners describe instructional problems that increased participant interest, course activities that stimulated curiosity, and motivation to explore content related questions.
Exploration	3 items	Learners explore problems through a variety of information sources, identifying relevant information to address content related questions, and affirming the value of online discussion to appreciate diverse perspectives.
Integration	3 items	Learners combine information to address questions, using learning activities to construct explanations, reflection on the course to understand fundamental concepts.
Resolution	3 items	Learners describe ways to apply knowledge, developing solutions to course problems and applying the knowledge beyond the course.

Note. Descriptions created based on survey items (CoI, 2020).

In addition to the initial validation (Arbaugh et al., 2008; Swan et al., 2008), this CoI survey has been validated by several researchers (Carlon et al., 2012; Caskurlu, 2018) including in many languages (Moreira et al., 2013; Olpak & Cakmak, 2018; Yu & Richardson, 2015). While the 34-item survey is used in several studies, there are also variations of the CoI survey used by researchers. Stenbom (2018) in a systematic review summarized that there were 26 studies that included changes to the CoI tool. Some of the changes proposed by researchers include Arbaugh (2008)—21 items; Chen et al. (2019)—9 items; Choy & Quek (2016)—18 items; Khodabandelou et al. (2014)—60 items; Lin et al. (2015)—31 items; Maddrell et al. (2017)—37 items; Mo & Lee (2017)—32 items; and van der Merwe (2014)—10 items.

In addition, CoI research focusing on presences has been conducted in online (Akyol & Garrisson, 2008; Alaulamie, 2014) and blended courses (Choy & Quek, 2016; Maddressll et al., 2017), across undergraduate (Van Schyndel, 2015) and graduate learner levels (Dempsey, 2017; Rockinson-Szapkiw, 2016), in the U.S., and outside the U.S. (Chen et al., 2019; Choy & Quek, 2016).

Elements of Presence

In the CoI research studies, researchers describe various ways in which they created presence in the online and blended courses. Fiock (2019) identified instructional activities for the three presences based on the seven principles of good practice for the online environment (Sorensen & Baylen, 2009), including student-teacher contact, cooperation among students, active learning, prompt feedback, time on task, communicate high expectations, and respect diverse ways of learning. These instructional activities assist practitioners as they design and facilitate courses. Some of the example instructional activities they included were a "Create a

"Meet Your Classmates" section of your course where you and students introduce yourselves to one another (Richardson, Ice, & Swan, 2009) for social presence; reflect on group work or peer-supported learning experiences (Redmond, 2014) for cognitive presence; and promptly answer email (Lowenthal & Parscal, 2008) for teaching presence. Richardson et al. (2010) suggested that the following design elements to be considered during the development of an online instructor: Design for open communication and trust, design for critical reflection and discourse, and create and sustain a sense of community. They also recommended some actions and activities in the process of the creation and facilitation of online courses, such as to ensure that students sustain collaboration, ensure that inquiry moves to resolution, and support purposeful inquiry. In this review, we refer to these as "elements of presence" to describe the instructional and learning activities that are designed and used in online and blended courses.

Learning Outcomes

Actual Learning, Perceived Learning, and Satisfaction

In this meta-analysis, we examine actual learning, perceived learning, and satisfaction of the learning outcomes. Actual learning "reflects a change in knowledge identified by a rigorous measurement of learning" (Bacon, 2016, p. 4). This could include measures of scores from tests, projects, presentations, and performances. Perceived learning denotes "a student's self-report of knowledge gain, generally based on some reflection and introspection" (Bacon, 2016, p. 4). This includes measures of surveys with Likert type items on their perception of learning. And finally, the third learning outcome we examine is satisfaction which is a commonly studied affective measure and describes the fulfillment of one's expectations or needs.

Several researchers have examined actual learning, perceived learning, and satisfaction to study various topics in education. Bacon (2016) emphasizes the importance of studying both actual and perceived learning in educational research and the importance of examining them as separate constructs. Some educational researchers have found gaps between these two constructs. Deslauriers et al. (2019) compared students' self-reported perception of learning with their actual learning in college physics courses and found that evaluating instruction based on students' perceived learning could inadvertently promote passive pedagogical methods compared to active learning methods as students in active learning classrooms had lower perception of learning. In another study, Carpenter et al. (2013) determined that students' perceived learning was not based on their actual learning but on instructor's effectiveness. This shows that there is a difference between these two constructs, and it is important to study them distinctly. Similarly, perceived learning is also different from other affective constructs such as satisfaction and it is important for it to be studied separately. Richardson and Swan (2003) examined effects of social presence in online courses on students perceived learning and satisfaction as separate constructs.

Systematic Reviews and Meta-Analyses on the Community of Inquiry

There has been an increase in the number of primary studies focusing on CoI. This has resulted in secondary research; there have been three systematic reviews published recently (Jan et al., 2019; Redstone et al., 2018; Stenbom, 2018) and two meta-analysis (Caskurlu et al., 2020; Richardson et al., 2017). Despite the comprehensiveness of the secondary research made, research has not focused on all presences of CoI (Richardson et al., 2017) or could not consider performance in the analysis (Jan et al., 2019). Redstone et al. (2018) categorized the existing research on CoI into four themes, testing the instrument, measuring CoI presence in different learning environments, examining causal relationships, and exploring potential revisions to the model. It is unclear what databases were used to identify the 24 studies included in this systematic review. Testing the CoI instrument resulted in eight studies and measuring CoI presence in different environments resulted in another eight. There were four studies in their review that examined causal relationships among elements and five studies that focused on exploring potential revisions to the framework. While this study identified four themes of research, they did not focus on the learning outcomes in relation to the presences. This review also identified the learning environment (online, blended, F2F) and methodology (Quantitative) of the studies included in the systematic review. Six out of the twenty-four studies used mixed methods while the rest were quantitative. Eleven studies were on online learning, while four studies were on blended learning and the remaining included both blended and online learning.

Stenbom's (2018) identified 103 studies examining the CoI in a systematic review. In this review, Stenbom provided details about the publication patterns and demographic contexts where the CoI survey has been used. In addition, the author reviewed the purposes and research designs used in CoI research and major results and conclusions. Stenbom concluded that Garrison had published nine articles, which was the largest number of articles on CoI by an author. *Internet and Higher Education* had published 22 articles, which was the most articles a single journal had published. This review confirmed that the CoI survey provided valid and reliable results and has been used in various contexts. Primary research has examined both causal and correlational relationships between CoI. The Stenbom review confirmed that CoI has been used in online and blended learning (Akyol, Garrison et al., 2009; Kucuk & Sahin, 2013; Shea and Bidjerano, 2013), and to examine synchronous (Claman, 2015) and asynchronous (Rockison-Szapkiw et al., 2010; Rockinson-Szapkiw & Wendt, 2015) interaction. Disciplinary differences (Arbaugh et al., 2010; Arbaugh, 2013) and learner characteristics such as age, gender, and academic level (Akyol, Arbaugh et al., 2010; Shea & Bidjerano, 2009b) were found in some of these studies in Stenbom's review.

Jan et al. (2019) performed a systematic review about the use of social network analysis (SNA) for studying online learning communities and included CoI as an element in addition to Communities of Practice (CoP). Their review included 10 studies, of which nine used the CoI framework while one used the CoP framework. The nine CoI focused individual studies were conducted in online or blended settings. The goal of the review was to extract the structural components of CoP and CoI that have been researched using SNA. Their findings were mixed on the effectiveness of SNA to identify different presences in CoI. One of the limitations they highlighted was the lack of use of student attributes (e.g., self-efficacy, goal orientation), or performance examined in most of the studies.

In addition, Richardson et al. (2017) published a meta-analysis focusing on social presence. Although this does not include all presences of CoI, it contributes to the social presence construct. Richardson et al. included 26 studies in their meta-analysis in which they studied the relationship between social presence and student satisfaction and learning in the online environment. Their study showed a moderately strong positive relationship between social presence and satisfaction (r = .56, k = 26) and social presence and perceived learning (r = .51, k = 26). Their moderator analysis results found that course length, discipline, and scale used significantly moderated the relationship between social presence and satisfaction, and course length, discipline, and target audience moderated the relationship between social presence and perceived learning. Caskurlu et al. (2020) published a meta-analysis focusing on teaching presence but included instruments in addition to the CoI survey. They found moderately strong correlation between teaching presence and perceived learning (r = .602, k = 23) and teaching presence and satisfaction (r = .59, k = 26). They found course length and audience as moderators for perceived learning and course length, discipline, and teaching presence scale as significant moderators for satisfaction. Table 2 provides a summary of the systematic reviews on the CoI framework.

Table 2
Systematic Reviews and Meta-Analyses on CoI

Year	Authors	Title	Number of Articles	Type of Review
2020	Caskurlu et al.	A meta-analysis addressing the relationship between teaching presence and students' satisfaction and learning	23 articles for perceived learning and 26 for satisfaction	Meta-Analysis
2019	Jan et al.	Social Network Analysis and Learning Communities in Higher Education Online Learning: A Systematic Literature Review	10 articles of which 9 articles use CoI	Systematic Review
2018	Stenbom	A systematic review of the Community of Inquiry survey	103 articles	Systematic Review
2018	Redstone et al.	MEASURING PRESENCE: A Review of Research Using the Community of Inquiry Instrument	24 articles	Systematic Review
2017	Richardson et al.	Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis	26 articles of which 6 articles use the CoI Survey	Meta-Analysis

Purpose of the Study and Research Questions

There has been an increasing number of primary studies using the CoI survey examining the relationship between presences and learning outcomes. Richardson et al. (2017) conducted a meta-analysis focusing on social presence and Caskurlu et al. (2020) conducted a meta-analysis on teaching presence in the online learning environment. Their studies, however, used several other scales in addition to using CoI as one of them. There is still a gap to quantitively examine the relationship between the three types of presences to actual and perceived learning and satisfaction and specifically from only using the CoI instrument. Also, the prior meta-analysis focused only on online courses and this meta-analysis examines both online and blended courses. This results in a need for a meta-analysis to examine the relationships between each of the three presences and their learning outcomes. This study seeks to meet this gap by addressing the following research questions:

1. What is the relationship between each CoI presence (teaching presence, social presence, and cognitive presence) and actual learning, perceived learning and satisfaction as measured by the CoI survey?
2. What are the various elements of teaching presence, social presence, and cognitive presence described in the studies reviewed?

Methods

This study followed the meta-analysis process as described by Wilson (2014). The steps included are: (1) identifying the right question; (2) determining eligibility criteria; (3) conducting a literature search and review; (4) calculating effect size; and (5) analysis. The methodology used in the meta-analysis is described in the sections below.

Data Sources and Search Strategies

We conducted a broad search of journal articles and doctoral dissertations published between 2000 and 2019 using the search term "Community of Inquiry" in the "Title" and "Subject" fields. We chose 2000 as the starting point, as this was when the CoI framework was first developed. An electronic search was conducted in six databases that included Academic Search Complete, Communication & Mass Media Complete, Education Research Complete, ERIC, Library, Information Science & Technology Abstracts with Full Text, and PsycINFO in November 2019.

Inclusion and Exclusion

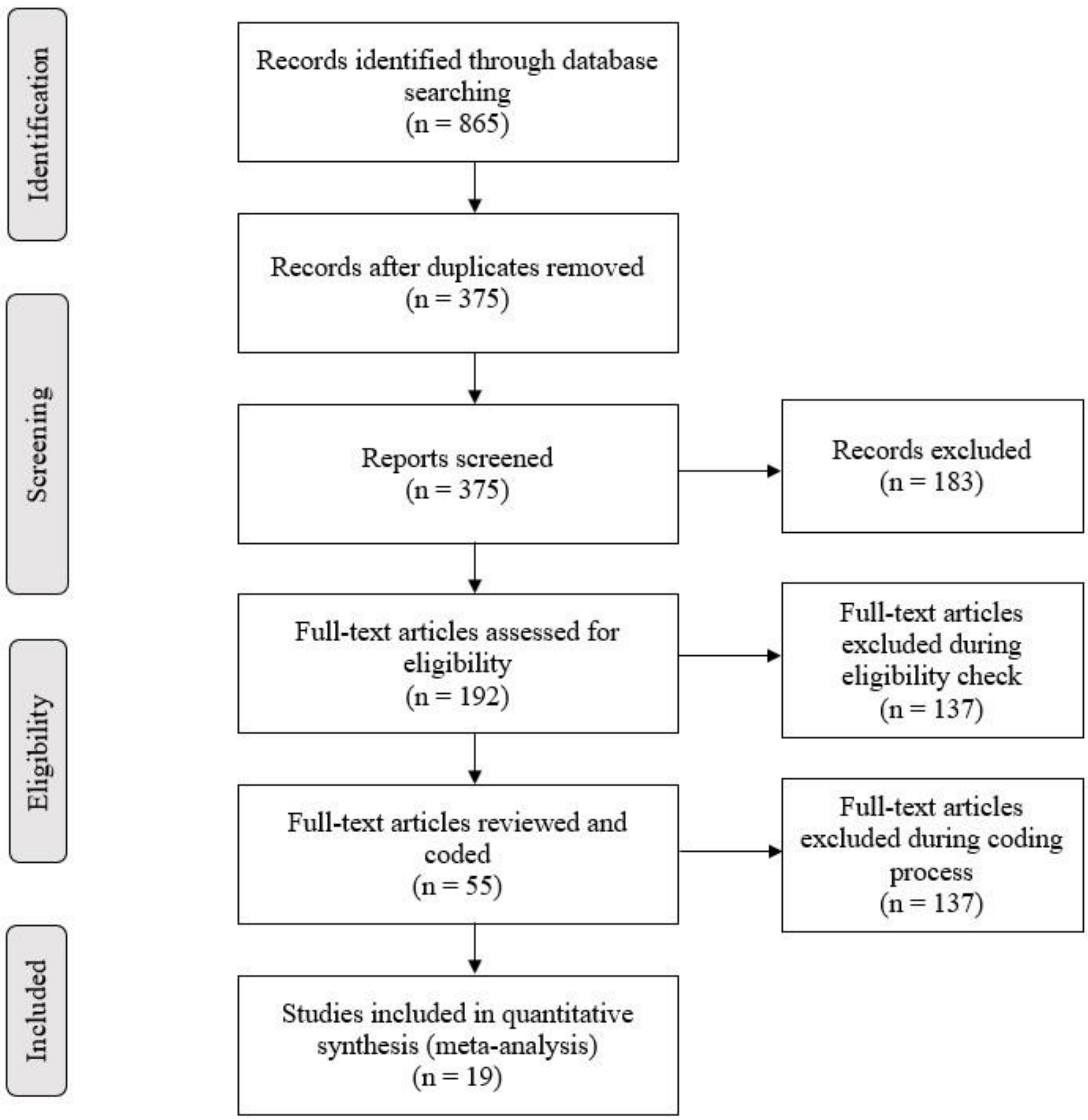
Table 3
Inclusion/Exclusion criteria

Criteria	Inclusion	Exclusion
CoI Focus	Studies that used CoI framework	Studies that did not focus on CoI
Publication date	2000 to 2019	Prior to 1999 and after 2019
Publication type	Scholarly articles of original research from peer reviewed journals and dissertations	Book chapters, technical reports, or proceedings
Language	Journal article or dissertation was written in English	Languages other than English
Research Design	Correlational and Regression design with learning outcome	Research designs that do not include correlational or regression studies
Results of Research	Adequate data for calculating effect sizes	Effect size was not reported or there was insufficient information provided for researchers to calculate effect size.
Learning Outcomes	Clear learning outcomes (Actual Learning, Perceived Learning or Satisfaction)	There were not clear learning outcomes in the study. For example, Pellas (2017) examined the interrelationships among presence indicators, but learning outcomes were not the focus of the study

Process Flow

We used the PRISMA flow model (Figure 2) to document the process flow of identification, screening, eligibility, and inclusion of studies. The PRISMA guidelines were proposed by the Ottawa Methods Center for reporting items for systematic reviews and meta-analyses (Moher et al., 2009).

Figure 2
PRISMA flow diagram for CoI review



When the records were screened, we found several studies that used the term "Community of Inquiry" but were focusing on Dewey's theory on social learning and not on presence in online learning. These studies were excluded. In addition, during full-text screening, we found several studies that did not use the CoI survey to measure presences which was the focus of this meta-analysis. During the coding process, we found that some studies did not provide the sufficient data for data extraction which were also excluded.

Study Coding

The research team developed and used a survey form using Qualtrics to code the variables described in Table 3. The form was divided into four sections to include study identification, outcome features, methodological features, pedagogical features, and demographics. There are four members in the research team, including three faculty members with expertise in online learning and one doctoral student majoring in research methodology. All the faculty members involved in the study have extensive coding experience. They provided training to the second author, the doctoral student, and supervised the entire coding process. The initial coding was performed by the second author and the third author. The two researchers initially coded the same eight articles with an inter-rater agreement of 86.84%. The entire research team met biweekly to discuss any coding related questions. The researchers discussed the areas of disagreement before further coding. The lead researcher then worked with the fourth author from the team for the effect size extraction.

Table 4

Description of the Coded Elements for Each Research Study

Element	Description
Article Information	Full reference including author(s), year of publication, article title, journal name, and type of publication (journal article, dissertation or other).
Outcome Type	Coded as Actual Learning, Perceived Learning and Satisfaction. Actual learning included measures such as final score, academic achievement, GPA, while perceived learning and satisfaction included measures of perceived learning and satisfaction.
Outcome Measures	Outcome measures were coded for each type of outcome variable.
Research or Analytical Methods	Correlation, Path analysis, Regression, Structural Equation Modeling.
Type of Online Course	Coded as an open-ended item.
Course Duration	The different options for course duration included, less than 15 weeks, 15 weeks, more than 15 weeks, and unknown.
Instructional Method	This was open coded as Blended or Online.
Technology Used	This was open coded.
Demographics	Types of learners (K-12, undergraduate, graduate, military, industry/business, professionals), discipline, gender and age of participants, and country were coded.
Effect Sizes	Statistical information to extract effect sizes were coded.

Dependent and Moderating Variables

Based on prior meta-analysis, we included perceived learning and satisfaction as outcome variables. In addition, we also included actual learning as a learning outcome. While it was our initial intent to examine pedagogical, methodological, and demographic moderators, due to the low frequency of studies for each outcome, we did not proceed with the moderator analysis.

Effect Size Calculation

Descriptive statistics were reported to address publication trends. The software Comprehensive Meta-Analysis software, Version 3.3.070 (CMA; Borenstein et al., 2014) was used to calculate the effect sizes. Effect size was calculated as the correlation between one of the three presences (teaching, social and cognitive presence) and one of the three learning outcomes (actual learning, perceived learning, and satisfaction). Initially, 102 effect size statistics were collected from 19 studies, including 93 Pearson's r from 17 studies and 9 standardized β from two studies. We contacted the authors of the two articles that reported standardized β and gathered the corresponding effect size estimates in the forms of Pearson's r for generating more accurate results. Cohen's (1988) effect size conventions for Pearson correlation coefficient was used for interpretation: .1 as small effect, .3 as medium effect, and .5 as large effect. .

Five studies in the meta-analysis used multiple measures representing the same construct. Therefore, the weighted averaging procedure was conducted by employing a calculator created by Lenhard and Lenhard (2014) to address the dependence issue (Borenstein et al., 2009). For example, Arbaugh (2013) reported the correlation coefficients between facilitating discourse and perceived learning, and between direct instruction and perceived learning to represent the correlation between teaching presence and perceived learning. The two coefficients were transformed into a Fisher's *z* value using the calculator mentioned above. After conducting all transformations, 78 effect sizes, including 67 Pearson's coefficients and 11 Fisher's *z*, were entered into CMA for further analysis.

Handling Dependence of Effect Size

It is worth noting that most of the studies in the meta-analysis reported multiple effect sizes to indicate the relationship between social, teaching, cognitive presences, and actual learning, perceived learning, and/or satisfaction. For example, Maddrell et al. (2017) reported six separate effect sizes to show the correlations between each of the three presences and perceived learning and satisfaction. Although these effect sizes were based on the same sample, they were treated independently because the major goal of the research is to detect the strength of the relationship between individual presence and specific types of learning outcomes. The overall effect of the combined presences on learning outcomes is not the focus of the study. Therefore, the effect sizes of the correlation between each presence and each learning outcome reported from one study are calculated separately.

Data Analysis

The CMA software during analysis converts Pearson's *r* to Fisher's *z* to calculate averaged Fisher's *z* scores and then converts back to correlation *r* (Borenstein et al., 2009). The current study does not use Pearson's correlation *r* because variance heavily depends on the correlation (Borenstein et al., 2009). In addition, Fisher's *z* transformation was used to normalize the sampling distribution of Pearson's *r*. CMA software calculates the effect sizes using the following equations (Borenstein et al., 2009).

Pearson's *r* can be transformed into Fisher's *z* using equation (1):

$$z = 0.5 \times \ln\left(\frac{1+r}{1-r}\right) . \tag{1}$$

The standard error of Fisher's *z* can be obtained by using equation (2):

$$SE_z = \sqrt{\frac{1}{-3}} \quad . \tag{2}$$

Equation (3) can be used to covert the Fisher's z back to correlation r:

$$r = \frac{e^{2z}-1}{e^{2z}+1} \quad . \tag{3}$$

There are two commonly used models to estimate effect sizes of a meta-analysis, including fixed-effects model and random-effects model. The two models not only have distinct underlying assumptions, but also influence the analysis and interpretation of the statistics (Borenstein et al., 2010). Fixed-effects model assumes that there is one common effect size across all studies. This model may manifest Type I bias in significant tests for the estimated effect sizes and produce biased confidence intervals that is smaller than their normal width if the assumption does not hold (Hunter & Schmidt, 2000). However, random-effects model allows that the studies to have varied effect sizes in the population, which is likely to generate appropriate Type I error rates and confidence intervals. For a meta-analysis, it is common to see that the effect sizes and the measures used across studies are different. Therefore, we employed a random-effects model in this meta-analysis study. In this study, we conducted nine subgroup meta-analysis:

(1) Teaching presence on actual learning
(2) Cognitive presence on actual learning
(3) Social presence on actual learning
(4) Teaching presence on perceived learning
(5) Cognitive presence on perceived learning
(6) Social presence on perceived learning
(7) Teaching presence on satisfaction
(8) Cognitive presence on satisfaction
(9) Social presence on satisfaction

Forest plots were included to show the visual representation of the studies and the effect sizes.

Sensitivity Analysis

In meta-analysis studies, it is important to address the issue of publication bias, which refers to the phenomenon that studies get published based on certain direction or strength of the findings (Dickersin & Min, 1993). Rosenthal (1979) used a term "file drawer problem" to describe the fact that journals are filled with the 5% of studies showing Type I errors whereas the rest of the studies with nonsignificant results are left in the drawers. In this meta-analysis, both journal articles and dissertations were included, but there is still the risk of having publication bias because unpublished work was not under the investigation. Several strategies were used to examine publication bias. Funnel plots were used to detect bias by showing visual representation of the studies included in a meta-analysis (Egger et al., 1997). Funnel plots illustrate the effect sizes from each study on horizontal axis against the standard error on vertical axis. A symmetrical funnel will be displayed if bias does not exist, and vice versa (Egger et al., 1997; Sterne & Harbord, 2004). In addition, Classic Fail-safe *N* (Rosenthal, 1979) that represents the number of missing studies to bring the *p* value to a non-significant level was included. Finally, Orwin's Fail-safe *N* (Orwin, 1983), which assists in computing the number of missing studies to bring the summary effect to a level below the specified value other than zero, was examined.

All statistical analyses using CMA used the *z*-transformed correlations. We report the effect size in this meta-analysis using Pearson *r* for the ease of interpretation. Publication bias was reported in Fisher's *z*.

Results

Publication Pattern

The publication trend for the results included in this CoI meta-analysis in provided in Figure 3, and the publication source of the journal articles and dissertations is included in Table 5.

Figure 3
Publication years of studies included in CoI Meta-Analysis

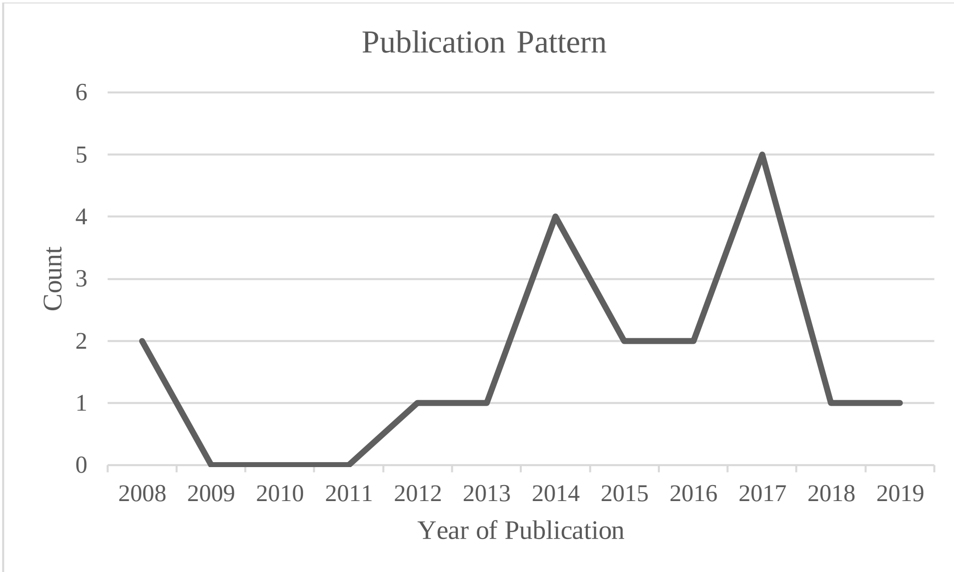


Table 5
Publication Source of CoI Studies in Meta-Analysis

Journal Articles (*n* = 11)	Dissertations & Theses (*n* = 8)
Journal titles	**Universities**
Australasian Journal of Educational Technology	Indiana University
Behaviour & Information Technology	Liberty University
Contemporary Educational Technology	McKendree University
Distance Education	Ohio University
International Journal of Learning Technology	University of California
International Review of Research in Open and Distance Learning	University of Idaho
Internet and Higher Education	Widener University
Journal of Asynchronous Learning Networks	Western Illinois University
Journal of Interactive Learning Research	
Multimedia-Assisted Language Learning	

Note. International Review of Research in Open and Distance Learning had two articles.

Descriptive Information of Primary Studies

Table 6 below provides a summary of the descriptive information from the 19 studies included in this meta-analysis. The final sample consisted of k = 78 effect sizes and n = 6,459 participants.

Table 6

Descriptive Information for the Primary Studies

Authors	Document Type	Outcome	Measure	Participants	Modality	Country/ region	# Survey Items
Akyol & Garrison (2008)	J	PL; Sat	PL; Sat	Graduate	Online	US	34
Alaulamie (2014)	D	Sat	Sat	Undergraduate	Online	US	34
Arbaugh (2008)	J	PL; Sat	PL; Sat: Delivery medium satisfaction	Other	Online	US	21
Arbaugh (2013)	J	PL, Sat	PL; Sat	Graduate	Online	US	34
Catron (2012)	D	Sat	Sat	Other	Online	US	34
Chen et al. (2019)	J	Sat	Sat	Other	Online	China	9
Choy & Quek (2016)	J	AL; Sat	AL: Academic achievement; Sat: Course satisfaction	Undergraduate	Blended	Singapore	18
Dempsey (2017)	D	PL	PL: Reflection scores, and critical thinking	Graduate	Online	US	34
Jones (2017)	D	AL	AL: Online course grade	Other	Online	US	34
Khodabandelou et al. (2014)	J	PL	PL	Undergraduate	Blended	Malaysia	60
Lee & Huang (2018)	J	AL	AL: Final score	Other	Online	US	34
Maddrell et al. (2017)	J	PL; Sat	PL; Sat	Graduate	Blended	US	37
Mo & Lee (2017)	J	PL	PL: Perceived proficiency learning	Other	Blended	South Korea	32
Table 6. Cont.							
Place (2017)	D	PL	PL	Other	Online	US	34
Rockinson-Szapkiw et al. (2016)	J	AL; PL	AL: Course points; PL: Cognitive, affective, and psychomotor	Graduate	Online	US	34

van der Merwe (2014)	J	AL	AL: Practical portfolio score	Other	Online	South Africa	10
Van Schyndel (2015)	D	Sat	Sat	Undergraduate	Online	US	34
Woiwode & Baysingar (2015)	T	AL	AL: Authentic learning, cumulative GPA, and final course grade	Undergraduate	Other	US	34
Yadon (2014)	D	AL; PL	AL; PL	Other	Online	US	34

Note. Other items in the Level of study included combination of levels, or professionals or studies that did not report the level. Acronyms are used to make the table easier to comprehend. In the Document Type column, the letters are (J)ournal article, (D)issertation, and (T)hesis. In the Measure column, AL, PL, and Sat represent actual learning, perceived learning, and satisfaction, respectively.

The instructional context provided in the studies were further analyzed to identify the different presences used in the setting of the study. Table 7 shows the various elements that were used in the study to establish various types of presence.

Table 7
Elements of Presence Described in the Studies

Presence	Elements of Presence
Teaching Presence	• Contacting the Teacher or Teaching Assistant directly (k = 2) • Instructors facilitated live synchronous lectures and discussions (k = 1) • Used LMS to host syllabus, content, assignments, and discussion forums (k = 2) • Teachers collaborating with students via email, message boards, announcements, wikis blogs and discussions (k = 1) • Establishing curriculum content, learning activities and timelines (k = 1) • Monitoring and managing purposeful collaboration and reflection (k = 1) • Ensuring that the community reaches the intended learning outcomes by diagnosing (k = 1) • Needs and providing timely information and direction (k = 1)
Cognitive Presence	• Taking Notes (k = 1) • Reading/Posting in the Forum (k = 1) • Group meets 3 times in a week in virtual space (k = 1) • Provided feedback for group members (k = 1) • Readings, video resources, and assignment by lecturers (k = 1) • Students participated in online discussion (k = 1) • Synchronous communication among peers (k = 1) • Synchronous communication among instructor and students (k = 1) • Students worked collaboratively on course assignments, studying for exams and quizzes, class presentations, and listened to lectures (k = 1)

Social Presence	• Making Friends in the Forum (*k* = 1) • Joining Social Media Groups (*k* = 1) • Groups of 8 to 10 to foster intimate interaction among members (*k* = 1) • Real-time chat among group members (*k* = 1)

Note. Not all studies described the elements of presence. This table includes data only from the studies that reported the description of presence elements.

Effect sizes (CP, SP, TP) for Actual Learning

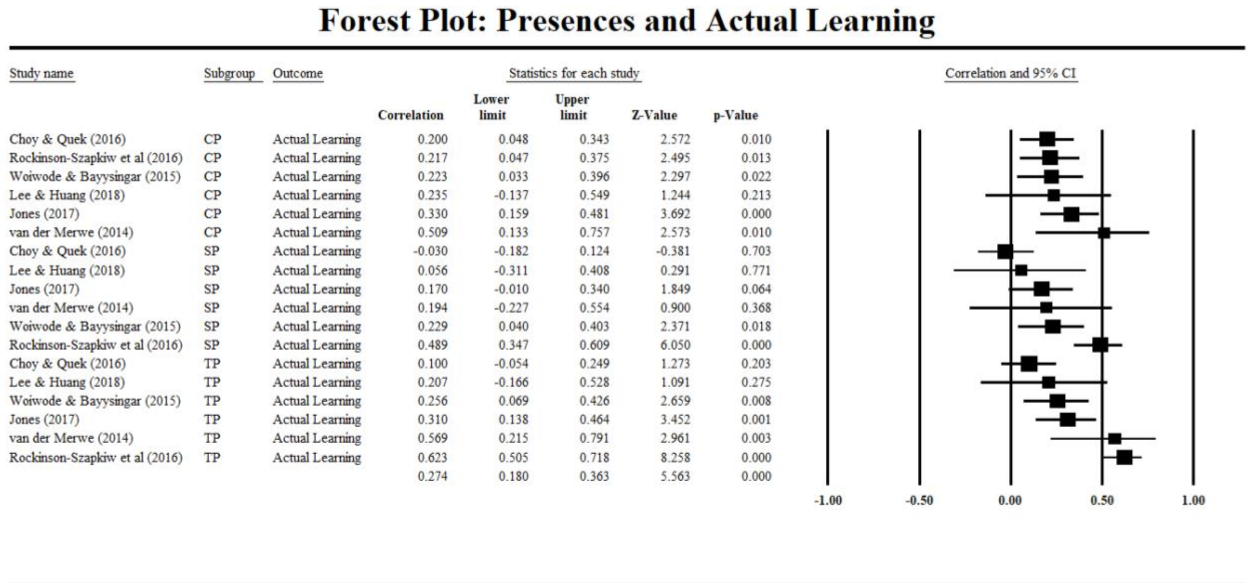
Six studies included in the analysis reported the effect sizes between each of the three presences and actual learning. The forest plots of the effect sizes between teaching, cognitive, social, and teaching presence and actual learning are shown in Figure 4. The effect size estimates were reported in Table 8. Teaching presence and actual learning were found to be moderately positively correlated ($r = .353$, $p = .001$). Cognitive presence and actual learning had a small correlation ($r = .250$, $p < .001$). Similarly, it was found that the effect sizes between social presence and actual learning was small ($r = .199$, $p < .042$). It is worthy to note that there were no statistically significant differences found among the three effect sizes, ($Q = 1.263$, $p = .532$).

Table 8
Effect Size Estimates for the Correlation Between Presences and Actual Learning

	k	*Effect estimate r*	95% CI	Z	*p*	*Q*-value	*df(Q)*	*p-value*
Actual learning								
Cognitive presence	6	.250	[0.171, 0.326]	6.030	<.001	3.549	5	.616
Social presence	6	.199	[0.008, 0.376]	2.038	.042	23.622	5	<.001
Teaching presence	6	.353	[0.144, 0.532]	3.228	.001	31.771	5	<.001
Total between						1.263	2	.532

Figure 4

Forest plot of studies on Actual Learning



Note. CP, SP, and TP refers to cognitive presence, social presence, and teaching presence, respectively.

Effect sizes (CP, SP, TP) for Perceived Learning

Ten out of the 19 studies reported the effect sizes of the relationship between teaching, cognitive, and/or social presence and perceived learning. The effect sizes of the relationship between each of the three presences and perceived learning are shown in Figure 5. The effect size estimates were reported in Table 9.

It is important to note that the correlation between each of the presences and perceived learning was significant ($p < .001$). The cognitive presence and perceived learning were found to be strongly correlated ($r = .663$, $p < .001$). Social presence and perceived learning were moderately positively correlated ($r = .432$, $p < .001$), followed by the correlation between teaching presence and perceived learning ($r = .392$, $p < .001$). There were significant differences in the three effect sizes ($Q = 6.921$, $p = .031$). Further analysis showed that the effect size of cognitive presence and perceived learning were significantly larger than the correlation between social presence and perceived learning ($p = .027$) and teaching presence and perceived learning ($p = .010$).

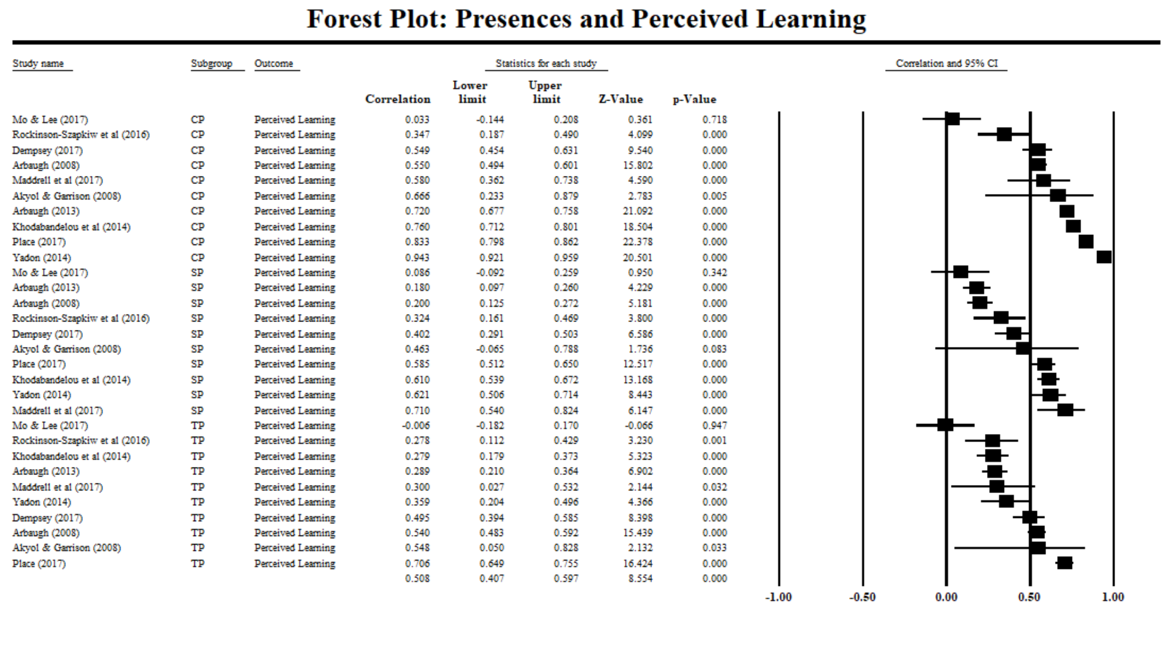
Table 9

Effect Size Estimates for the Correlation Between Presences and Perceived Learning

	k	*Effect estimate r*	95%CI	Z	*p*	*Q*-value	*df(Q)*	*p-value*
Perceived learning								
Cognitive presence	10	.663	[0.503, 0.780]	6.359	<.001	324.229	9	<.001
Social presence	10	.432	[0.286, 0.559]	5.367	<.001	147.844	9	<.001
Teaching presence	10	.392	[0.248, 0.520]	5.046	<.001	133.660	9	<.001
Total between						6.921	2	.031

Figure 5

Forest Plot of Studies on Perceived Learning



Note. CP, SP, and TP refers to cognitive presence, social presence, and teaching presence, respectively.

Effect sizes (CP, SP, TP) for Satisfaction

The relationship between each of the three presences and satisfaction were reported in 10 studies. Forest plots that indicate the relationship between teaching, cognitive, or social presence, and perceived learning can be found in Figure 6. Table 10 provided the summary statistics of the relationships.

It was identified that there was a statistically significant and strong relationship between cognitive presence and satisfaction (r = .586, p < .001). Like cognitive presence, teaching presence was also strongly correlated with satisfaction (r = .510, p < .001). Social presence and satisfaction were moderately correlated (r = .447, p < .001). The difference in the three effect sizes reported did not differ significantly (Q = 2.255, p = .324).

Table 10

Effect Size Estimates for the Correlation Between Presences and Satisfaction

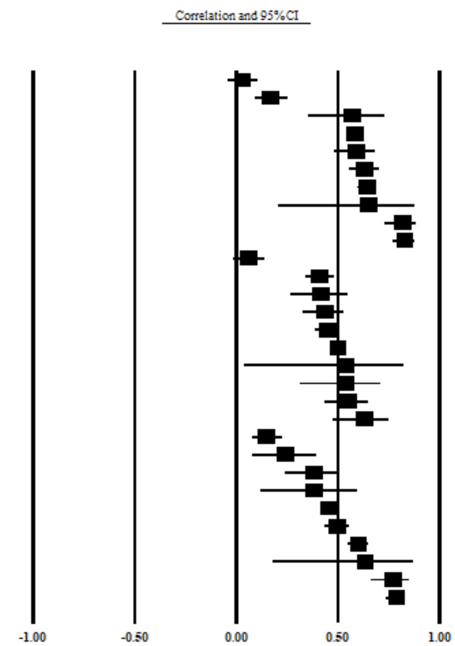
	k	*Effect estimate r*	95% CI	Z	*p*	*Q*-value	*df(Q)*	*p-value*
Satisfaction								
Cognitive presence	10	.586	[0.423, 0.712]	5.983	<.001	411.530	9	<.001
Social presence	10	.447	[0.337, 0.544]	7.258	<.001	133.038	9	<.001
Teaching presence	10	.510	[0.381, 0.620]	6.801	<.001	215.719	9	<.001
Total between						2.255	2	.324

Figure 6

Forest plot of studies on Satisfaction

Forest Plot: Presences and Satisfaction

Study name	Subgroup	Outcome	Statistics for each study				
			Correlation	Lower limit	Upper limit	Z-Value	p-Value
Arbaugh (2008)	CP	Satisfaction	0.030	-0.047	0.106	0.767	0.443
Arbaugh (2013)	CP	Satisfaction	0.170	0.087	0.251	3.989	0.000
Maddrell et al (2017)	CP	Satisfaction	0.570	0.349	0.731	4.486	0.000
Alaulamie (2014)	CP	Satisfaction	0.585	0.558	0.610	33.090	0.000
Choy & Quek (2016)	CP	Satisfaction	0.590	0.480	0.682	8.599	0.000
Carton (2012)	CP	Satisfaction	0.633	0.553	0.702	11.778	0.000
Chen et al (2019)	CP	Satisfaction	0.644	0.596	0.687	19.398	0.000
Akyol & Garrison (2008)	CP	Satisfaction	0.650	0.206	0.872	2.686	0.007
van Schyndel (2015)	CP	Satisfaction	0.820	0.729	0.882	9.884	0.000
Yadon (2014)	CP	Satisfaction	0.829	0.768	0.875	13.768	0.000
Chen et al (2019)	SP	Satisfaction	0.062	-0.015	0.138	1.574	0.115
Arbaugh (2013)	SP	Satisfaction	0.410	0.337	0.478	10.123	0.000
Yadon (2014)	SP	Satisfaction	0.414	0.265	0.544	5.117	0.000
Carton (2012)	SP	Satisfaction	0.434	0.328	0.529	7.335	0.000
Arbaugh (2008)	SP	Satisfaction	0.450	0.387	0.509	12.386	0.000
Alaulamie (2014)	SP	Satisfaction	0.500	0.470	0.529	27.128	0.000
Akyol & Garrison (2008)	SP	Satisfaction	0.539	0.037	0.824	2.088	0.037
Maddrell et al (2017)	SP	Satisfaction	0.540	0.311	0.710	4.186	0.000
Choy & Quek (2016)	SP	Satisfaction	0.550	0.433	0.649	7.846	0.000
van Schyndel (2015)	SP	Satisfaction	0.630	0.472	0.749	6.335	0.000
Arbaugh (2008)	TP	Satisfaction	0.150	0.074	0.224	3.862	0.000
Yadon (2014)	TP	Satisfaction	0.239	0.075	0.391	2.832	0.005
Choy & Quek (2016)	TP	Satisfaction	0.380	0.241	0.504	5.076	0.000
Maddrell et al (2017)	TP	Satisfaction	0.380	0.117	0.593	2.772	0.006
Alaulamie (2014)	TP	Satisfaction	0.456	0.424	0.487	24.310	0.000
Arbaugh (2013)	TP	Satisfaction	0.495	0.429	0.556	12.618	0.000
Chen et al (2019)	TP	Satisfaction	0.600	0.548	0.647	17.576	0.000
Akyol & Garrison (2008)	TP	Satisfaction	0.634	0.180	0.865	2.591	0.010
van Schyndel (2015)	TP	Satisfaction	0.770	0.659	0.848	8.718	0.000
Carton (2012)	TP	Satisfaction	0.788	0.736	0.831	16.823	0.000
			0.516	0.445	0.580	12.157	0.000



Note. CP, SP, and TP refers to cognitive presence, social presence, and teaching presence, respectively.

Publication Bias

Publication bias, as one of the major threats to the validity of meta-analysis, was examined for studies focusing on the relationship between teaching, cognitive, and social presence and a specific type of learning outcomes through visual inspection of funnel plots, Classic Fail-Safe *N* test, and Orwin's Fail-Safe *N* tests. Funnel plots depict effect sizes estimates against the standard error, which represents the study precision (Sterne & Egger, 2001). The funnel plots can be found in Appendix. It seems that there was a lack of symmetric distribution of the point estimates in each of the funnel plot, indicating the presence of the publication bias. The Classic Fail-Safe *N* and Orwin's Fail-Safe *N* are reported in Table 11 for further understanding the publication bias of the studies that investigated the correlations between the presence and actual learning, perceived learning, and/or satisfaction. It can be identified that there was a lack of publication bias on perceived learning and satisfaction using the Classic fail-safe *N* larger than $5k + 10$ (Rosenthal, 1995) as a criterion. However, the publication bias seems to exist in actual learning, as only 52 additional studies on cognitive presence, 26 on social presence, and 95 studies on teaching presence are needed to nullify the effect size. With respect to the results from Orwin's Fail-Safe *N* test, publication bias also existed in actual learning because 148 additional studies on cognitive presence, 117 studies on social presence, and 203 studies on teaching presence may bring correlation under .01. Publication bias was not of a major concern in perceived learning and satisfaction based on the results from Orwin's Fail-Safe *N* test.

The three criteria used to examine publication bias for actual learning all indicated the presence of publication bias. For perceived learning and satisfaction, Classic Fail-Safe *N* and Orwin's Fail-Safe *N* showed little evidence of publication bias, though funnel plots indicated that additional studies may change the results.

Table 11
Classic Fail-Safe N *and Orwin's Fail-Safe* N

Model	**Classic Fail-Safe *N***	**Orwin's Fail-Safe *N***
CP and actual learning	52	148
CP and perceived learning	3717	820
CP and satisfaction	3052	559
SP and actual learning	26	117
SP and perceived learning	1016	384
SP and satisfaction	1832	454
TP and actual learning	95	203
TP and perceived learning	1067	457
TP and satisfaction	2449	496

Discussion

In this meta-analysis, we examined the relationship between cognitive presence, teaching presence and social presence, and actual learning, perceived learning, and satisfaction on online and blended courses. While there has been individual meta-analysis conducted on teaching presence (Caskurlu et al., 2020) and social presence (Richardson et al., 2017), these had included several instruments in addition to the CoI survey and focused only on online courses. There was a need to examine the effects of the presences based on the CoI instrument, in both blended and online courses and also examine the effects of all three presences in a single meta-analysis.

Relationship between Presences and Actual Learning

Actual learning is an important learning outcome to study (Bacon, 2016) and limited research has examined effects of presences on actual learning. Researchers have studied effects of presences on actual learning through measures including academic achievement (Choy & Quek, 2016), online course grade (Jones, 2017), Final Score and portfolio score (Lee & Huang, 2018; van der Merwe, 2014), Course points (Rockinson-Szapkiw et al. (2016), authentic learning, cumulative GPA, and final course grade (Woiwode & Bayysingar, 2015). While cognitive presence and social presence had a small effect on actual learning, teaching presence had a medium effect on actual learning. Based on this meta-analysis only six studies had examined the effect of presences on actual learning. Although there were no significant differences in the effect sizes among the three presences for actual learning, it is important to note that the effect of each of the presences on actual learning was significant with teaching presence having the largest effect in online and blended courses.

Relationship between Presences and Perceived Learning

Social and teaching presence had a medium effect on perceived learning, and cognitive presence had a large effect. Each of the three presences on perceived learning was significant. In addition, there were significant differences in the effect sizes among the three presences on perceived learning. Also, there was a significant difference in the effect sizes between cognitive presence and social presence and cognitive presence and teaching presence. Richardson et al.

(2017) found a medium effect to indicate social presence predicts perceived learning in their meta-analysis. Our findings are consistent with Richardson et al.'s (2017) findings on social presence having a medium effect for perceived learning. This shows that the effect sizes stayed the same in both online and blended courses in our study, while Richardson study used only online courses. Caskurlu et al. (2020) found moderately strong correlation between teaching presence and perceived learning while we found medium effects between teaching presence and perceived learning. While we examined both online and blended courses, Caskurlu and colleagues examined only online courses.

Relationship between Presences and Satisfaction

While social presence had a medium effect, cognitive presence and teaching presence had a large effect on satisfaction. Though there were no significant differences in the effect sizes among the three presences, each of the three presences on satisfaction was significant. Similar to Richardson et al. (2017) study which found a medium effect to indicate social presence predicts satisfaction the findings of our study are consistent with the Richardson et al. (2017) study on social presence having medium effect on satisfaction. Caskurlu et al. (2020) found moderately strong correlation between teaching presence and satisfaction; this is consistent with our finding of it having a large effect. This shows when studying effects of presences on satisfaction, the effects remained the same in online and blended courses and only in online courses studied by Richardson and Caskurlu.

Lack of studies for Moderating Effects

We found that there were only few studies that examined actual learning. Also, though we coded for several moderating variables, due to the low frequencies we were unable to run moderator analysis. We hope with the increase in studies using the CoI instrument and examining the relationship between actual learning, perceived learning, and certification, moderating effects can be studied. Also, while coding for articles, we found that the authors of the primary studies did not include several of the details that we were interested in coding as moderators such as course duration, types of learners, course discipline, etc.

Elements of Cognitive, Teaching, and Social Presence

The second research question coded for the different elements of presences described in the articles. This finding has implications for instructors who design online and blended courses. Instructors can include the elements of presences as shown in Table 7 to enhance presences in their courses. For example, for teaching presence providing the opportunity to contact the teacher, for cognitive presence the opportunity for reading/posting in the forum and for social presence including real-time chat opportunities among group members. There were fewer elements of social presence described compared to cognitive and teaching presence reported in these research studies. Also, only two cognitive presence elements were reported in two studies, and the rest of the elements were included only once in each study. These design elements from online blended instruction used in the various research studies has implications to support learners' achievement. This overlaps with some of the design and facilitation recommendations from Fiock (2020) for including various presences in online courses.

Limitations

Only 19 studies that met the inclusion and exclusion criterion were included this meta-analysis. The numbers were insufficient, especially considering the fact that we conducted analysis with nine different models separately. There were only six studies that focused on actual learning. Therefore, the differences between subgroups, (e.g., the difference between teaching presence and actual learning and cognitive presence and actual learning), should be interpreted cautiously. Another limitation of this study is the problem of publication bias on the studies related to actual learning, which might prevent us from generating accurate effect size estimates or developing a more comprehensive understanding of the relationship between the presences and actual learning. Also, though we coded several variables to run moderator analysis, we were unable to because of the low frequencies which is a limitation of this study.

Implications and Future Directions

The findings from our meta-analysis shows it is important for online and blended learning to include teaching, cognitive and social presence. The CoI survey indicates to be stable measure for studying presence in online learning and blended learning environments in multiple contexts. In summary, cognitive presence had a small effect on actual learning, and large effect on perceived learning and satisfaction. Teaching presence had a medium effect on actual and perceived learning and a large effect on satisfaction. Social presence had a small effect on actual learning but medium effect on perceived learning and satisfaction. Cohen's (1988) effect size conventions for Pearson correlation coefficient was used for interpretation, .1 as small effect, .3 as medium effect and .5 as large effect. The findings show the importance of building in the different presences in online and blended learning environments though their effect sizes may vary (see Table 12). The large effect size estimates identified in the correlations indicated that if a specific type of presences increases, the corresponding learning outcome tends to increase. Hattie et al. (2014) argued that interpreting effect sizes only based on the descriptors, such as "small," "medium," and "large" seems to be too simple. When practical factors and the context are taken into consideration, even the small effect have important implications. Based on the results from our study, although effect sizes from small to large were found, it is still important for instructors to increase all the presences such that all learning outcomes are likely to achieve improvement.

Table 12

Summary of Effects of Cognitive, Teaching, and Social Presence

	Actual Learning	**Perceived Learning**	**Satisfaction**
Cognitive Presence	Small	Large	Large
Teaching Presence	Medium	Medium	Large
Social Presence	Small	Medium	Medium

There were only 19 studies that we were able to identify to use in this meta-analysis that had used the CoI instrument and had examined relationship to learning outcomes. This shows the need for more studies to examine the relationship of presences with the learning outcomes especially with actual learning. Another challenge we faced while coding variables for moderator analysis was the lack of detail reported by authors in primary studies. This demonstrates a need for future studies to describe the instructional setting thoroughly when presences are examined.

Declarations

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References

***Indicates studies that were included in the meta-analysis**

Abdous, M., & Yen, C.-J. (2010). A predictive study of learner satisfaction and outcomes in face-to face, satellite broadcast, and live video-streaming learning environments. *The Internet and Higher Education, 13*, 248–257.

*Akyol, Z., & Garrison, D. R. (2008). The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence. *Journal of Asynchronous Learning Networks*, *12,* 3–22.

Akyol, Z., Garrison, D. R., & Ozden, M. Y. (2009). Online and blended communities of inquiry: Exploring the developmental and perceptional differences. *International Review of Research in Open and Distance Learning, 10*(6), 65–83.

Akyol, Z., Arbaugh, J. B., Cleveland-Innes, M., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. (2009). A response to the review of the community of inquiry framework. *Journal of Distance Education*, *23*(2), 123–135.

*Alaulamie, L. A. (2014). *Teaching presence, social presence, and cognitive presence as predictors of students' satisfaction in an online program at a Saudi University* [Unpublished doctoral dissertation]. Ohio University.

Ali, A., & Smith, D. (2015). Comparing social isolation effects on students' attrition in online versus face-to-face courses in computer literacy. *Issues in Informing Science and Information Technology*, *12*, 11–20.

Anderson, T., Rourke, L., Garrison, D. R., Archer, W. (2001). Assessing Teaching presence in a Computer Conference Environment. *Journal of Asynchronous Learning Networks*, *5*(2), 1–17.

*Arbaugh, J. B. (2008). Does the community of inquiry framework predict outcomes in online MBA courses? *The International Review of Research in Open and Distributed Learning*, *9*(2), 1–21

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, & Swan, K. P. (2008). Developing a community of inquiry instrument: Testing a measure of the Community of Inquiry framework using a multi-institutional sample. *The Internet and Higher Education*, 11(3–4), 133–136.

Arbaugh, J. B., Bangert, A., & Cleveland-Innes, M. (2010). Subject matter effects and the Community of Inquiry (CoI) framework: An exploratory study. *Internet and Higher Education*, *13*(1–2), 37–44.

*Arbaugh, J. B. (2013). Does academic discipline moderate CoI-course outcomes relationships in online MBA courses? *The Internet and Higher Education*, *17*, 16–28.

Bacon, D. R. (2016). Reporting actual and perceived student learning in education research. *Journal of Marketing Education, 38*(1), 3–6

Bolliger, D. U., & Inan, F. A. (2012). Development and validation of the online student connectedness survey (OSCS). *The International Review of Research in Open and Distributed Learning*, *13*(3), 41–65.

Bolliger, D. U., & Martin, F. (2018). Instructor and student perceptions of online student engagement strategies. *Distance Education*, *39*(4), 568–583.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis*. John Wiley & Sons.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. *Research Synthesis Methods*, *1*(2), 97–111.

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2014). Comprehensive meta-analysis (Version 3.3.070) [Computer software]. Biostat. https://www.meta-analysis.com/

Carpenter, S. K., Wilford, M. M., Kornell, N., & Mullaney, K. M. (2013). Appearances can be deceiving: Instructor fluency increases perceptions of learning without increasing actual learning. *Psychonomic Bulletin & Teview*, *20*(6), 1350–1356.

Carlon, S., Bennett-Woods, D., Berg, B., Claywell, L., LeDuc, K., Marcisz, N., ... & Zenoni, L. (2012). The community of inquiry instrument: Validation and results in online health care disciplines. *Computers & Education*, *59*(2), 215–221.

Caskurlu, S., Maeda, Y., Richardson, J. C., & Lv, J. (2020). A meta-analysis addressing the relationship between teaching presence and students' satisfaction and learning. *Computers & Education*, *157*, 103966.

Caskurlu, S. (2018). Confirming the subdimensions of teaching, social, and cognitive presences: A construct validity study. *Internet and Higher Education*, *39*, 1–12.

*Catron, S. D. (2012). *An investigation of online educational quality in professional and continuing education using the Community of Inquiry framework*. [Unpublished doctoral dissertation]. University of California, Davis.

*Chen, Y., Gao, Q., Yuan, Q., & Tang, Y. (2019). Discovering MOOC learner motivation and its moderating role. *Behaviour & Information Technology*, 1–19.

Chen, Y., Lei, J., & Cheng, J. (2019). What if online students take on the responsibility: Students' sognitive presence and peer facilitation techniques. *Online Learning*, *23*(1), 37–61.

*Choy, J. L. F., & Quek, C. L. (2016). Modelling relationships between students' academic achievement and community of inquiry in an online learning environment for a blended course. *Australasian Journal of Educational Technology*, *32*(4).

Claman, F. L. (2015). The impact of multiuser virtual environments on student engagement. *Nurse Education in Practice*, *15*(1), 13–16.

Croft, N., Dalton, A., & Grant, M. (2010). Overcoming isolation in distance learning: Building a learning community through time and space. *Journal for Education in the Built Environment*, *5*(1), 27–64.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed). Academic Press.

CoI Framework (2020). *Community of Inquiry Framework*. Retrieved from https://coi.athabascau.ca/coi-model/

CoI Survey (2020). *CoI Survey*. Retrieved from https://CoI.athabascau.ca/CoI-model/CoI-survey

*Dempsey, P. (2017). The relationship between a community of inquiry and transformative learning. [Unpublished doctoral dissertation]. Liberty University.

Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences*, *116*(39), 19251–19257.

Dewey, J. (1933). *How we think.* Mineola, NY: Dover Publications.

Dickersin, K., & Min, Y. I. (1993). NIH clinical trials and publication bias. *The Online Journal of Current Clinical Trials*. https://pubmed.ncbi.nlm.nih.gov/8306005/

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *Bmj*, *315*(7109), 629–634.

Fiock, H. S. (2020). Designing a Community of Inquiry in online courses. *International Review of Research in Open and Distance Learning, 21*(1), 135–153.

Galikyan, I., & Admiraal, W. (2019). Students' engagement in asynchronous online discussion: The relationship between cognitive presence, learner prominence, and academic performance. *The Internet and Higher Education*, *43*, 100692.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2/3), 87–105.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education*, *15*(1), 7–23.

Garrison, D. R. (2007). Online community of inquiry review: Social, cognitive, and teaching presence issues. *Journal of Asynchronous Learning Networks*, *11*(1), 61–72.

Garrison, D. R. (2009). Communities of inquiry in online learning: Social, teaching and cognitive presence. In C. Howard et al. (Eds.), *Encyclopedia of Distance and Online Learning* (2nd ed., pp. 352–355). Hershey, PA: IGI Global.

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education*, *13*(1–2), 5–9.

Garrison, D. R., Cleveland-Innes, M., & Fung, T. S. (2010). Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *The Internet and Higher Education*, *13*(1–2), 31–36.

Garrison, D. R. (2011). *E-Learning in the 21st Century: A Framework for Research and Practice* (2nd ed). London: Routledge/Taylor and Francis.

Gašević, D., Adesope, O., Joksimović, S., & Kovanović, V. (2015). Externally-facilitated regulation scaffolding and role assignment to develop cognitive presence in asynchronous online discussions. *The Internet and Higher Education*, *24*, 53–65.

Hattie, J., Rogers, H. J., & Swaminathan, H. (2014). The role of meta-analysis in educational research. In A. D. Reid, E. Hart, & M. Peters (Eds.), *A Companion to Research in Education* (pp. 197–207). Springer. https://doi.org/10.1007/978-94-007-6809-3_26

Hosler, K. A., & Arend, B. D. (2012). The importance of course design, feedback, and facilitation: Student perceptions of the relationship between teaching presence and cognitive presence. *Educational Media International*, *49*(3), 217–229.

Hunter, J. E., & Schmidt, F. L. (2000). Fixed effects vs. random effects meta-analysis models: Implications for cumulative research knowledge. *International Journal of Selection and Assessment*, *8*(4), 275–292.

Jan, S. K., Vlachopoulos, P., & Parsell, M. (2019). Social network analysis and learning communities in higher education online learning: A systematic literature review. *Learning*, *23*(1), 249–264.

*Jones, C. R. (2017). *Examination of Online Community College Students: Community of Inquiry Theoretical Model* [Unpublished doctoral dissertation]. McKendree University.

Joo, Y. J., Lim, K. Y., & Kim, E. K. (2011). Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Computers & Education, 57*, 1654–1664.

Kang, M., Liew, B. T., Kim, J., & Park, Y. (2014). Learning presence as a predictor of achievement and satisfaction in online learning environments. *International Journal on E-Learning*, *13*(2), 193–208.

Kanuka, H., Rourke, L., & Laflamme, E. (2007). The influence of instructional methods on the quality of online discussion. *British Journal of Educational Technology, 38,* 260–271.

*Khodabandelou, R., Ab Jalil, H., Ali, W. Z. W., & bin Mohd Daud, S. (2014). Moderation effect of gender on relationship between community of inquiry and perceived learning in blended learning environments. *Contemporary Educational Technology*, *5*(3), 257–271.

Kovanović, V., Joksimović, S., Poquet, O., Hennis, T., Dawson, S., Gašević, D., ... & Siemens, G. (2017, March). Understanding the relationship between technology use and cognitive presence in MOOCs. In *Proceedings of the Seventh International Learning Analytics & Knowledge Conference* (pp. 582–583).

Kozan, K., & Richardson, J. C. (2014). Interrelationships between and among social, teaching, and cognitive presence. *The Internet and Higher Education*, *21*, 68–73.

Krathwohl, D. R., Bloom, B. S. and Masia, B. B. (1964). *Taxonomy of educational objectives, Book II. Affective domain.* David McKay Company, Inc.

Kranzow, J. (2013). Faculty leadership in online education: Structuring courses to impact student satisfaction and persistence. *MERLOT Journal of Online Learning and Teaching*, *9*(1), 131–139

Kucuk, S., & Sahin, I. (2013). From the perspective of community of inquiry framework: An examination of Facebook uses by pre-service teachers as a learning environment. *Turkish Online Journal of Educational Technology, 12*(2), 142–156.

Lenhard, W., & Lenhard, A. (2014). *Hypothesis Tests for Comparing Correlations*. Psychometrica. https://www.psychometrica.de/correlation.html. doi: 10.13140/RG.2.1.2954.1367

*Lee, S. J., & Huang, K. (2018). Online interactions and social presence in online learning. *Journal of Interactive Learning Research*, *29*(1), 113–128.

Lin, S., Hung, T. C., & Lee, C. T. (2015). Revalidate forms of presence in training effectiveness: Mediating effect of self-efficacy. *Journal of Educational Computing Research*, *53*(1), 32–54.

Lowenthal, P. R., & Parscal, T. (2008). Teaching presence online facilitates meaningful learning. *The Learning Curve*, *3*(4), 1–2

*Maddrell, J. A., Morrison, G. R., & Watson, G. S. (2017). Presence and learning in a community of inquiry. *Distance Education*, *38*(2), 245–258.

*Mo, S. K., & Lee, S. (2017). The relationships among the presences of community of inquiry and the perceptions of EFL college students in online learning. *Multimedia-Assisted Language Learning*, *20*(2), 11–35.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, *151*(4), 264–269.

Moreira, J. A., Ferreira, A. G., & Almeida, A. C. (2013). Comparing communities of inquiry of Portuguese higher education students: One for all or one for each? *Open Praxis*, *5*(2), 165–178.

Olpak, Y. Z., & Cakmak, E. K. (2018). Examining the reliability and validity of a Turkish version of the Community of Inquiry Survey. *Online Learning Journa*l, *22*(1), 142–160.

Pellas, N. (2017). An exploration of interrelationships among presence indicators of a community of inquiry in a 3D game-like environment for high school programming courses. *Interactive Learning Environments*, *25*(3), 343–360.

*Place, M. A. (2017). *Comparing online learning perceptions of adult students: An application of the Community of Inquiry framework* [Unpublished doctoral dissertation]. Widener University.

Redmond, P. (2014). Reflection as an indicator of cognitive presence. *E-Learning and Digital Media, 11*(1), 46–58.

Redstone, A. E., Stefaniak, J. E., & Luo, T. (2018). Measuring Presence: A review of research using the Community of Inquiry instrument. *The Quarterly Review of Distance Education*, *19*(2).

Richardson, J. C., Maeda, Y., Lv, J., & Caskurlu, S. (2017). Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. *Computers in Human Behavior*, *71*, 402–417.

Richardson, J. C., Arbaugh, J. C. Cleveland-Innes, M., Ice, P., Swan, K., and Garrison, D. R. (2010). Using the community of inquiry framework to inform effective instructional design. In L. Moller & J. B. Huett (Eds.), *The next generation of distance education.* Springer. https://doi.org/10.1007/978-1-4614-1785-9_7

Richardson, J. C., & Swan, K. P. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks*, *7*, 68–88.

Rockinson-Szapkiw, A. J., Baker, J. D., Neukrug, E., & Hanes, J. (2010). The efficacy of computer mediated communication technologies to augment and support effective online helping profession education. *Journal of Technology in Human Services, 28*(3), 161–177.

Rockinson-Szapkiw, A. J., & Wendt, J. (2015). Technologies that assist in online group work: A comparison of synchronous and asynchronous computer mediated communication technologies on students' learning and community. *Journal of Educational Multimedia and Hypermedia, 24*(3), 263–279.

*Rockinson-Szapkiw, A. J., Wendt, J., Whighting, M., & Nisbet, D. (2016). The predictive relationship among the community of inquiry framework, perceived learning and online, and graduate students' course grades in online synchronous and asynchronous courses. *International Review of Research in Open and Distributed Learning*, *17*(3), 18–35.

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychology Bulletin, 86*, 638–641.

Rosenthal, R. (1995). Writing meta-analytic reviews. *Psychological Bulletin*, *118*(2), 183.

Seaman, J. E., Allen, I. E., & Seaman, J. (2018). *Grade increase: Tracking distance education in the United States*. Babson Survey Research Group.

Shea, P., & Bidjerano, T. (2009a). Cognitive presence and online learner engagement: A cluster analysis of the community of inquiry framework. *Journal of Computing in Higher Education, 21*(3), 199.

Shea, P., & Bidjerano, T. (2009b). Community of inquiry as a theoretical framework to foster "epistemic engagement" and "cognitive presence" in online education. *Computers & Education*, *52,* 543–553

Shea, P., Li, C., Swan, K. P., & Pickett, A. (2005). Developing learning community in online asynchronous college courses: The role of teaching presence. *Journal of Asynchronous Learning Networks*, *9*, 59–82.
Shin, N. (2003). Transactional presence as a critical predictor of success in distance learning. *Distance Education*, *24*, 69–86.
Sorensen, C. K., & Baylen, D. M. (2009). Learning online: Adapting the seven principles of good practice to a Web-based instructional environment. In A. Orellana, T. L. Hudgins, & M. Samonson (Eds.), *The perfect online course: Best practices for designing and teaching* (pp. 69–86). Information Age Publishing.
Sterne, J. A., & Egger, M. (2001). Funnel plots for detecting bias in meta-analysis: Guidelines on choice of axis. *Journal of Clinical Epidemiology*, *54*(10), 1046–1055.
Sterne, J. A., & Harbord, R. M. (2004). Funnel plots in meta-analysis. *The Stata Journal*, *4*(2), 127–141.
Stenbom, S. (2018). A systematic review of the Community of Inquiry survey. *The Internet and Higher Education*, *39*, 22–32.
Swan, K., Shea, P., Richardson, J., Ice, P., Garrison, D. R., Cleveland-Innes, M., & Arbaugh, J. B. (2008). Validating a measurement tool of presence in online communities of inquiry. *E-Mentor*, *2*(24), 1–12.
Swan, K. P., & Shih, L. (2005). On the nature and development of social presence in online course discussions. *Journal of Asynchronous Learning Networks, 9*, 115–136.
Orwin, R. G. (1983). A fail-safe *N* for effect size in meta-analysis. *Journal of Educational Statistics, 8*(2), 157–159. https://doi.org/10.2307/1164923
*van der Merwe, M. D. (2014). Community of Inquiry framework: Employing instructor-driven measures in search of a relationship among presences and student learning outcomes. *International Journal of Learning Technology*, *9*(3), 304–320.
*van Schyndel, J. L. (2015). Nursing students' perceptions of presence in online courses [Unpublished doctoral dissertation]. Indiana University.
Wilson, L. C. (2014). *Introduction to meta-analysis: A guide for the novice*. Association for Psychological Science. https://www.psychologicalscience.org/observer/introduction-to-meta-analysis-a-guide-for-the-novice
*Woiwode, K., & Baysingar, M. (2015). *Impact of community of inquiry and authentic learning on learning outcomes in online health science education* [Unpublished master's thesis]. Western Illinois University.
Xie, K., DeBacker, T. K., & Ferguson, C. (2006). Extending the traditional classroom through online discussion: The role of student motivation. *Journal of Educational Computing Research, 34*(1), 67–89.
Xie, K., Durrington, V. A., & Yen, L. L. (2011a). Relationship between students' motivation and their participation in asynchronous online discussions. *Journal of Online Learning and Teaching, 7*(1), 17–29.
Xie, K., & Ke, F. (2011b). The role of students' motivation in peer-moderated asynchronous online discussions. *British Journal of Educational Technology, 42*(6), 916–930.
Xie, K., Miller, N. C., & Allison, J. R. (2013). Toward a social conflict evolution model: Examining the adverse power of conflictual social interaction in online learning. *Computers & Education, 63,* 404–415.

Xie, K., Lu, L., Cheng, S. L., & Izmirli, S. (2017) The interactions between facilitator identity, conflictual presence, and social presence in online collaborative learning. *Distance Education*, *38*(2), 230–244.

*Yadon, B. C. (2014). *Improving online programs and community of inquiry through analysis of discussion boards, instructor self-efficacy, and student satisfaction* [Unpublished doctoral dissertation]. University of Idaho.

Yu, T., & Richardson, J. C. (2015). Examining reliability and validity of a Korean version of the community of inquiry instrument using exploratory and confirmatory factor analysis. *The Internet and Higher Education*, *25*, 45–52.

Appendix

Funnel Plots of Standard Errors for Variables in this Study

Figure A.1

Funnel plot for the correlation between cognitive presence and actual learning

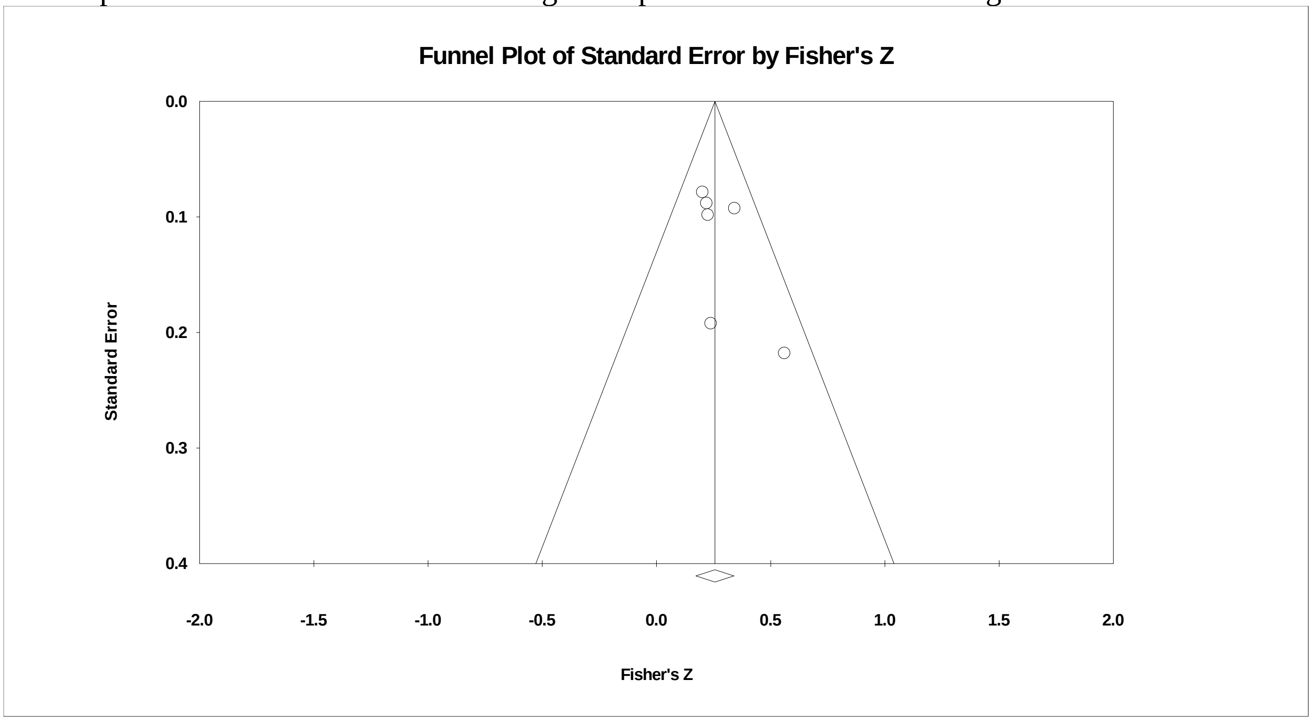

Figure A.2

Funnel plot for the correlation between social presence and actual learning

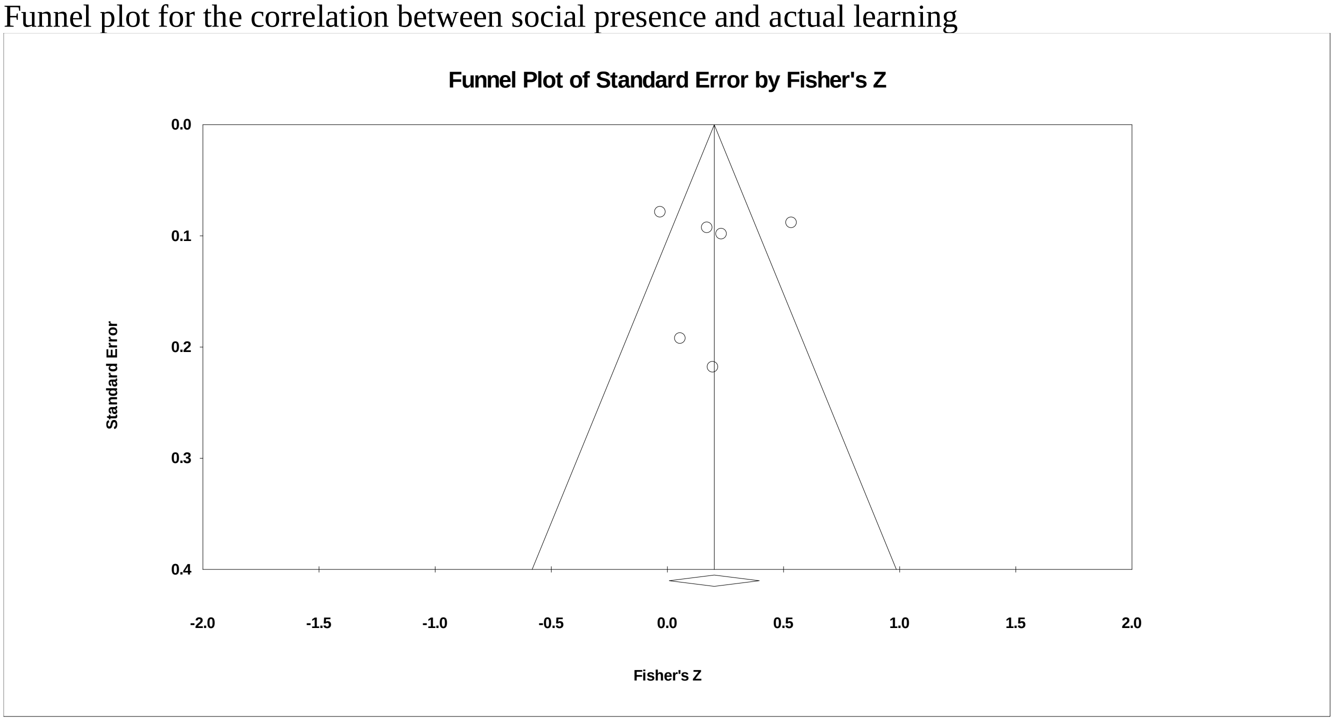

Figure A.3
Funnel plot for the correlation between teaching presence and actual learning

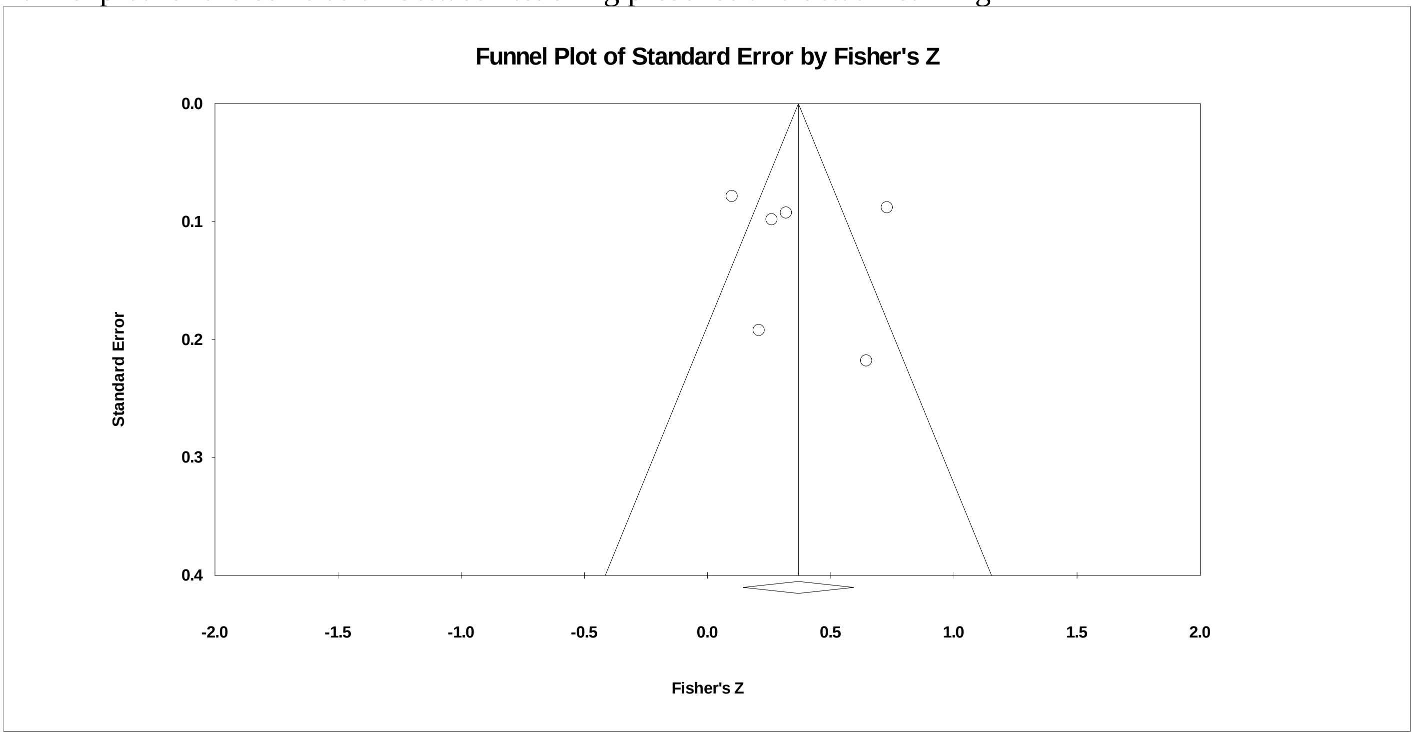

Figure A.4
Funnel plot for the correlation between cognitive presence and perceived learning

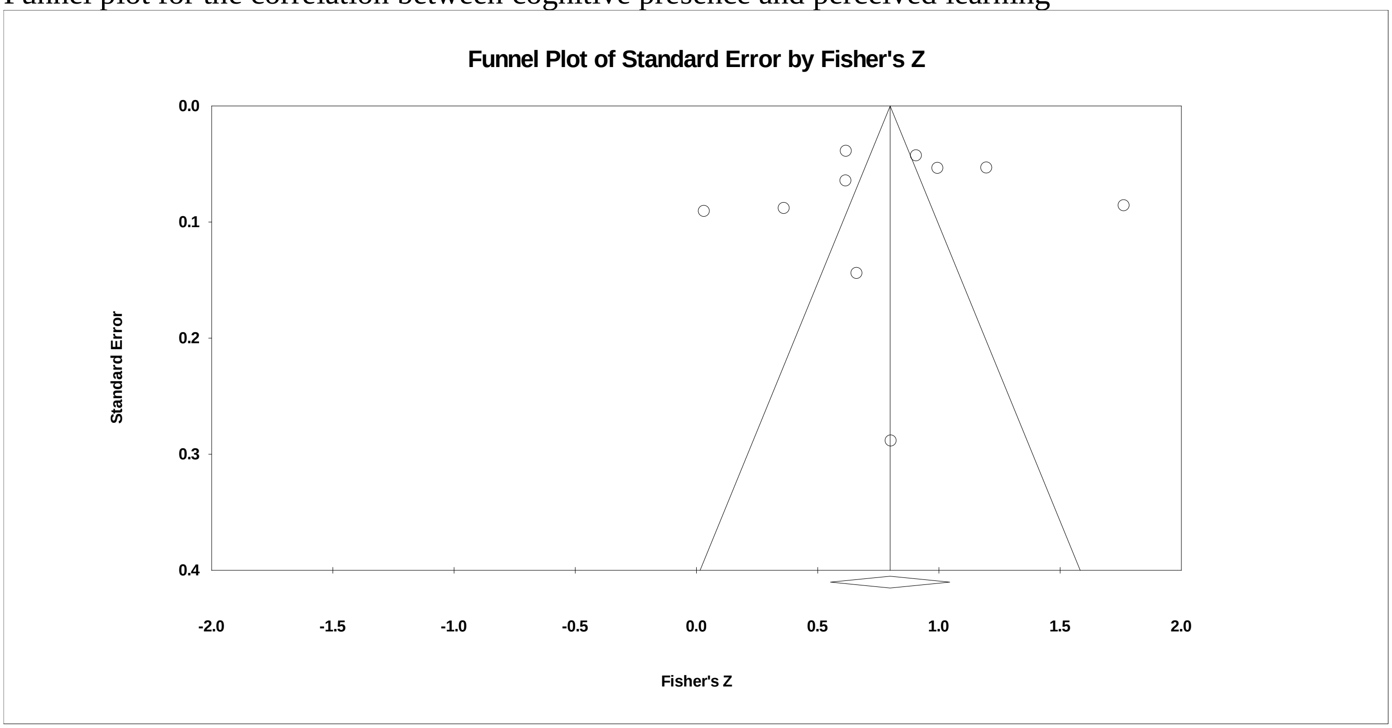

Figure A.5
Funnel plot for the correlation between social presence and perceived learning.

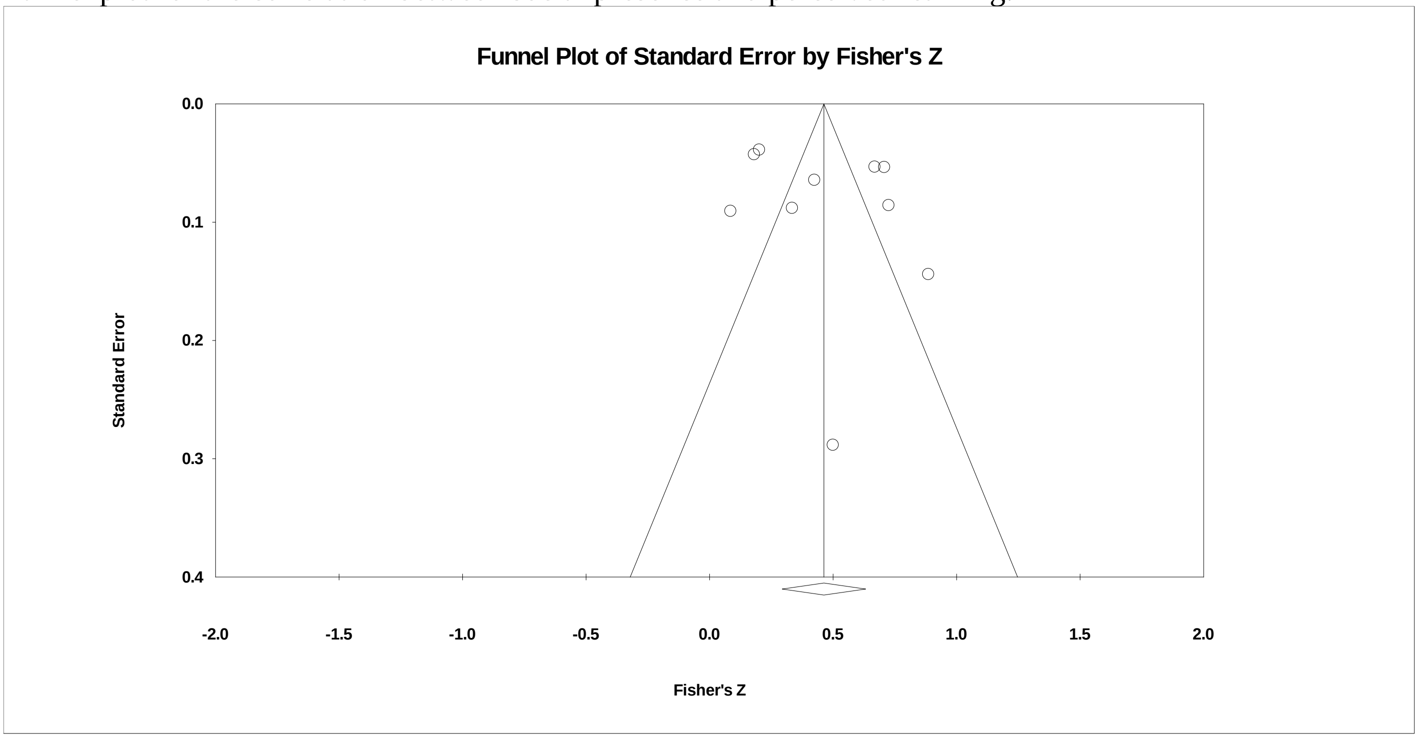

Figure A.6
Funnel plot for the correlation between teaching presence and perceived learning

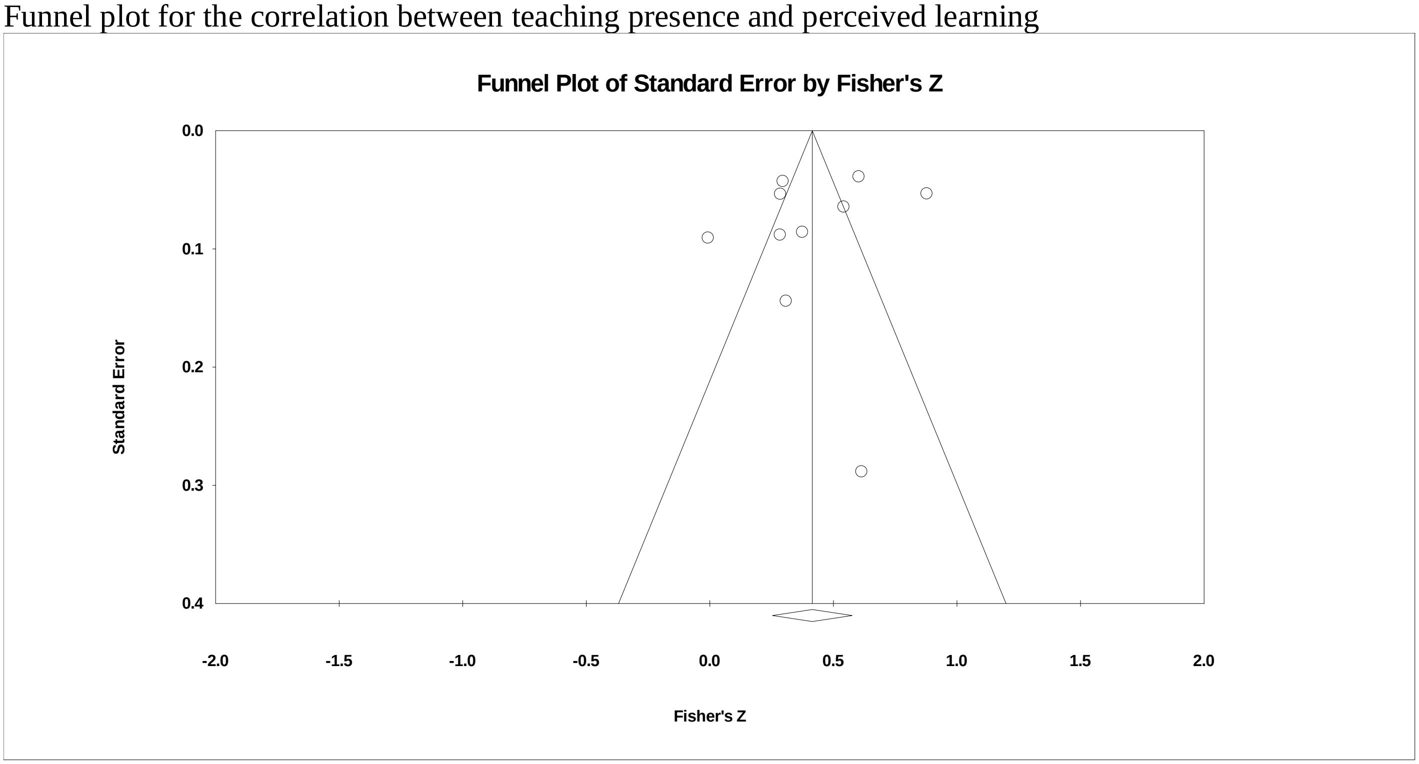

Figure A.7
Funnel plot for the correlation between cognitive presence and satisfaction

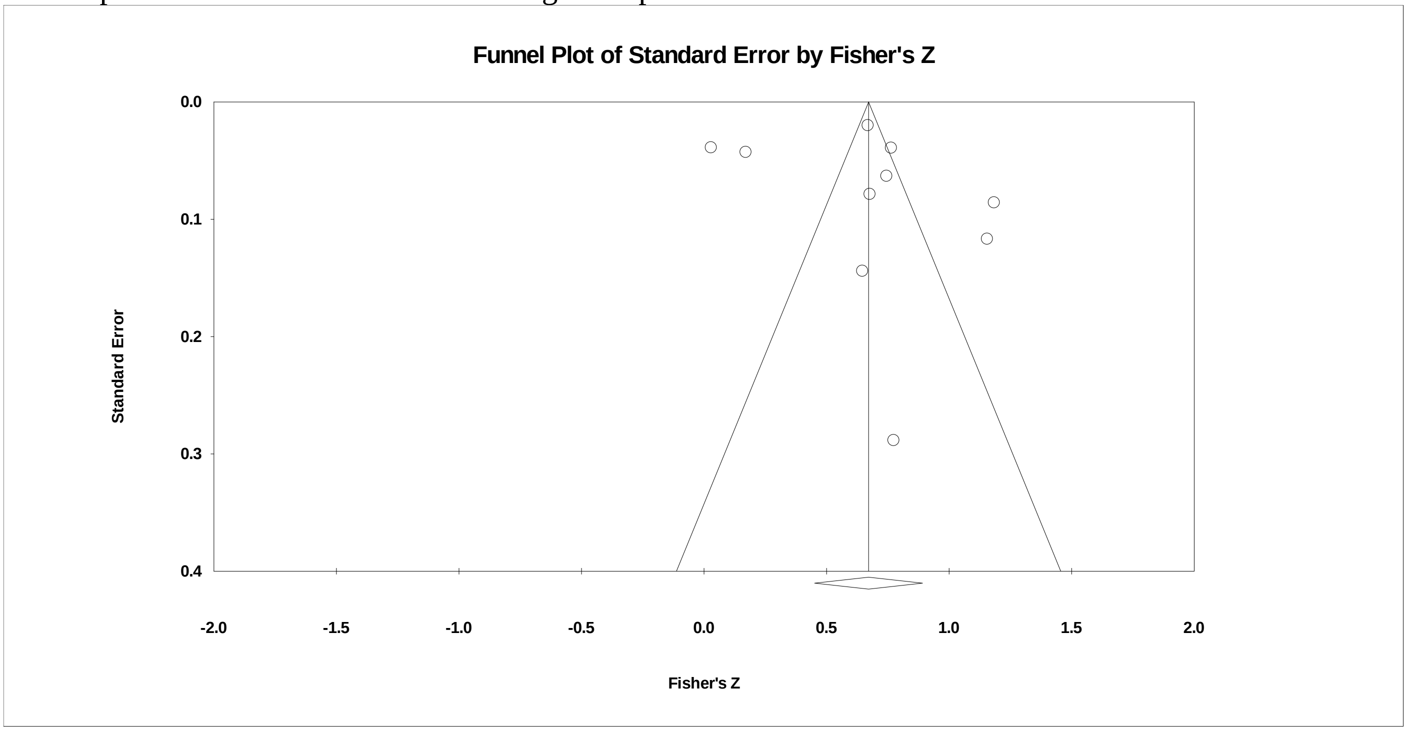

Figure A.8
Funnel plot for the correlation between social presence and satisfaction

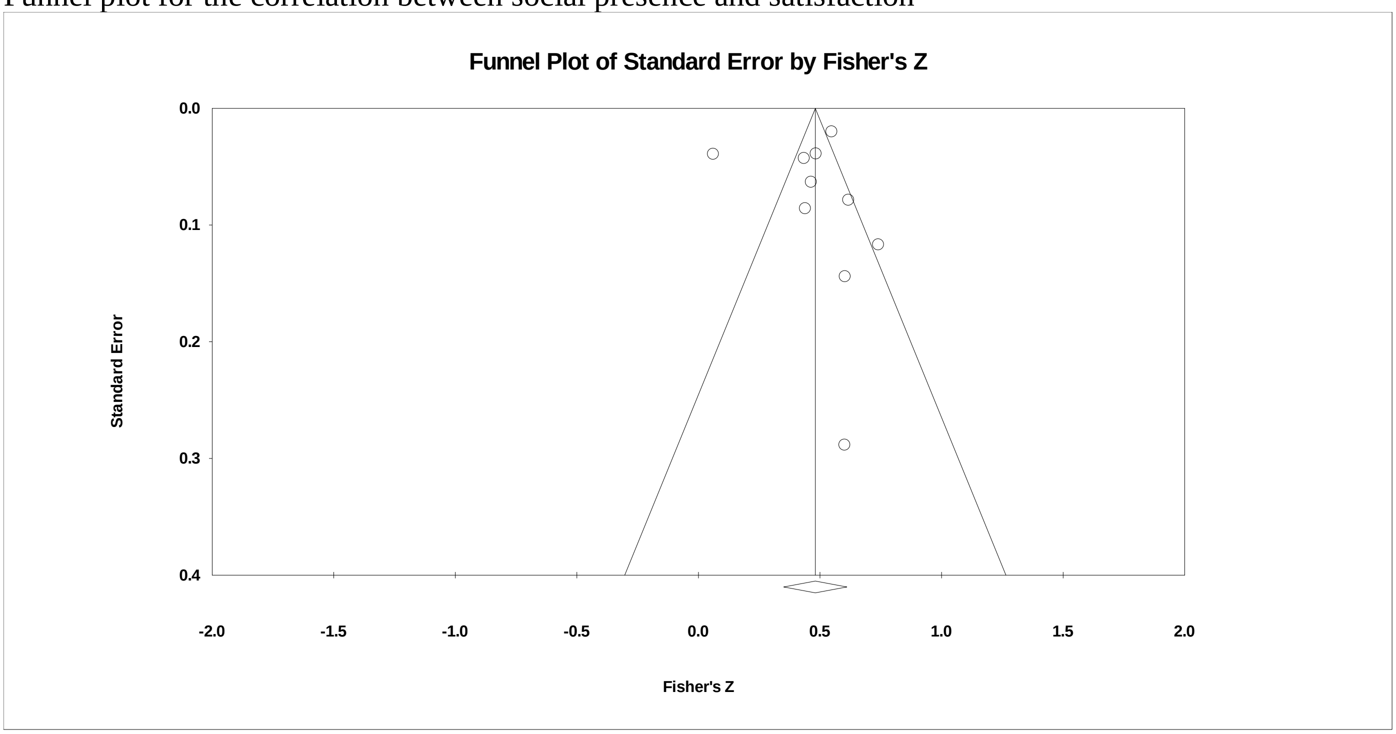

Figure A.9
Funnel plot for the correlation between teaching presence and satisfaction