Introduction to the Special Issue: Select Papers Presented at the 2021 OLC Accelerate Conference and the 2022 OLC Innovate Conference

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In the 1990s, a small community of higher education professionals came together to promote the idea that online learning could provide access to a quality education. Beginning as the Sloan Consortium (Sloan-C) with funding by the Alfred P. Sloan Foundation, the organization quickly led the field as a leader in online learning. Sloan-C sponsored activities and events designed to promote the concept that the design and implementation of high quality online and blended learning should be strategic and based on sound pedagogical principles. An annual meeting of the Alfred P. Sloan Foundation's Anytime, Anyplace Learning Program grant recipients formed the first Sloan-C event featuring a small group of early online learning innovators. Then, in 2001, the University of Central Florida hosted the first Sloan-C International Conference on Online Learning fall conference in Orlando, Florida. The second yearly event, the Sloan-C Blended Learning Conference and Workshop, quickly followed in 2003.

In 2016, the Online Learning Consortium rebranded its two flagship conferences to be named OLC Accelerate, held in the fall, and OLC Innovate, held jointly with MERLOT each spring. This past year, OLC Accelerate 2021, was held virtually September 20-24, 2021, and live, near Washington, D.C. October 5-8, 2021. OLC Innovate 2022, was held virtually March 29-April 1, 2022, and in person in Dallas, Texas, April 11-13, 2022.

Each year, *Online Learning* solicits research papers from those who have presented at the most recent OLC Accelerate and Innovate conferences. In this special section, we feature four articles from experts in the field of online learning. Much of the work showcased at our conferences presents case studies and research from faculty and practitioners in the field. The growing focus on online learning due to the pandemic has resulted in many new models, approaches, and applications being deployed to address instructional needs in the virtual classroom. These provide a valuable opportunity to examine how faculty and researchers are adapting their instruction to provide quality online learning across various institutions and disciplines.

In *Effect of Role-Play in Online Discussions on Student Engagement and Critical Thinking*, Laurie Berry and Kristin Kowal discussed their research from the University of Wisconsin Extended Campus. The use of role-play, including written reflections was investigated as an instructional strategy to facilitate critical thinking and student engagement by integrating authentic, real-world contexts in an online, self-paced, biology course. This approach enabled students to engage with the content to help them discover new knowledge and construct new meaning from examining multiple perspectives. Garrison, Anderson and Archer's (2000) four-phase model of cognitive presence and Gunawardena, Lowe, and Anderson's (1998) five-staged model of knowledge construction were used to gauge the presence of critical thinking in student discussion post. Evidence of students' knowledge construction increasing was found after their interaction with others' posts, with the highest evidence of critical thinking and knowledge construction in the written reflections. Details on the role-playing exercise are provided for replication and strengths and weaknesses of their instructional approach are thoughtfully discussed. Implications for practice are provided, including the importance of including a student refection at the end of a discussion activity. Based on this study, Berry and Kowal developed the "Framework for Student Engagement and Critical Thinking in Online Discussions," to guide others in the field. Future research recommendations focus on the need for evaluating this framework and the continued application and examination of this method to other discussion strategies.

Suzanne Ensmann and Aimee Whiteside in *"It Helped to Know I Wasn't Alone:" Exploring Student Satisfaction in an Online Community with a Gamified, Social Media-Like Instructional Approach,* discussed the utilization of creating instruction that utilizes a platform called Yellowdig® to facilitate game-like student interactions in courses to foster connectivity and satisfaction. Eighteen courses in various disciplines utilized this instructional tool across four semesters. The authors provide examples to illustrate the class interface and discusses issues around the integration of this approach. Researchers found that students were positive about this new environment, and their analysis found significant differences between Generations Z and Y, with the former rating clarity higher in this approach. Lessons learned are discussed, including critical course design elements that faculty should consider implementing when using this instructional method.

Emily Faulconer in *A Case Study of Community of Inquiry Presences and Cognitive Load in Asynchronous Online STEM Courses* examined the relationship between students' cognitive load and Community of Inquiry presences in an asynchronous, online course in undergraduate physics. The study analyzed student and instructor discussion post content for presence density and compared these measures across cohorts and modules. The NASA Task Load Index® was used to assess students' subjective cognitive workload, and then its impact on students' performance is examined. The authors provide discussion about how the findings prompt implications for course design, specifically the instructional design of discussions, and highlights the need for quality and ongoing faculty development. During the analysis, the researchers found downloading and de-identifying discussion posts to be extremely time consuming, so they developed a Python® script to extract the discussion test, parse the sentence structure, and de-identify the text. The GitHub link to this code is also provided for readers.

Finally, in *Teaching and Learning with AI-Generated Courseware: Lessons from the Classroom*, Kersten Schroeder, Martha Hubertz, Rachel Van Campenhout and Benny Johnson describe a case study where two courses, Microbial Metabolism, and Psychology of Sex and Gender, were redesigned. Acrobatiq®'s artificial intelligence engine was utilized to automatically generate questions from existing e-textbooks to create coursework containing formative practice for students. The researchers describe the course redesign process and how student engagement increased with the integration of the practice into the course. The authors share lessons learned including how they motivated students to complete the practice and they illustrate how that translated into increased student engagement. While more research needs to be done to determine the link between student performance and engagement, researchers found that the low end of the range of exam scores increased with the new approach, hinting at the possibility for this approach to more help for the most struggling students. Opportunities for future research are discussed.

We would like to acknowledge the hard works of OLC staff and numerous conference support members from the OLC community who gave countless hours to make 2021 OLC Accelerate and 2022 OLC Innovate successful. We also are grateful to Mary Rice, managing editor, and Peter Shea, editor, of *Online Learning*, for their continuing guidance and help in continuing this focus on OLC Conferences and to our OLJ reviewers.

To the OLJ readers, we invite you to consider submitting your research for presentation to OLC Accelerate in fall, or to OLC Innovate in spring. Quality research is critical to improving the field and these venues along with OLJ submissions allow others to learn from your experiences. Also, please consider submitting your original research here to *Online Learning* in the future.

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Effect of Role-Play in Online Discussions on Student Engagement and Critical Thinking

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Abstract
Without a strategy in place, online discussions in asynchronous courses rarely rise above the level of information sharing. As a result, it is important to design discussion strategies that push students further in their interactions with both the content and each other. In this case study, the role-play strategy was examined to determine whether it fosters critical thinking and student engagement. Student discussion transcripts were examined from an online, self-paced human biology course using both Garrison et al.'s four-phase model of cognitive presence and Gunawardena et al.'s five-stage model of knowledge construction to look for evidence of higher-order thinking. Furthermore, the transcripts were examined qualitatively for phrasing that signified evidence of student engagement. The findings indicate that the role-play instructional strategy, when used in online discussions, does support student engagement and critical thinking. This strategy places students in authentic, real-world contexts and enables them to explore different perspectives while engaging with the content to discover new knowledge and construct new meaning. The research presented here also supports evidence that written reflection should be incorporated when employing the role-play strategy. Based on the insights from this study, the researchers have developed a framework for students to achieve deeper, more engaging online discussions. This framework is called the "Framework for Student Engagement and Critical Thinking in Online Discussions."

Keywords: Online discussions, student engagement, critical thinking, role-play strategy

Berry, L. A., & Kowal, K. B. (2022). Effect of role-play in online discussions on student engagement and critical thinking. *Online Learning, 26*(3), 4-21.

Discussions are a widely used technique in online courses to support learning and encourage engagement (Gao, 2014). However, when overused or designed solely to mimic the face-to-face environment, discussions become stagnant and student engagement dwindles (Acolatse, 2016). Students may find little to no value in participating in discussions because they feel doing so is busywork that is merely meant to satisfy a requirement (Buelow et al., 2018; Martin & Bollinger, 2018). Because of this preconception among students, discussions rarely go beyond knowledge and information sharing to reach knowledge construction and application (Brokensha & Greyling, 2015; Domakin, 2013; Gao, 2014; Jarosewich et al., 2010). In response to the prescribed read-write-post pattern that is often used in many online courses, the researchers recommend using instructional strategy alternatives (such as role-play, debate, and images) to enliven or add “zest” to an online course (Berry & Kowal, 2019). Berry and Kowal (2019) claim that utilizing active learning strategies can make student discussions more enjoyable and meaningful. Jarosewich et al. (2010) suggest that adjusting the traditional elements of design offers students an opportunity to apply the constructivist approach, which enables them to reach deeper levels of learning.

Garrison et al. (2000) argue that cognitive presence, the extent to which students apply higher-order critical thinking skills, is crucial for students to be able to engage with content in online discussions. When students interact with content in ways that allow them to construct new meaning from their learning, they continue to build on their prior knowledge, forming a deeper connection to the content itself, and are able to interact more meaningfully with others (Brokensha & Greyling, 2015; Galikyan & Admiraal, 2019; Jarosewich et al., 2010; Wang & Chen, 2008).

Previous research shows the need for instructional strategies that push students beyond information sharing into knowledge construction (Brokensha & Greyling, 2015; Darabi et al., 2011; Domakin, 2013; Gao, 2014; Jarosewich et al., 2010). The purpose of this study is to examine role-play as an online discussion instructional strategy and to determine whether it fosters critical thinking and student engagement. The analysis of this question builds on prior research and the body of research that stems from it.

Review of Relevant Literature

Critical Thinking and Student Engagement

Researchers have used models such as the four-phased cognitive presence component of the Community of Inquiry (COI) model developed by Garrison, Anderson, and Archer (Galikyan & Admiraal, 2019; Garrison et al., 2000) to measure the impact of different instructional strategies on critical thinking in online discussions for over a decade. According to Garrison et al. (2000), cognitive presence develops and progresses through four phases: triggering event, exploration, integration, and resolution. The integration phase of the cognitive presence model is indicative of higher-order thinking (Galikyan & Admiraal, 2019). Discussions reaching this phase show evidence that learners are thinking critically about the content while engaging with others to inform and construct new meaning (Brokensha & Greyling, 2015; Galikyan & Admiraal, 2019; Jarosewich et al., 2010; Wang & Chen, 2008). Research by Wang and Chen (2008) showed that when discussions reach the integration phase, students move from sharing and comparing information to debating ideas at a much deeper level, often supporting their arguments with evidence. However, when using this model as a measure of cognitive presence, it, unfortunately, shows too often that online discussions fail to develop beyond the exploration phase (Darabi et al., 2011). This finding calls for a reimagining of instructional strategies on discussion forums to achieve higher-level thinking, as most discussions do not naturally lead to critical thinking or knowledge construction (Brokensha & Greyling, 2015; Domakin, 2013; Jarosewich et al., 2010), or ensure cognitive engagement (Brokensha & Greyling, 2015). Providing students with alternative discussion formats empowers them to become active learners, form deeper connections to the content, and engage more meaningfully with their peers.

While online discussions without a well-executed strategy are not proven to lead to higher-order thinking, they are still used with the expectation that students will collaborate with each other and show evidence of knowledge construction (Galikyan & Admiraal, 2019). Unfortunately, as Gao (2014) uncovered, this expectation does not come automatically, and when it does, students often fail to interact beyond the surface level of social exchange or apply newly acquired information. It has become evident that in order for students to move toward achieving deeper learning, there needs to be interaction between the student and the activity itself. Instructors need to recognize the discussion board as a flexible tool that can be used for more than discussion (Meyer, 2014) and as a medium to increase student-to-content engagement.

Gunawardena et al. (1998) developed a five-stage model to measure critical thinking in online student discussions and found little evidence that students moved beyond the information-sharing stage. Domakin (2013) believes a limitation of this model is that it assumes that discussions will progress linearly as students analyze materials and construct new meaning. Domakin (2013) also argues that Gunawardena et al.'s five-stage model of knowledge construction misses key components that should be considered when analyzing discussion transcripts—for example, emotion and the organic nature of discussions themselves. Jarosewich et al. (2010) also looked for evidence of critical thinking in online discussions and found that students did not push beyond the initial discussion question and challenge each other into higher-level thinking.

Discussions Used for Authentic Learning

Research measuring how alternative discussion strategies can help achieve higher-level thinking has been conducted. Martin and Bollinger (2018) claim one way to achieve learner-to-content engagement and develop critical thinking skills is to design real-world, authentic activities that allow students to examine different perspectives and utilize a variety of resources and information. They argue that creating such activities enables learners to explore and discover new knowledge that is key to constructing new meaning. Work by Chan et al. (2016) indicates that designing discussions that expose learners to real-life problems is a key component to achieving knowledge construction. Darabi et al. (2011) examined four alternative discussion strategies and concluded that putting students in authentic contexts, such as role-play, facilitated critical thinking and moved students through each of the four phases of Garrison et al.'s four-phase model of cognitive presence.

Role-Play Strategy

Research conducted by Darabi et al. (2011) showed that when learners are provided with a realistic situation and assume a given role or perspective, they engage in critical thinking and knowledge construction. The Darabi et al. study indicates that with debate and role-play strategies, learners display evidence of reaching the integration phase of Garrison et al.'s four-phase model of cognitive presence at 41.3% and nearly half (49.3%) respectively, as compared to the non-role specific discussion strategies of structured (36.6%) and scaffolded (35.6%)...

These findings suggest that learners make and justify decisions made through a given role. Darabi et al. claim that a strong characteristic of the role-play strategy is its ability to present learners with relevant and authentic learning scenarios that expose them to multiple perspectives and enable them to broaden their knowledge and exercise problem-solving and critical-thinking skills, resulting in higher levels of cognitive presence.

Similarly, Richardson and Ice's study (as cited in Meyer, 2014) shows that when using case-based discussions and online debates (i.e., authentic applications), 78% and 77% of the student posts, respectively, reached the integration phase of Garrison et al.'s four-phase model of cognitive presence. On the other hand, only 60% of open-ended discussions were able to reach this level. Meyer (2014) states that using active learning strategies in online classrooms, such as project work and experiential learning, engages students in their learning similarly to a face-to-face format. Thus, when students are motivated, they display more engagement (Chan et al., 2016).

Both studies show that students should be provided with realistic situations that they can relate to and that allow them to consider perspectives other than their own. In addition, these situations may introduce students to discourse or controversial topics. Incorporating such elements into online discussions can be critical to students' engagement with both the course content and their peers and their ability to construct new knowledge and meaning from the materials.

Schindler and Burkholder (2014) report that research into the effectiveness of role-play has been mixed. Their findings indicate that in one study by Kalelioğlu and Gűlbahar (as cited in Schindler & Burkholder, 2014), when students were assigned roles in an educational professional setting, results showed a low level of critical thinking. However, in other studies with discipline-specific roles, education and engineering students showed higher levels of critical thinking (as cited in Schindler & Burkholder, 2014). Schindler and Burkholder (2014) also found that when students were allowed to choose their roles, they reported higher levels of critical thinking; the authors posited that students might choose roles that they were already familiar with or felt most passionate about and thus reported higher levels of student-to-student and student-to-content engagement. In a 2012 research study by Dracup, students who were assigned a specific role perspective in the case study activity felt safer to experiment within their role because of the distance the online asynchronous format offered. Students felt a sense of anonymity because their discussion post was viewed by their peers through their role's perspective rather than their own; therefore, students were able to dig deeper into their assigned role, which deepened their knowledge and broadened their perspective. Even though these studies showed mixed results on critical thinking, evidence indicates that assigning students specific roles in online discussions may be beneficial in certain disciplines or when students are asked to explore divisive topics.

While the studies conducted by Richardson and Ice (as cited in Meyer, 2014), Darabi et al. (2011), and Dracup (2012) support the use of the role-play instructional strategy in online discussions, the findings are more than a decade old. Since then, the learning environment, educational technologies, and educational techniques have advanced (Dye, 2022). In addition, there has been a seismic shift in the college student population toward the non-traditional student (Hittepole, 2019; Pelletier, 2010). Non-traditional students want to actively apply their knowledge to their personal or professional experiences (Pelletier, 2010). Therefore, it is important to retest these former claims to verify the validity of the results. It is also important to test the existing claims using role-play in a self-paced asynchronous discussion forum where students are not expected to interact with each other. Having current data in this area will benefit institutions of higher education, such as colleges and universities, as there has been an enormous increase in online course and degree offerings. In addition, new research will provide both instructors and instructional designers with tools to create authentic, real-world experiences and content application in student coursework. The research question this study sets out to examine is if role-play, as an online discussion instructional strategy, fosters critical thinking and student engagement.

Method

This study used the case-study qualitative research method to examine existing information. This process included content analysis to transform qualitative data markings into quantitative data to make comparisons. Cohen's kappa statistical coefficient was used to calculate the inter-rater reliability score.

Population

A concluded self-paced online human biology course, which ran from December 2017 to January 2019, was chosen for the case study because it contained two role-play discussion activities. This course was part of an independent learning array that was offered for credit transfer through a large university in the Upper Midwest. During this time, 17 undergraduate students were enrolled in the course. All undergraduate student discussion board transcripts and written reflection Word documents were analyzed for evidence of critical thinking and student engagement. All subject data personal identifiers (such as subject names, gender reference, course or program names, and/or locations) were removed by someone outside of the research team before the transcripts and written reflections were analyzed. In addition, any words, language, or phrases that could be identified, characterized, or traced to an individual student were removed to retain the confidentiality of the subjects.

Data Collection and Procedure

Each role-play discussion activity was split into two parts. In part 1, the initial discussion post, the instructor assigned students to a particular role based on the first letter of their last name (see Table 1).

Table 1
Assigned Roles for Each Role-play Activity

Role-play Activity 1: Organ Donation	
Role	First Letter of Last Name
Donor	A-E
Recipient	F-J
Family member of donor	K-O
Family member of recipient	P-T
Doctor performing transplant	U-Z
Role-play Activity 2: Vaccines	
Role	First Letter of Last Name
Parent of child with healthy immune system	A-E
College student living on campus	F-J
Doctor	K-O
Community member	P-T
Parent of an immunodeficient child	U-Z

Students were then instructed to conduct research based on their assigned role and to post their position to the discussion board, summarizing what they learned. Replying to peers was not a requirement, though several students chose to respond to others. Students could only begin part 2, the written reflection, after they had made their initial post. For part 2 of the assignment, students were instructed to review the other role perspectives and write a reflection paper based on the information from all of the roles and reflections.

After reviewing the literature on critical thinking and student engagement for online discussions, two existing models were used to measure and identify evidence of critical thinking and student engagement within the role-play discussion activities. The two models used were Garrison et al.'s four-phase model of cognitive presence and Gunawardena et al.'s five-stage model of knowledge construction for online learning. These two models were used in multiple studies and therefore would provide reproducible results to look for evidence of critical thinking. It was also valuable to use more than one model, so possible overlaps could be identified to support and confirm the findings.

The role-play discussion activities in each course were reviewed separately. Furthermore, parts 1 and 2 of the discussions were analyzed and evaluated separately across each of the two models looking for evidence of critical thinking and student engagement. Any student replies for part 1 were examined and included as part of the discussion transcript. Each model was marked independently by the two researchers. Rather than coding the individual transcripts to look for patterns, the models' categories and/or associated indicators were marked with the sentence or phrase as proof of whether the individual transcript displayed direct evidence. This enabled the researchers to analyze the models holistically and categorically for results and patterns.

Content from the discussion transcripts was also coded into three categories determined by the researchers: critical thinking, knowledge construction, and student engagement. This qualitative data is a collection of key words and phrases that support the markings in the two models.

Researcher Agreement

Once each segment of the discussion transcripts was marked for each model, if a marking between the two researchers showed an overall agreement of less than 73.3% with Garrison et al.'s four-phase model of cognitive presence or less than 60% with Gunawardena et al.'s five-stage model of knowledge construction, the individual markings were reviewed and discussed. This process resulted in a percent agreement between the researchers of 89.7% for Garrison et al.'s four-phase model of cognitive presence, 88.7% for Gunawardena et al.'s five-stage model of knowledge construction, and an overall average agreement of 89.2%. This information is displayed in Table 2.

The inter-rater reliability coefficient score was also calculated using Cohen's kappa statistical equation to indicate the level of reliability between the researchers. This value was calculated to be 0.703 for Garrison et al.'s four-phase model of cognitive presence and 0.843 for Gunawardena et al.'s five-stage model of knowledge construction. These values were averaged to produce an overall inter-rater reliability score of 0.773 (see Table 2). According to Cohen's kappa statistic, this value falls within the range of 0.61–0.80, which indicates substantial agreement between the researchers.

Table 2
Researcher Agreement

Model	Overall percent (%) agreement	Cohen's kappa
Garrison et al.'s four-phase model of cognitive presence	89.7	0.703
Gunawardena et al.'s model for online learning	88.7	0.843
Overall average	89.2	0.773
Standard deviation	0.74	0.10

Results

Each discussion part—the initial discussion post (part 1) and the written reflection (part 2)—was analyzed and evaluated separately across each model.

Knowledge Construction for Online Learning Using the Gunawardena Model

Within the Gunawardena et al. five-stage model of knowledge construction for online learning, stages 2–5 were identified as indicators for students showing evidence of critical thinking. More specifically, stage 3 (construction of knowledge) was identified by the researchers to be the strongest indicator and measurement of critical thinking. Stage 2 of Gunawardena et al.'s five-stage model of knowledge construction was marked with an average frequency of 83.5%; stage 3 was marked with an average frequency of 48.1%. The higher stages of knowledge construction were marked less frequently (only a 3.0% average frequency of transcripts were marked for stage 4 and 1.6% were marked for stage 5). Previous research by Domakin (2013) found little evidence of online discussions reaching all five stages of knowledge construction and more often found that discussions remained in stage 1, sharing and comparing information. With that, the results reported here are assuring as they indicate that the role-play discussion strategy encouraged students to think critically about the topic or concepts and construct new knowledge and meaning from the materials. It was also found that the reflection transcripts (part 2) had a higher frequency of stage 3 markings [75.6%] compared with the initial discussion post transcripts (part 1) [20.6%] (see Table 3). The researchers speculate, based on what was often found in the review of the transcripts, that students had a harder time achieving the higher stages of critical thinking on their own; however, once students could see their peers' role perspectives, they were able to broaden their own perspectives, constructing new knowledge and thinking critically about their own personal perspectives and/or biases.

Table 3
Results Using Gunawardena et al.'s Five-Stage Model for Online Learning

Stage	Average percent (%) frequency overall	Average percent (%) frequency discussion posts (part 1)	Average percent (%) frequency reflections (part 2)
1. Sharing/comparing information	100.0	100.0	100.0
2. Discussion of concepts and ideas focusing on differences	83.5	79.4	87.5
3. Construction of knowledge arising from this	48.1	20.6	75.6
4. Testing these ideas	3.0	0	6.1
5. Agreement about the knowledge arising from this	1.6	0	3.1

Garrison's Cognitive Presence Model and Critical Thinking

The results of the Garrison et al. four-phase model of cognitive presence were examined both holistically by phase and by the individual indicator. When the researchers reviewed the individual transcripts, they noticed that this particular model was more descriptive and specific when viewed via the indicators. As a result, three indicators within the exploration phase— 1) suggestions or consideration, 2) brainstorming, and 3) leaps to conclusion—and all five indicators within the integration phase—1) convergence, among group members (reference to previous messages), 2) convergence, among group members (building on, adding to other's ideas), 3) convergence, within a single message, 4) connecting ideas/synthesis, and 5) creating solutions—were determined to be specific areas that indicate evidence of student engagement and critical thinking. With this approach, the exploration phase was found to have an overall frequency of markings of 100%, but the indicators that were singled out had a frequency of markings of 16.5%, 37.3%, and 86.5%, respectively. The integration phase was found to have an overall frequency of markings of 89.5%, and the individual indicators had a frequency of markings of 25.8%, 36.3%, 58.4%, 74.5%, and 43.5%, respectively (see Table 4).

Table 4

Average of Markings per Phase vs. Indicator Using Garrison et al.'s Four-Phase Model of Cognitive Presence

Phase	Indicators	Average percent (%) frequency per indicator	Average percent (%) frequency per phase
Triggering event	Recognizing the problem	26.7	34.0
	Sense of puzzlement	17.8	
Exploration	Divergence - within the online community	10.7	100.0
	Divergence - within a single message	73.1	
	Information exchange	95.5	
	Suggestions for consideration	16.5	
	Brainstorming	37.3	
	Leaps to conclusion	86.5	
Integration	Convergence - among group members (reference to previous messages, e.g., "I agree because…")	25.8	89.5
	Convergence - among group members (building on, adding to others' ideas)	36.3	
	Convergence - within a single message	58.4	
	Connecting ideas, synthesis	74.5	
	Creating solutions	43.5	
Resolution	Vicarious application to real world	93.9	93.9
	Testing solutions	1.6	
	Defending solutions	16.5	

When the discussion post transcripts (part 1) and reflection transcripts (part 2) were analyzed separately, a similar pattern to what was uncovered using Gunawardena et al.'s five-stage model of knowledge construction was not found. However, when data from the eight identified indicators was analyzed, discussion post transcripts (part 1) showed 15% or higher frequency of markings compared to the reflection transcripts (part 2) for the following indicators: brainstorming [31.2%], leaps to conclusion [21.2%], and connecting ideas/synthesis [15.7%]. In turn, it was found that the reflection transcripts (part 2) displayed a 10% or higher frequency of markings for the following indicators: suggestions for consideration [21.3%], convergence -

among group members (reference to previous messages) [34.0%], convergence - among group members (building on, adding to other's ideas) [43.2%], convergence - within a single message [16.7%], and creating solutions [10.5%] (see Table 5). Based on these results, the conclusion was drawn that part 1 scored more strongly in the exploration phase because students are just beginning to understand the role assigned to them; part 2 showed more evidence of students making connections after they had encountered more information. The researchers thought this model was more complex than Gunawardena et al.'s five-stage model of knowledge construction, and this difference in approach accounts for uncovering different patterns based on the model.

Table 5

Analysis of Part 1 and Part 2 Discussion Transcripts Using Garrison et al.'s Four-Phase Model of Cognitive Presence

Phase	Indicators	Average percent (%) frequency per indicator discussion posts (part 1)	Average percent (%) frequency per indicator reflections (part 2)
Triggering event	Recognizing the problem	38.2	15.1
	Sense of puzzlement	8.8	26.8
Exploration	Divergence - within the online community	2.9	18.4
	Divergence - within a single message	76.5	69.7
	Information exchange	97.1	93.9
	Suggestions for consideration	5.9	27.2
	Brainstorming	52.9	21.7
	Leaps to conclusion	97.1	75.9
Integration	Convergence - among group members (reference to previous messages, e.g., "I agree because…")	8.8	42.8
	Convergence - among group members (building on, adding to others' ideas)	14.7	57.9
	Convergence - within a single message	50.0	66.7
	Connecting ideas, synthesis	82.4	66.7
	Creating solutions	38.2	48.7
Resolution	Vicarious application to real world	94.1	93.8
	Testing solutions	0.0	3.1
	Defending solutions	14.7	18.2

Qualitative Indicators

During the review, content from the discussion transcripts was analyzed to identify key words and phrases that could be used as qualitative evidence to support the findings. These findings were then coded into three categories: critical thinking, knowledge construction, and student engagement. These findings aligned with the researchers' markings to the specific indicators of Garrison et al.'s four-phase model of cognitive presence and Gunawardena et al.'s five-stage model of knowledge construction. Table 6 shows several of these identified key words and phrases.

Table 6
Qualitative Indicator Key Words and Phrases

Indicator category	Key words and phrases
Critical thinking	"It seems…"
	"It makes me wonder…"
	"I like to think…"
	"Think about it, …"
	"I suspect…"
Knowledge construction	"I hadn't initially thought of…"
	"After learning that…"
	"I feel more informed…"
	"It never occurred to me…"
	"Struck by the idea…"
	"But after doing research…"
Student engagement	"I read [the doctor's] perspective and learned some interesting facts."
	"I enjoyed reading the community perspective."
	"I thought [student] made a good point."

Discussion

Previous research asserts the need for discussion strategies that elevate discussions from the sharing and comparing information phase to the higher levels of knowledge construction (Darabi et al., 2011). Darabi et al.'s work (2011) is one of the foundational studies this research is based on and calls for discussion strategies to be developed, examined, and recommended if found to be sound.

Evidence of Critical Thinking Makes Role-Play a Sound Strategy

This study sought to determine whether the role-play discussion strategy is a sound strategy for fostering critical thinking and student engagement. When students interact with content in ways that allow them to construct new meaning, they form a deeper connection to the content itself and are able to interact more meaningfully with others (Brokensha & Greyling, 2015; Galikyan & Admiraal, 2019; Jarosewich et al., 2010; Wang & Chen, 2008). In examining student posts, the researchers found that students did, in fact, form these deeper connections to the content due to the role-play strategy. These findings stand out compared with other findings because most discussions do not naturally lead to critical thinking (Brokensha & Greyling, 2015; Domakin 2013; Jarosewich et al. 2010). The role-play strategy used in this study was part of a self-paced course, without as much involvement from the facilitator or other students (as in a semester-based course). In this context, student-to-content interaction is emphasized. Therefore, the evidence is strong that the strategy itself is sound as it facilitates critical thinking and student engagement because students are first forming a deeper connection to the content.

Interpretations of Evidence of Critical Thinking

One interpretation of this evidence of critical thinking can be explained by the real-world application of the role-play strategy; application to the real world leads to higher-order thinking (Darabi et al., 2011). Ninety percent of student posts were marked in the application to the real-world phase indicator in the Garrison et al. four-phase model of cognitive presence. In addition, brainstorming, leaping to conclusions, and connecting ideas (synthesis) were also observed to be strong indicators of critical thinking.

Another interpretation of the data that indicates role-play leads to critical thinking is that the strategy easily invites students to think about other perspectives. Using the role-play strategy enables students to think critically and achieve levels of knowledge construction they might not achieve if they were solely focused on their own perspective. In many online discussions, students might not encounter another viewpoint until the discussion has progressed beyond the initial post. A strength of the role-play strategy, therefore, is that students begin the activity by considering a viewpoint that may be different from their own. This strength has been confirmed in research by Buelow et al. (2018) showing that students enjoy being able to hear from different perspectives and imagining different scenarios.

The Written Reflection: A Key Component

While the research by Darabi et al. (2011) advocates for discussion strategies such as role-play or debate, a key difference in this study is that the role-play activity also included a written reflection (part 2). The researchers observed the strongest evidence of critical thinking and knowledge construction in the written reflections. Scores were consistently higher across the entire Garrison et al.'s four-phase model of cognitive presence integration category in part 2, with a smaller range of 42.8%–66.7% versus a larger range of 8.8%–82.4% from part 1, the initial post. The findings show similar results in Gunawardena et al.'s five-stage model of knowledge construction. In this model, part 2 scored higher in the knowledge construction stage (75.6% versus 20.6% from part 1). In part 1, before students read and/or replied to the postings from others, evidence of knowledge construction was 20.6%. In part 2, once students interacted with others' posts, the evidence of knowledge construction increased to 75.6%.

There are two explanations for the difference between part 1 and part 2. First, students may have been pushed further by taking in new information and points of view from other students; the role-play strategy is a strong facilitator of introducing other points of view. Second, the nature of writing a reflection allows students to communicate their thought processes. From the data gathered, it can be concluded that including a written reflection is an effective method to push students into knowledge construction and beyond.

Interpretations of Evidence of Student Engagement

While the research shows strong evidence of critical thinking, it also shows evidence of student engagement. As students dig deeper and construct new knowledge and meaning, the process commands a level of attention that signifies student engagement (Galikyan & Admiraal, 2019). Additional evidence that the role-play strategy promotes student engagement was found in the key words and phrases listed in Table 6. These words, taken directly from the discussion transcripts, indicate that the students were engaged with the content. Finally, there is evidence of engagement in how the students displayed creativity in writing their posts from their assigned role. One student posted from the point of view of a pig, and another student's perspective was so convincing that the other students in the discussion could not tell if the post was from the portrayed role or personal experience. The researchers conclude that knowledge construction, key words and phrases, and displayed creativity indicate students were engaged in the role-play discussion.

Beware of the Information Dump: A Weakness of Role-Play

While the role-play discussion strategy has inherent strengths, it also has an inherent weakness that must be addressed. When students are exploring their roles, they have a natural tendency to only include details and information related to their specific role rather than their own personal thoughts or ideas. The term "information dump" was used to refer to any post that stayed within stage 1 (sharing/comparing information) of Gunawardena et al.'s model of knowledge construction; as Domakin (2013) found, this stage is where most discussion posts tend to stop. When reviewing student posts using Garrison et al.'s four-phase model of cognitive presence, these types of posts also lacked markings in the categories identified as signifiers of critical thinking.

It is worth discussing the relationship between post length and what was considered to be an "information dump." When reviewing the transcripts, the researchers came across several discussion posts that initially looked as though they would be rich examples of knowledge construction. However, after examination, these posts did not move beyond the exploration phase in Garrison et al.'s four-phase model of cognitive presence. Without Gunawardena et al.'s five-stage model of knowledge construction and Garrison et al.'s four-phase model of cognitive presence as guides, it might be assumed that students who made longer and more detailed posts were digging deeper into the discussion topic. In cases like these, using both models was helpful to remain objective in the search for evidence of critical thinking.

Limitations

The nature of two independent researchers examining student transcripts was a limitation of this study. While the researchers' markings were examined rigorously and areas of disagreement were discussed, these markings cannot be completely free from personal bias. Looking for evidence of critical thinking includes the unavoidable process of deciphering meaning and subtext. To minimize the effects of these limitations, two models were used to identify overlaps. Another limitation of the study was the number of discussion prompts and the amount of student-to-student interaction since the students were in a self-paced course. When using these findings across contexts, for example, in an asynchronous course, the format of the self-paced course should be considered.

Implications for Practice

Brokensha and Greyling (2015) cite a criticism of using online discussions in that it is often assumed that students already know, without further instruction or guidance, how to generate meaningful and engaging discussions. Researchers in the field claim that following a framework will not only enable one to think about what a successful discussion might look like but also provide the structure to make it happen (Brokensha & Greyling, 2015; Jarosewich et al., 2010). Based on the insights from this study, the researchers have developed a framework for students to achieve deeper, more engaging online discussions. This framework is called the

"Framework for Student Engagement and Critical Thinking in Online Discussions" and is described in more detail in Table 7 below.

Table 7
Framework for Student Engagement and Critical Thinking in Online Discussions

Framework component	Description
Detailed instructions and clear expectations	Provide detailed instructions and clear expectations for students to know how to approach the discussion assignment.
Share thought process	Invite students to share their thought process for all to see; similar to a think-aloud process.
Prompt discussion with questions	Students pose questions in their post to invite more discussion with peers.
Weave evidence into post	Students weave in research or found evidence into the body of the discussion.
Reflection	Include a reflection at the end of the discussion post.

Detailed Instructions and Clear Expectations

One recommendation is to provide detailed instructions and clear expectations, so students know how to approach the discussion assignment. The instructions should also be complete and informative. Though, as pointed out in Brokensha and Greyling (2015), having detailed instructions does not guarantee cognitive levels of engagement but rather shapes and guides the instruction. The findings in this study support Gao et al. (2009), who found that when guidelines are in place, students reach higher levels of learning.

Share Thought Process

In synchronous discussions, the instructor can probe further into a student's thought process by asking questions. But the question remains how to build this feature into asynchronous environments. The recommendation is to ask students to share their thought processes for all to see (similar to a think-aloud process). Using this process benefits students because they can see how their peers approached the learning and, in turn, respond with insights from their own learning (Cowan, 2019). This approach invites students into deeper discussion and helps them avoid the "information dump" described earlier. Additionally, this approach challenges students to be more thoughtful and thorough (Jarosewich et al., 2010).

Prompt Discussion With Questions

Another recommendation, as also suggested by Gao et al. (2009), is to have students pose questions in their posts to invite more discussion with their classmates. An example might be, "I wonder what others think about . . .?" Having such questions may automatically invite students to think and engage with each other.

Weave Evidence into Post

A fourth recommendation is to have students weave in research or evidence into the body of the discussion to support their claims (Gao et al., 2009) instead of generalizing and including a link at the bottom of the post. When the researchers reviewed the transcripts, they often wondered whether students were integrating their found sources into the discussion body. Several instances were noted where students merely posted a link at the bottom of their discussion without referencing it in the discussion body. Jarosewich et al. (2010) indicate that most discussion prompts do not ask students to refer to materials to support their answers. As an instructor, it may prove more beneficial to have students specifically incorporate this knowledge into their posts.

Reflection

The final recommendation is to include a reflection at the end of the discussion activity. This is similar to what Gao et al. (2009) recommend as part of the Productive Discussion Model. The written reflection is where the strongest evidence of knowledge construction, the strongest indicator of critical thinking and engagement, was found in this study. While incorporating a reflection will take more time for students to write and instructors to grade, the task gives students the opportunity to synthesize not only their own thoughts but also the thoughts and insights of others. An example of the *Framework for Student Engagement and Critical Thinking in Online Discussions* used in discussion instructions can be seen in Figure 1.

Figure 1

Example of Framework Used for Online Discussion

Purpose

This is a research activity with a twist - you will be conducting research about vaccines from an assigned role (or point of view). Your goal in this activity is to communicate clearly and effectively with others about your research and to demonstrate your ability to think critically.

Instructions

Part 1: Discussion

Consider vaccinations from the role assigned to you by the first letter of your last name. Conduct research based upon your assigned role and summarize what you learn. Include your view of vaccines in your role. In your post, include:

- Title, author (list the organization or agency if a specific name is not included), published date, and hyperlink for each source.
- Whether each source is "pro-vaccine", "anti-vaccine", neutral, or any other observations about potential biases.

Part 2: Reflection

After posting to the discussion topic, review the other perspectives; replies are not required. Then, write up your reflection based upon information from all roles. Your reflection should be at least half a page (single spaced). Please note that the first few posts are from students in a previous version of the course.

Criteria For Success

Your answer will be evaluated using the criteria in the attached rubric.

- You can show evidence of critical thinking by going beyond information sharing in your post. For example, you can post an opinion/solution from your point of view and weave in evidence from your research to support it.
- You can show evidence of critical thinking in your reflection by sharing your thought process in doing the activity. Did you learn anything new? Did you change your mind about anything? Why or why not?
- You can ask questions of others, or even in your own post or reflection something you may be struggling with or thinking about.

Implications for Future Research

Further research is called for the same research methods to be applied to other discussion strategies such as, but not limited to, debates, group problem-solving, fishbowl, hypothetical situations, external discussion and reflections, and "bad design." In addition, further research should be considered on the effectiveness of the *Framework for Student Engagement and Critical Thinking in Online Discussions.*

Conclusion

Based on the findings of this study, the role-play strategy is a sound recommendation for fostering critical thinking and student engagement in online discussions. This strategy is best suited for exploring different viewpoints and constructing knowledge within a real-world context. In addition, the researchers recommend including a written reflection with this strategy, as the most significant evidence of knowledge construction was found in the reflection. Finally, to further elevate discussions, the researchers recommend crafting discussion prompts using the *Framework for Student Engagement and Critical Thinking in Online Discussions*. More research is recommended on the effectiveness of this framework in different contexts, such as with other discussion strategies.

Declarations

The authors have no conflicts of interest to disclose.

The authors received approval from the ethics review board (IRB) of the University of Wisconsin-Madison.

The authors received no financial support for the research, authorship, and/or publication of this article.

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"It Helped to Know I Wasn't Alone": Exploring Student Satisfaction in an Online Community with a Gamified, Social Media-Like Instructional Approach

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Abstract
This descriptive study offers lessons learned from students' experiences with a gamified, social media-like instructional approach in eighteen courses from spring 2021 through spring 2022. Researchers at a mid-sized university in the southeastern United States leveraged Christensen's (2011) disruptive innovation theory as a guiding framework to explore student satisfaction with this instructional method. This first phase of the study measures learner satisfaction with this approach using the Ritzhaupt (2019) Electronic Learning Satisfaction Survey (eLSS). Preliminary results suggest that learners (n=145) rated their experience with this disruptive technology above average on all Likert scale questions on the eLSS. Identified best practices for instructional design using similar approaches include repeating the game rules, reframing the purpose beyond the game, helping students appreciate their community, guiding students to lead their own posts and gain reactions, and thwarting those trying to game the system. Initial findings across multiple courses suggest that instructors can leverage the gameful experience and social media-like engagement to foster critical connections and increase course satisfaction.

Keywords: Gameful experience; gamification; social media; social presence; disruptive innovation theory; disruptive technology

Ensmann, S., Whiteside, A. (2022). "It helped to know I wasn't alone": Exploring student satisfaction in an online community with a gamified, social media-like instructional approach. *Online Learning, 26*(3), 22-45.

Memorizing content to master an exam is familiar and attainable for students. Suggesting that scholars consider problems, review the peer-reviewed literature, share their findings, and build potential solutions based on those findings can be unfamiliar, ambiguous, and uncertain. Which learning design is more comfortable? Which will facilitate learners' critical thinking and problem-solving skills to address future societal issues? Which disruptive technologies best allow students to hone these skill sets and allow for increased learner satisfaction?

This study employs disruptive innovation theory (Christensen et al., 2011) as a lens that posits that learning with disruptive technologies can foster positive changes, such as critical thinking and problem-solving skills, despite unforeseen interruptions to traditional learning. According to Flavin (2012), "Disruptive technologies are those that disrupt established practices, often starting with a small number of users, but growing over time to the extent that they displace a previously dominant, incumbent technology" (p. 102). Christensen et al. (2011), suggests higher education could benefit by offering a value proposition with these technologies to offer cost-effective connections, making "students happy" (p. 49), while delivering what they need to learn.

Yellowdig is one such technology that can help faculty rethink their approach to traditional instruction, showing promise in fostering engagement and learner satisfaction. This disruptive technology uses a gamified social media-like system, awarding points based on engagement and interactive reactions, to encourage students' online scholarly discourse. The system automates the cumbersome process of assigning participation points, thereby allowing instructors to focus on facilitating concepts rather than counting discussion posts. An interdisciplinary team of faculty carefully and purposefully incorporated this technology into their courses to facilitate social constructivism (Vygotsky, 1978, 1997) through discussions in an environment where students can build their learning together.

This study applies and extends the lessons learned from a previous study where an interdisciplinary team examined student experiences (n=507) during emergency remote learning (Ensmann et. al., 2021). These prior findings revealed a paradigm shift in education whereby disruptive technologies offer a means beyond traditional classrooms for interconnectedness and learning through social development theory and the social presence model (Vygotsky, 1978, 1997; Whiteside, 2015, 2017). The data revealed the depth of anxiety felt by students and suggested the need for increased empathy, communication, interaction, and flexibility from instructors and course communities to proceed with academic coursework, particularly for first-year college students. The findings elevate the importance of social presence as a literacy for learning in any modality, underscore the need to support students' mental health, and stress the urgency for online and remote learning readiness (Ensmann et. al., 2021). Lessons learned included connections matter and professors matter. Generational perspectives, self-regulation education, and technology training needs are essential elements to address when creating online learning environments (Ensmann, et al., 2021; Meyer, K. A., 2011; Motz et al., 2021; Whiteside & Ensmann, 2021; Ulrich & Karvonen, 2011).

This descriptive study follows up on addressing the students' need for connections by exploring their experiences with a disruptive technology utilized to move student participants beyond the reactive stage to the proactive stage concerning their learning. In this phase of the study, we explore learner satisfaction using the electronic Learning Satisfaction Survey (eLSS) (Ritzhaupt, 2019). Preliminary results suggest that learners (n=145) rated their course experience using this instructional approach above average on the eLSS Likert scale. Initial findings across multiple courses suggest that instructors can leverage the gameful experience and social media-like engagement to foster critical connections and course satisfaction.

Researchers sought to answer the following overarching question during this phase: What is the learner experience when a disruptive technology is purposefully incorporated into courses to foster engagement and improve learner satisfaction? Focusing on the results related to learner satisfaction from the students' perspective, this article provides the first in a series of data analysis reports that examine the overall learning experience.

Literature Review

This review examines learning communities, social media-like engagement, and gamification to situate this study in filling the gap of understanding students' experience when a gamified, social media-like online community is used to foster learner satisfaction across disciplines. Despite growing literature in recent years regarding positive outcomes of gamification in education, the need still exists for research in this area examining interdisciplinary studies, including those offering contextual designs focusing on social-oriented affordances that this instructional method can provide (Hung, 2017; Majuria et al., 2018; Mustafa, 2021; Uz Bilgin & Gul, 2020).

Engaging Learning Communities

Lave and Wenger (1991) and Wenger (1998) addressed the importance of relationships, networking, and connections for meaning-making within a discipline. To thrive in a learning community, students need to "engage directly in activities, conversations, reflections, and other forms of personal participation" while simultaneously interacting with the material and learning "artifacts" (Wenger, 2000, p. 225). Learning is a powerful negotiation of meaning among participants in an "informal and dynamic social structure" (p. 226). Not only is learning a social activity that exists within a community, but it is also a deeply personal process of trust and relationship building. In their phases of engagement framework, Conrad and Donaldson (2012) suggested that relationship building is the first phase of engaging the online learner and is not to be skipped. Stimulating engagement through inquiry and emerging technologies is the first step to begin cultivating connections before full realization of learning can occur (Blaschke, 2012; Cook & Gregory, 2018).

Social Media-Like Engagement

Social media are internet-based technologies that support multimedia content and interaction (Koehler & Vilarinho-Pereira, 2021). Instruction utilizing social media can offer outlets for learners to produce outcomes of their learnings using media and dialogue on platforms with Twitter-like features (Busque & Mingoia, 2021; Nelimarkka et al., 2021; Sohoni, 2019). The benefits of using social media offer avenues to foster connections with learning communities, subject communication, motivation, and networking.

Social media platforms do not by themselves foster social presence in the online classroom. Based on a study using Yellowdig with students at a midsize public university in the States (n=30), students' perceptions of social presence did not increase (Conklin et al., 2019). Koehler & Vilarinho-Pereira (2021) reviewed the literature to examine social media affordances to support problem-solving skills and suggest that social media does not automatically improve education. The study suggests that facilitators cannot assume that intrinsic motivation affects all learners similarly. Social media could be overwhelming for some students, misinform them, and be distracting in the classroom setting. Thus, educators must create an effective problem-centered environment with intentionality for learners to generate solutions. The facilitator's role should include meaningful planning, encouraging collaboration and reflection and incorporating assessment into the instructional design. When approached in this manner, social media can increase learners' exposure to problem-solving content, visible behaviors, such as likes and comments, identity creation, and engagement. Access using mobile devices offers students the medium to connect with other learners efficiently through social media platforms, providing the ability to network anytime and anywhere. Overall, this study suggests that using social media offers ample opportunities for educators. Teachers must be intentional with integrating social media; when used appropriately, social media can boost students' problem-solving skills and engagement in the classroom.

Lastly, this literature review examines a study on social learning utilizing Yellowdig as a platform in four business marketing courses at a Midwest university (Martin et al., 2017). The research reports that this instructional method allowed students to engage in a social media-like online community, as they are accustomed to doing on social media daily, to improve connections inside and outside of the classroom. It also provided the ability to easily reward students for connecting with each other. Furthermore, the study reports that the analytics of the platform offer graphics to motivate learning and engagement. Quantitative analysis suggests that instructors benefit from having access to learners' network of interactions and that engagement improves student learning.

Gamification

Nick Pelling first coined the word gamification as a means to motivate student engagement (Kapp, 2016). The concept gained popularity in instructional design research focusing on game thinking and the mechanics used to engage audiences in a fun manner to solve problems (Deterding et al., 2011; Deterding, 2012; Kapp, 2012, 2016). Deterding et al. (2011) defined gamification as "the use of game design elements in non-game contexts" (2011, p. 1), while Kapp combined concepts to suggest gamification is "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" (2012, p. 10; 2016, p. 356). Using B.F. Skinner's behaviorism theory of learning, structural gamification (not to be confused with content gamification or digital game-based learning), may be used over time and curriculum to motivate engagement, choice selection, and levels of competence (Deterding et al., 2011; Kapp, 2016).

Ten years later, the literature in educational research begins to reveal empirical data supporting the positive effects of gamification on motivation, learning outcomes, and achievement progression (Chen et al., 2018; Majuria et al., 2018; Mustafa, 2021; Subhash & Cudney, 2018; Uz Bilgin & Gul, 2020). Game elements used for gamification that are most identified include rules, goals, challenges, points, leaderboards, levels, badges of recognition, responsive feedback, graphics, fantasy, progress bars, and user control (Kapp, 2016; Subhash & Cudney, 2018). The literature seems to suggest that although not all game elements must be used to be considered gamification, a combination may afford the gameful experience in a non-game context. Eppmann et al. (2018) suggest that the gameful experience may be described as one that offers a positive emotional reaction coupled with involvement using a gamified application.

Learning designs need to go beyond leading to prescribed learning outcomes, and interactive components can facilitate "open-to-learning behaviours" (Greener, 2020, p. 657) to prepare students with skills beyond school. Furthermore, the essence of gamification is that it offers a fail-safe experience (Justice & Ritzhaupt, 2015), a fertile environment to study group dynamics fostering communication, cohesion, and trust (Uz Bilgin & Gul, 2020). Huotari and Hamari (2017) suggest gamification even makes the learners producers of services rather than just consumers.

Conceptual Framework

This study leverages Christensen's (2011) disruptive innovation theory as a lens to examine the participant experience when two instructors in different disciplines at one mid-sized, private university incorporate an instructional approach utilizing gamification and social-media elements to foster discussions. According to Christensen et al. (2011), disruptive innovation consists of the idea that technology can offer a solution to the challenges of isolation and disconnectedness that can emerge in various face-to-face, blended, and online learning environments. According to Christensen (2011), "This emerging disruptive innovation [online learning] also presents an opportunity to rethink many of the age-old assumptions about higher education—its processes, where it happens, and what its goals are" (p. 11).

Furthermore, disruptive forces can lead to new social structures when designing and developing online programs (Yamagata-Lynch et al., 2015). Christensen et al. (2016) tracked the theory's evolution in the literature from a "descriptive framework of technology change to a normative theory of innovation and competitive response" (p. 30). Meyer (2011) expounds upon this literature review and identifies elements of disruptive technologies in online learning. These include a) technologies considered essential to learning and b) those potentially disrupting traditional teaching while improving student learning and interaction, and decreasing long-term costs and investment of faculty time on repetitive efforts (Twigg, 2003; Wingard, 2004). Ultimately, Meyer (2011) summarized the literature noting the overwhelming success of disruptive innovation practices. Finally, in examining Christensen's suggestion that online learning is a disruptive innovation, Meyer (2011) contends, "It isn't the technology per se, but the new thinking it inspires, that can be disruptive" (p. 45). Meyer's research suggests that the disruptive innovation of online learning has not jumped the curve in higher education due to one significant barrier: time. Meyer offers the new ways of thinking that disruptive innovation inspires take considerable time to explore, adopt, implement, and evaluate.

Integrating a Gamified, Social Media-Like Instructional Approach

This section addresses elements of Yellowdig and then explains how the researchers integrated it into their courses. We address the gameful experience as well as the ways that we used it in our classes.

Designing the Gameful Experience with Intentionality

First, this research team explored the gameful experience and how it fits with the courses. To offer the gameful experience of fostering positive emotions based on interactions (Eppmann et al., 2018), instructors structured Yellowdig content to elicit engagement between learners with competition and collaboration fostering individual learning outcomes.

As Huotari and Hamari (2017) suggest that the first game element is to create the rules to motivate behavior, researchers posted an introduction to the online community to relay clear, consistent rules to all learners, as revealed in Figure 1. In this case, students earned one thousand points per week through a combination of options, including authoring discussion posts, commenting on peers' posts, receiving accolades for insightful posts, and accumulating social media reactions from their peers. See Appendix A for the full-page post of the rules.

Figure 1
Rules revealed

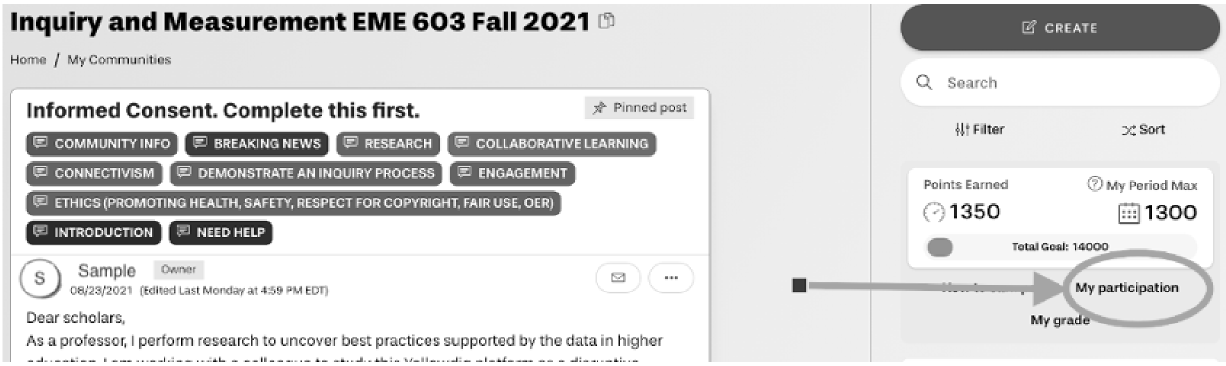
👏 Let's get started! 👏

Yellowdig is all about helping you connect and have meaningful conversations with the people you would normally sit next to in class or talk to in a study lounge. The posts you make and the articles you share should be things that genuinely interest you because they will probably be interesting to your peers as well. Most importantly, read a lot and comment often. You can't have a good conversation without listening to and responding to your peers. Remember that this is your community to create, and you're in control of how well it works.

In Yellowdig, you get points for how much you engage and interact with others. The point system allows you to earn points for **posting or commenting** and **receiving comments, reactions, and accolades** from other people reading your posts. The more you interact, and the more people you have conversations with, the more points you'll get. You can track more about your point earning by clicking "**My Participation**" in the blue points display. You can always learn more about earning points by clicking "**How to earn points**" on that same display. The conversations should build upon connecting your community of practice in IDT and the knowledge you are learning in the course content. So, if someone goes "off-topic," you as the community can flag those posts to stay focused on building skills and knowledge in the field of IDT. **Flagged points lose points rather than insightful or helpful conversations that can earn extra points,** so focus on your learning to excel in the field (and in this class)!

Learners then create individualized profiles to begin engaging. Points are revealed to prompt competition, facilitated by weekly deadlines as reflected in Figure 2.

Figure 2
Points Revealed

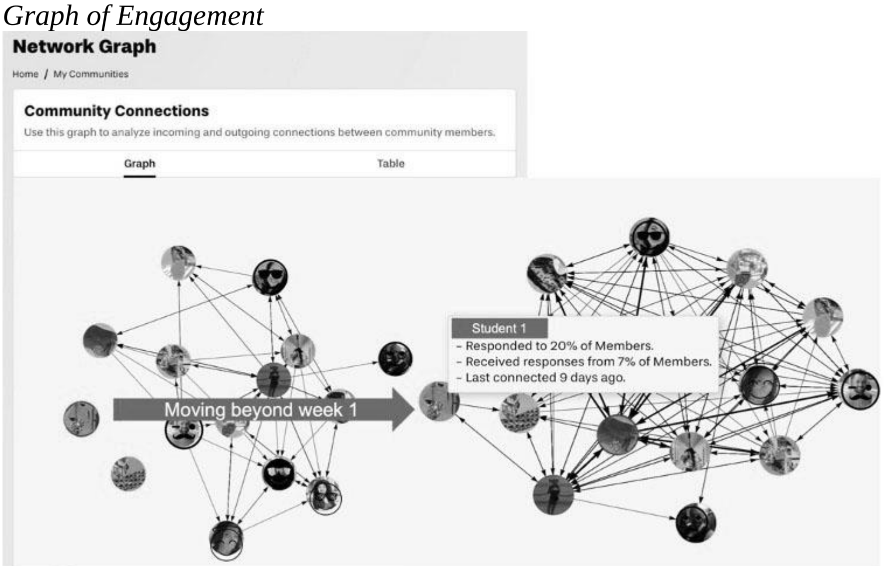


Clever learners quickly recognize that proactively initiating discussions about course content and skills at the beginning of the week leads peers to contribute to their success as points for reactions and comments contribute to the original authors' points.

Engagement, Community Connections, and Tracking Overall Participation

Once learners stop waiting for directives about what to write and realize they can author reflections of the peer-reviewed literature as producers (Huotari & Hamari, 2017), thereby leading the story they want to tell, they see the choices they can make with the gameful experience. Points are generated based on initial scholarly posts and peer engagement, building upon the initial reflections and continuing the conversation, as reflected in Figure 3. This encourages learner-driven rather than instructor-driven learning.

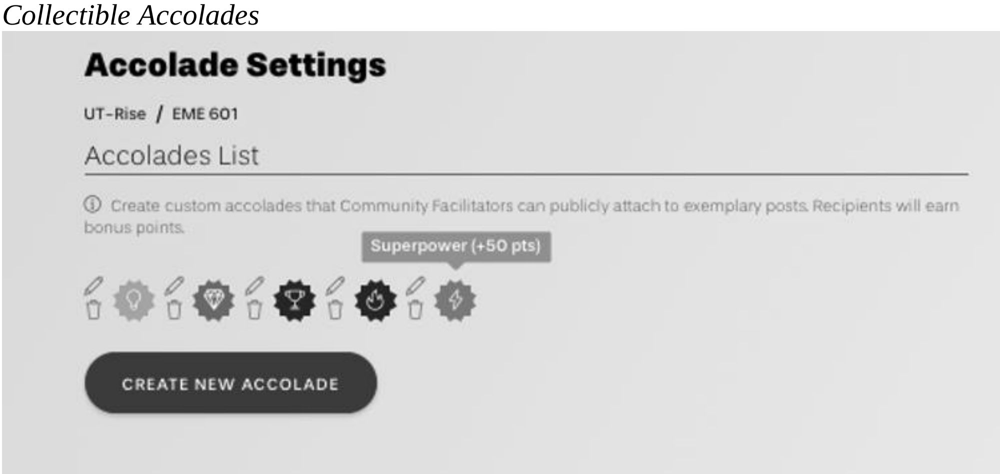
Figure 3
Graph of Engagement



Moving beyond a point-driven system, learners become aware of more game elements that emerge, inciting gameful behavior (Deterding et al., 2011; Eppman et al., 2018; Huotari & Hamari, 2017). For example, learners can also keep community members on-task by flagging posts as off-topic from the course materials.

Additionally, instructors award accolades (a form of incentives termed *treasures* or *collectibles* in the gaming industry) to advance learners' position in the game. This study offered these game tributes, including insightfulness, helpfulness, and superpowers. When discussions demonstrate insightfulness, instructors award a trophy. Helpfulness is illustrated with a lightbulb; interesting excerpts are depicted as a diamond, and superpower is represented with a lightning bolt, as in Figure 4. Superpowers are awarded when learners demonstrate an air of creativity in posts and innovative applications of concepts or ideas.

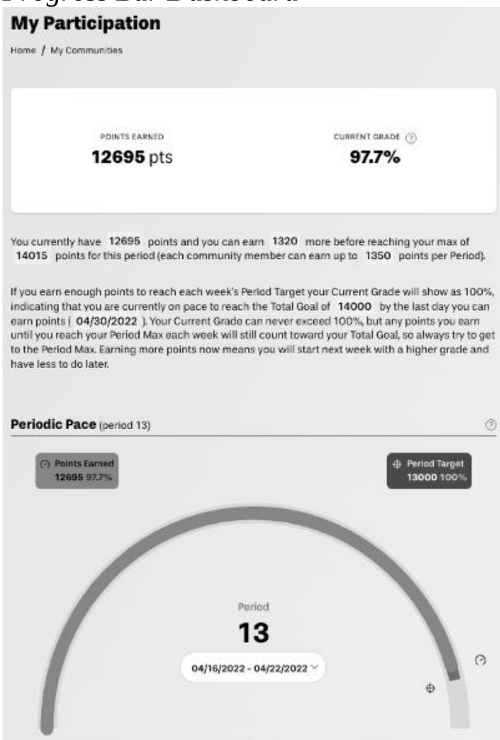
Figure 4
Collectible Accolades



Another accolade did not advance learners' position in the community but prompted them to engage with a nudge represented with a flame. All accolades are customizable.

As reflected in the literature (Subhash & Cudney, 2018), other motivational game elements designed to foster the gameful experience within this interactive online community include a leaderboard and progress bar to promote competition and self-regulation, as seen in Figure 5.

Figure 5
Progress Bar Dashboard



Innate to the gameful experience, competition engages learners in the online community, ultimately supporting peers to succeed.

Methods

This study used a cohort descriptive survey design, gathering quantitative and qualitative data from students to capture their perspectives on using this gamified social media-like online community to foster connectivity and learning satisfaction.

Research Site and Participants

Researchers conducted this study using courses from multiple disciplines offered at a mid-sized, private four-year residential urban university adjacent to a downtown area. Traditionally a face-to-face institution slowly moving toward more hybrid, blended, and online options, this southeastern university serves 10,500 students from 50 states and 130 countries with over 1,200 international students during 2021. Students used the Yellowdig online community while enrolled in 18 courses over Spring 2021, Summer 2021, Fall 2021, and Spring 2022. Courses include Research and Writing, Professional Editing, Technical Writing, Discovering the Leader Within, and Senior Portfolio at the undergraduate level and Global Communication Design, Introduction to Instructional Design, Inquiry and Measurement, Design of Online Collaborative Learning, Introduction to Distance Learning, Trends and Issues, and Management of Change at the graduate level as reflected in Table 1 below.

Demographics

Participants (n=145), from a population of 297 with a 49.2% response rate, self-identified as graduate (30%), senior (25%), sophomore (23%), junior (11%), or freshmen (10%) students. Most were females (75%), with 23% identifying as male and 1% as transgender males. Using generations classifications as specified by Bencsik et al. (2016), researchers found most participants were in the younger Z generation (1995 - 2010) (77%), followed by the Y generation (1980 - 1994) (14%), and the X generation (1960 - 1979) (7%), with 3% not reporting. Ethnicity included primarily white, non-Hispanic (75%), followed by equal numbers of Hispanic/Latino (6%), black or African American, non-Hispanic (6%), and equal numbers following in the two or more races including Hispanic (3%) and two or more races, non-Hispanic (3%) Asian, non-Hispanic following (2%), and equally a limited amount of Asian, non-Hispanic, white (1%), and two or more races including black or African American, white, Hispanic and non-Hispanic (1%).

Table 1

Demographic Descriptors of the Study (n=145)

Ethnicity	74.50% White, non-Hispanic	6.20% Hispanic/ Latino	6.20% Black or African American, non-Hispanic		6.20% Two or more races (including Hispanic & Non-Hispanic	2.10% Asian, non-Hispanic	2.80% Other 2.10% prefer not to answer
Gender	74.50% Female	23.40% Male	1.40% Transgender Male	.70% prefer not to answer			
Age	76.60% Z generation (1995-2010)	13.80% Y generation (1980-1994)	6.90% X generation (1960-1979)	2.80% not reported			
Classification	30.30% Graduate	24.80% Senior	22.80% Sophomore	11.0% Junior	9.70% Freshman	1.40% prefer not to answer	
Term	42.80% Spring 2022	29.70% Fall 2021	15.90% Spring 2021	11.70% Summer - 6 weeks			

Data Collection

Since the literature points to the value of survey methods (Babbie, 1973; Fowler, 2009; Creswell, 2014), the researchers selected the Electronic Learning Satisfaction Survey (eLSS) to measure electronic learning satisfaction (Ritzhaupt, 2019) of e-Learning environments. See Appendix B for the eLSS instrument conceptual model. Ritzhaupt validated this instrument as a reliable way to measure multimedia learning environments with higher ed learners (n=635) at a southeastern university, with a strong Cronbach alpha reliability coefficient of $\alpha = .93$ (2019). Having psychometric evidence to support the use of this instrument at a comparable location, researchers selected the eLSS to measure participants’ satisfaction with Yellowdig. Designed to be comfortable for the user experience, the instrument uses bipolar adjectives at opposite ends of a five-point Likert scale with nine questions. Examples of question responses include negative to positive, unnatural to natural, ineffective to effective, and unsupportive to supportive. This instrument also included two short-answer questions to complement the quantitative data with qualitative data and provide an opportunity for participants to further elaborate upon their experiences in this new instructional method. Researchers administered the surveys to the student participants in the final two weeks of the term by pinning the script of the survey invitation to the top of the online communities for each course.

Data Analysis

Researchers analyzed the descriptive statistics in Excel and SPSS. ANOVA tests compared multiple variables for statistical significance. Additionally, the researchers provided descriptive statistics based on the continuum found within the Likert scales of the eLSS. To triangulate the data, we analyzed the response to the two open-ended questions (asking about opposing sentiments, favorable or negative) to further explore learners' perspectives and satisfaction with the learning experience. Researchers completed a thematic analysis by coding these survey responses (Croucher & Cronn-Mills, 2014; Owens, 1984). Given the magnitude of learners across disciplines, this study has limitations as each class is individually managed by different professors, focused on various subjects, and delivered via several modalities (face-to-face, hybrid, online, and remote). Some classes offered more direction for postings which offers further room for examination within each of these classes, modalities, and subjects.

Results

Generations View Educational Gameful Experiences Differently

ANOVA tests reflected statistical significance between generations Y and Z. While all generations rated the platform above average overall, generation Z rated the gameful experience as the clearest with a mean of 4.53. Generation Y rated the clarity of their experience at a 3.60 level as displayed in Table 2 where statistical significance is bolded.

Table 2

Learners' Online Community Satisfaction Levels

Generation factor	X (1960 - 1979)	Y (1980 - 1994)	Z (1995 - 2010)	Statistical significance
Variables	Mean (SD)	Mean (SD)	Mean (SD)	*p-Values*
Unclear = 1: Clear = 5	4.40 (1.350)	3.60 1.142		.324
	4.40 (1.350)		4.53 (0.698)	.985
		3.60 1.142	**4.53 (0.698)**	**.006**

Researchers ran Levene's Homogeneity of Variance tests to determine variances and post hoc tests to run (Green & Salkind, 2005). Multiple comparison results using the Dunnett post hoc test confirmed the ANOVA statistical significance of groups Y and Z regarding the clarity of Yellowdig. It is essential to recognize that all means are still above average ratings for clarity. Still, the statistical significance in the generations offers considerations for further research.

Learner Satisfaction

The majority of participants found the online community mainly easy to learn rather than complex to learn; mostly positive rather than negative; natural rather than unnatural; effective rather than ineffective; clear rather than unclear; supportive rather than unsupportive; pleasing rather than annoying; easy rather than hard; and gratifying rather than frustrating as reflected in Table 3.

Table 3

eLSS Instrument Results: Overall Learner Satisfaction Levels

Variable	N	Mean	Std. Deviation	Min	Max
Hard to learn: Easy to learn	145	4.41	0.969	1	5
Negative: Positive	145	4.02	1.139	1	5
Unnatural: Natural	145	3.65	1.233	1	5
Ineffective: Effective	145	3.81	1.236	1	5
Unclear: Clear	145	4.35	0.924	1	5
Unsupportive: Supportive	145	4.16	1.078	1	5
Annoying: Pleasing	145	3.46	1.399	1	5
Difficult: Easy	145	4.32	0.927	1	5
Frustrating: Gratifying	145	3.57	1.284	1	5

Participants overwhelmingly noted that Yellowdig was easy to learn. One student explained, “It was just an easy way to ask questions and get feedback.” The reactions to the online community were mainly positive, most suggesting that it was both easy and helpful to their learning. One student commented in the survey, “I thought this was an easy but helpful way to gain points in this class. I liked being able to comment on other people’s posts like social media and be able to interact with classmates. Also, it was nice seeing certain comments that helped me add valuable things to my paper.” Since it was still an assignment for a course, many students couldn’t quite place it as gratifying. As one student noted, “It was nice to be able to communicate what I was feeling about certain things and to see how other people felt as well. I wouldn’t say it was beneficial for me, except for the fact it was part of my grade.”

After running eLSS quantitative analyses, the researchers sought to learn more about student satisfaction with the experience. We coupled the eLSS inventory results with a thematic analysis examining the responses of the two eLSS questions asking if students found Yellowdig to be a positive experience or negative experience through Atlas.ti. As an example, for the question asking for positive experiences, Table 4 below reflects the participant comments based on the word used most frequently (in case, the word was *like*) and thematic elements that emerged.

Table 4
Positive Experience Analysis (n=70)

Participant Comments	Thematic Element
I like how it continuously tracks your points and encourages you to engage!	Progress bar / Managing self
Liked hearing from my classmates. It made our classroom a more positive community.	Community
I like the fact that it was point-based and motivating to gain more points.	Points / Motivational
I liked how we could engage with other students and get to know each other a lot better with all of the interactions.	Interactions / Community
I liked how easy it was to interact with others and to have conversations with others in the class that you might not sit next to or interact with a lot.	Interactions
I liked getting and giving feedback on my thoughts	Feedback/ Interactions
I like the different ways to post like attaching documents, polls, emojis	Social media
I liked how it was easy to use and rack up points, enjoyable to scroll through, and that we were permitted to post about whatever we wanted to. It also definitely allowed me to become more acquainted with my classmates than I would have otherwise.	Points / Community

The researchers also reviewed the negative responses, analyzed participants' comments, and determined themes from those frequencies and comments. As an example, for the question asking for negative experiences, Table 5 below reflects the participant comments based on the word used most frequently (in case, the word was *post*) and thematic elements that emerged.

Table 5
Negative Experience Analysis (n=31)

Participant Comments	**Thematic Element**
There are certain actions that email does not notify me about, such as when other students comment on one another's posts. Something annoying about the point system is that you either get 0 points or several hundred depending on the length of a post. I'd be encouraged to post more content more often if I didn't have to meet a certain quota in order to receive credit. Consequently, I haven't posted much.	Design Improvement
When it comes to the actual platform, it was hard to navigate because the posts don't necessarily appear in order and there isn't a "homepage" that easily shows posts. It was like once I saw a post, it almost disappeared, and I had to go through a few cumbersome steps to go back and find what I was looking for.	Design Improvement
There can be a bit of favoritism where friends mainly react to their friend's posts	Self-Efficacy
It was annoying because I completed the classwork and participated in class but, I would forget to post because I work nights. I enjoyed the overall concept. It was interesting.	Self-Regulated Learning
It felt unnatural and forced as we put bland comments and posts just to get the points.	Authenticity and Gaming
It's not very visually appealing and I find it a little confusing to find certain posts. In the past, we have used LinkedIn for reflection & found that more useful for reflection and as a networking tool.	Change Resistant

Results suggested elevated levels of learner satisfaction for the online community's gamification elements on Ritzhaupt's Electronic Learning Satisfaction Survey (eLSS) where students recognized the positive effects of the game elements supporting time management, self-regulation, learning, and connectivity. A smaller number of participants who expressed negative sentiments offered design improvements were concerned about gaming authenticity and made comments that suggested they were resistant to change.

Discussion

Initial findings across multiple courses suggest that instructors can leverage the gameful experience and social media-like reactions in Yellowdig to motivate student engagement, and foster learner satisfaction and critical connections. According to Majuria et al. (2018), gamification offers notably positive results in fostering human development but they suggested that future research was needed for solutions to prompt social interaction with gamification. This study offers empirical data addressing that need, illustrating positive satisfaction for learners across disciplines, including courses in education, communication, leadership, and writing.

To improve motivation and interaction, instructors customized the use of game elements (Subhash & Cudney, 2018; Kapp, 2016), including points, leaderboard, progress bar, accolades, feedback, and social media reactions. They provided rewards for leading discussions and consequences for going off-topic to engage in the knowledge exchange. Analytics are automatically generated and presented with a progress bar type dashboard to support self-regulated learning, whereby learners can monitor and manage their course engagement. At the same time, the instructors' display provides diagrams of network interactions to support learners who fail to engage or need further facilitation of concepts. This study also offers a look at findings between generations and provides further consideration for strategies to harness the Z generation's perspectives of clarity with this technology.

Lessons learned in the development of the instruction for this study include (a) repeating the game rules, (b) reframing the purpose beyond the game, (c) helping students appreciate their community, (d) guiding students to lead their own posts and gain reactions, and (e) thwarting those trying to game the system. These are valuable for instructional design of courses utilizing Yellowdig or other social media-like, gamification course elements.

Repeating Game Rules

The first lesson learned was that students needed constant reminders of the game rules (Kapp, 2016) in the first three to four weeks of the term. Instructors learned to save dedicated time for revisiting the weekly point targets, the many ways to earn points, how buffer points worked, and when the earning period began and ended. Additionally, the instructor may need to reinforce the notion of planning ahead to students. Instructors may also need to offer specific online community reminders along with other course assignments and remind busy learners of the various options to enhance their learning (such as authoring their own posts that extend the course content.) As reflected in Figure 3, the analytics for both instructors and students offered support for learning. Progress bars (Kapp, 2016; Subhash & Cudney, 2018) guided learners, while network graphs for instructors revealed struggling learners needing additional support. Students can feel a sense of relief and familiarity once they gain a clear understanding of the rules. As one student noted, "The format was very modern and fun; the gamification aspect of it made interactions more significant and required more critical thinking than most discussion boards."

Reframing the Purpose Beyond the Game

Once students understood how the online community worked functionally as a game, instructors needed to leverage the resources in this platform and help students understand the opportunities this platform offers them. The unique affordances of this gamified social media-like instructional approach allowed students to extend the course content and the course community outside the physical or virtual classroom doors. Instead of the typical discussion board that ends at Week 1 and begins at Week 2 and so on through the term, this instructional approach allows students to comment continuously through the term as they grow as learners. As one student noted, "I liked how it was easy to use and rack up points, enjoyable to scroll through, and that we were permitted to post about whatever we wanted to. It also definitely allowed me to become more acquainted with my classmates than I would have otherwise." Moreover, this approach offers instructors an automated point-based system (Subhash & Cudney, 2018; Kapp, 2016) and valuable data analytics to monitor student engagement. This supports instructors to allow them to use the time they would typically spend grading discussion boards in better and more effective ways, such as maximizing higher-level engagement. The more effective use of instructional time is an essential ingredient that propels these disruptive technologies to advance learning (Meyers, 2011).

Helping Students Appreciate Their Course Community

Many students have been conditioned to seek their instructor's approval and may come into a course disparaging the value of their peers' contributions to the course community. Additionally, for content that requires a lecture-based approach to help students master the required material, instructors may leverage Yellowdig to continue the conversation, and build relationships through inquiry-based learning (Blaschke, 2012; Conrad & Donaldson, 2012; Cook & Gregory, 2018). Thus, the instructors in this study needed to help students appreciate their peers' comments, suggestions, and experiences and understand the value of a course community.

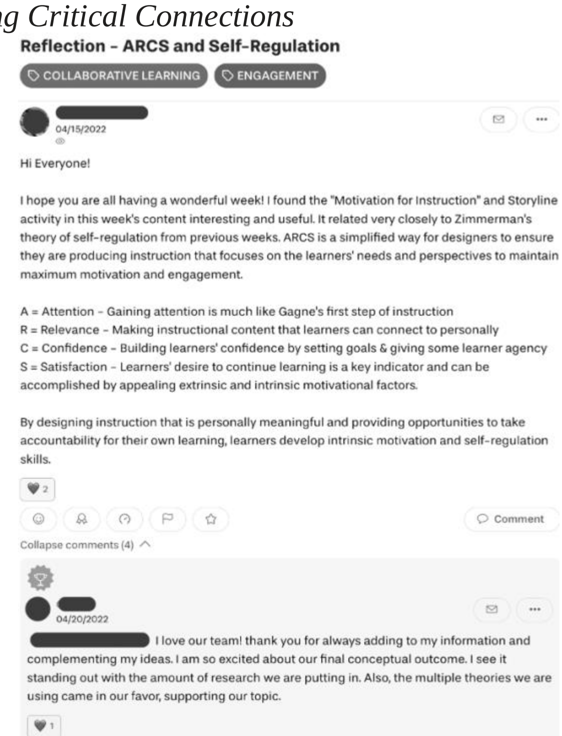
As a result, student participants in this study reflected upon the peer-to-peer engagement and motivation of the gameful experience: "I liked how we could engage with other students and get to know each other a lot better with all the interactions." Another offered, "Easy collaborative efforts, the points earned are rewarding to see and encouraging." These students found the online community helpful in offering options for them to advance their own learning.

Guiding Students to Lead Their Own Posts and Gain Social Media Reactions

Rather than wait for the professor to make a prompt at the beginning of the week, the faculty in this study redirected learners to leverage the affordances of the social media-like community to lead their own posts (Le Busque & Mingoia, 2021; Nelimarkka et al., 2021; Sohoni, 2019). Furthermore, data analytics provided instructors the platform to prompt low-achieving learners to focus on their own self-efficacy (Bandura, 1982) to market themselves by improving posts with thought-provoking questions, polls, literature, or videos. Figure 6 shows an example of a learner making critical connections between material read and previous lessons on self-related learning.

Figure 6

Making Critical Connections



Once learners begin to lead discussions with their own posts, they pave the way to engage with responses and affective expressions as they would with other social media as they earn points for each interaction (Martin et al., 2017). Thus, the platform promotes earning points for leading a post and then, allows them to gain more points from their peers' social media reactions (likes, dislikes, and emojis allowing for cultural and diverse expression). In doing so, learners earned points when they prompted others to engage in their ideas, and they also extended their knowledge and created critical connections within the course community.

Thwarting Those Trying to Game the System

Once the rules and norms of the community are well established, members of the course community are empowered to self-regulate (Zimmerman, 2008). Gamers who play for entertainment purposes understand that if they choose not to engage or if they do not follow the rules, they lose the opportunity for advancement that day. In a fail-safe gamified environment, they learn either by losing points, failing to advance in levels, or losing critical connections. Likewise, in this Yellowdig platform, any community member (instructor or student) can flag a post, and they can offer a rationale for their assertion of why a post is worth more or fewer points.

Students, particularly those who are entertainment gamers, may resist these same gameful experience rules for educational purposes when they fail to see a gain from themselves and do not fully appreciate the course community. They may try to simply add superfluous words to posts to game the system or try to bend the established rules. As one participant noted in response to the open-ended question in the eLSS, "My only gripe with it was at times I needed to make posts or comments that did not necessarily benefit me and seemed forced." These five lessons learned—(a) repeating the game rules, (b) reframing the purpose beyond the game, (c) helping students appreciate their community, (d) guiding students to lead their own posts and gain reactions, and (e) thwarting those trying to game the system—provide a set of best practices that may help instructors and researchers to help with learner satisfaction in the future.

Conclusion

This study explores a gamified social media-like approach for college students, spanning disciplines, delivery formats, and subjects. The guiding framework for this study posits that disrupting traditional teaching can improve student learning and interaction and decrease long-term costs by saving faculty time on repetitive efforts (Meyer, 2011; Twigg, 2003; Wingard, 2004). This study offered findings reflective of these elements embodied in Christensen's disruptive innovation framework. Students rated their satisfaction in all nine different areas of the eLSS as above average.

Additionally, the open-ended data suggests that, in the context of these learning communities, this instructional approach with Yellowdig offered an effective platform for student engagement, sharing of ideas, and extending their learning (Vygotsky, 1978, 1997). Moreover, this approach allowed faculty to invest in guiding the learning experience, rather than counting discussion board posts. As Meyer (2011) suggests, "It isn't the technology per se, but the new thinking it inspires, that can be disruptive" (p. 45). Ultimately, this gamified social media-like approach offers new thinking—a paradigm shift for the learners, allowing them to drive their own learning rather than waiting for a prompt from an instructor.

Based on the statistical significance in regard to clarity between Generation Y and Z, researchers suggest future research studies using interviews, observations, and other qualitative methods to dig deeper into how the generations are using this instructional approach. Future studies might examine how variables affect the learning experience including teaching strategies, such as directives for posting, subject-specific, classification, or delivery format. Additionally, researchers might explore performance-based research to examine student learning outcomes to support this instructional approach as well as the return on investment of this disruptive technology.

This study yielded several best practices and lessons learned: (a) repeating the game rules, (b) reframing the purpose beyond the game, (c) helping students appreciate their community, (d) guiding students to lead their own posts and gain reactions, and (e) thwarting those trying to game the system. Ultimately, the gameful experience occurs when platforms offer connected elements designed to provide a yin and yang reaction. One element leads the learner to the next task to problem-solve, compete, collaborate, and collect incentives to achieve higher-order thinking desired outcomes.

Acknowledgments

Thanks to the 2021-2022 University of Tampa Research Innovation and Scholarly Excellence (RISE) Award/Dana Foundation Grant for funding this project.

Declarations

In compliance with ethical standards at the University of Tampa, researchers obtained informed consent from all individual participants.

All procedures performed in this study involving human participants followed ethical standards and the 1964 Helsinki declaration and its later amendments.

This study was funded by a University of Tampa Research Innovation and Scholarly Excellence (RISE) grant. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The eLSS conceptual model showing nine items on the semantic differential scale was included in this article with written permission from Albert Ritzhaupt.

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Appendix A

Rules Post

I Instructor Owner
01/01/2021 (Edited 08/23/2021)

👏 Let's get started! 👏

Yellowdig is all about helping you connect and have meaningful conversations with the people you would normally sit next to in class or talk to in a study lounge. The posts you make and the articles you share should be things that genuinely interest you because they will probably be interesting to your peers as well. Most importantly, read a lot and comment often. You can't have a good conversation without listening to and responding to your peers. Remember that this is your community to create, and you're in control of how well it works.

In Yellowdig, you get points for how much you engage and interact with others. The point system allows you to earn points for **posting or commenting** and **receiving comments, reactions, and accolades** from other people reading your posts. The more you interact, and the more people you have conversations with, the more points you'll get. You can track more about your point earning by clicking "**My Participation**" in the blue points display. You can always learn more about earning points by clicking "**How to earn points**" on that same display. The conversations should build upon connecting your community of practice in IDT and the knowledge you are learning in the course content. So, if someone goes "off-topic," you as the community can flag those posts to stay focused on building skills and knowledge in the field of IDT. **Flagged points lose points rather than insightful or helpful conversations that can earn extra points,** so focus on your learning to excel in the field (and in this class)!

If you see a "current grade" in your points display, you should know that your "current grade" represents your **pace** 🏃 towards reaching your total goal for this Yellowdig community until the end of the course. So, if you are on track to meet the participation target at the end of week one, your grade will be a 100% even though there are still plenty of points left to earn in the class. 💯 At the start of each week, your grade will go down, even though your earned points do not. That's because your current grade is re-calculated based on the points you'll need to stay on **pace** for the new week. To understand more about points and grading, this article may help.

At the end of the term, the percent of total Yellowdig points you earn will transfer back as the percent of participation points you can earn in this class, as noted on your syllabus.

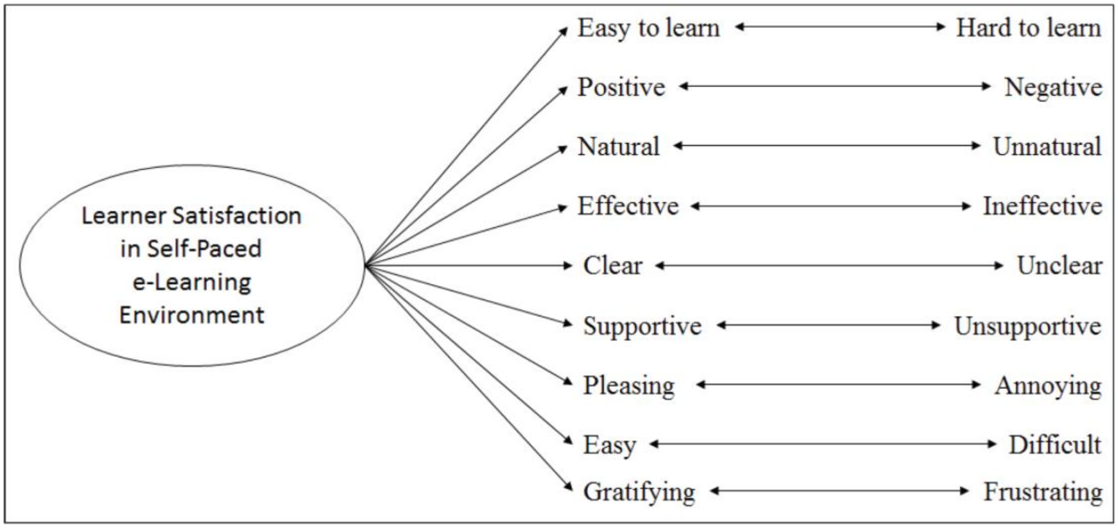
Any time you have a question about Yellowdig, you can click on your avatar picture and select "Help." That will take you to our Knowledge Base. From there, you can also "Contact Support" (at the top right).

The rules here are simple, make posts and comments that spark good conversations about topics that help your community, be respectful of others with different backgrounds and opinions, and don't be afraid to have some fun while doing it! 🎉

Happy Yellowdigging!🎉

Appendix B

eLSS Conceptual Model (Ritzhaupt, 2019)



Note: Image and model used with permission from Albert Ritzhaupt.

A Case Study of Community of Inquiry Presences and Cognitive Load in Asynchronous Online STEM Courses

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Abstract
The design and facilitation of asynchronous online courses can have notable impacts on students related to persistence, performance, and perspectives. This case study presents current conditions for cognitive load and Community of Inquiry (CoI) presences in an asynchronous online introductory undergraduate STEM course. Researchers present the novel use of Python script to clean and organize data and a simplification of the instructional efficiency calculation for use of anonymous data. Key relationships between cognitive load and CoI presences are found through validated use of NASA-TLX instrument and transcript analysis of discussion posts. The data show that student presences are not consistent throughout a course but are consistent across sections. Instructor presences are not consistent throughout a course or across sections. The study also explored predominant factors within each presence, confirming previous reports of low cognitive presence in discussions. The highest extraneous cognitive load was reported for understanding expectations and preparing an initial post. These results provide support for improvements to course design and instructor professional development to promote Community of Inquiry and reduce extraneous cognitive load.

Keywords: Cognitive load, online courses, instructional design, community of inquiry, cognitive presence, teaching presence

Faulconer, E. Chamberlain, D. J., Jr. Wood, B. (2022). A case study of Community of Inquiry presences and cognitive load in asynchronous online STEM courses, *Online Learning, 26*(3), 46-72.

The rise in online course offerings in higher education already underway was accelerated by the COVID-19 pandemic. Withdrawal rates in online STEM courses tend to be higher than traditional courses (Wladis et al., 2012). Dimensions of persistence revealed in the literature include learner characteristics, institutional characteristics, external and environmental factors, student expectations and satisfaction, and internal personal factors (including engagement and psychological attributes) (Cochran et al., 2014; Hachey et al., 2015; Harrell & Bower, 2011; Hart, 2012; McKinney et al., 2018).

Some factors linked to persistence are within the realm of control for course designers and instructors. Specifically, attrition has been correlated to cognitive load, especially when cognitive overload (often the result of extraneous and intrinsic load) occurs early in the online course (Tyler-Smith, 2006). Extraneous cognitive load is the working memory required to interact with learning materials while intrinsic cognitive load results from the inherent difficulty of the learning task. Course designers can address elements of cognitive load when developing online course templates, including design of instructions, rubrics, and other course materials. In order to do this, though, course designers must understand where students perceive the highest extraneous load. Measuring cognitive load in asynchronous online courses is an emerging research topic.

Instructors can directly influence student persistence in online STEM courses through careful course design and strategic selection of pedagogical methods employed (Lou et al., 2006). Instructors can work to reduce cognitive load in their online courses, though their level of control over course materials may be limited based on institutional policy such as using course templates and centralizing course edits through an instructional design team. The Community of Inquiry (CoI) framework may also support persistence. The CoI framework, which encompasses teaching, social, and cognitive presences, is a well-known and widely applied theoretical framework that centers on the creation of meaningful learning through collaboration and discourse (Garrison & Arbaugh, 2007). CoI presences can be evaluated directly through transcript analysis or indirectly through self-reported perspectives. While there are understandable benefits to the direct measure, transcript analysis is time-consuming, and thus many studies rely on indirect measures. Currently, uncertain relationships exist between CoI presences and cognitive load.

Because of persistence issues in online STEM courses, it is important to investigate and establish course design and facilitation best practices. Cognitive load mitigation strategies and the Community of Inquiry framework are not discipline-specific pedagogical approaches, making them transferable across STEM courses in online learning. Careful course design can strengthen the Community of Inquiry presences while mitigating impacts to cognitive load, thus promoting persistence, performance, and satisfaction. This case study presents a picture of current conditions for cognitive load and Community of Inquiry presences in an asynchronous online introductory undergraduate STEM course. Importantly, this study seeks to establish key relationships between cognitive load and CoI presences to answer the following exploratory research questions:

1. Are student social and cognitive presences and instructor social and teaching presences consistent throughout a course (module to module) and across sections?
2. What factors predominate within each presence?
3. What tasks in asynchronous online discussions influenced cognitive load?

This study presents important information to both researchers and practitioners. As previously mentioned, transcript collection and analysis are time-intensive, complex activities. This study presents methods for the novel use of Python script to clean and organize raw discussion transcript data used in this type of analysis. Furthermore, this study presents a simplification of the instructional efficiency calculation to be used with anonymous data. Important to practitioners, researchers, and administrators, this study reports on predominant CoI presence factors and cognitive load in asynchronous discussions. The unexpected results justify further investigation regarding students' self-reported cognitive load. By understanding the classroom ecosystem through the lenses of CoI and cognitive load, we can design effective interventions aimed at improving persistence in online STEM courses.

Literature Review

Community of Inquiry

Many asynchronous online courses implement an online discussion to promote peer interactivity, nurture communication skill, and develop a sense of community. This community can be evaluated through the lens of Community of Inquiry (CoI), specifically teaching presence, social presence, and cognitive presence (deNoyelles et al., 2014). This model presents each of these presences as distinct but interrelated, whose synergy promotes an effective learning environment (Garrison & Arbaugh, 2007).

Learners and instructors project their personality into the community through social presence, with the dimensions of affective responses, interactive communication, and cohesive responses. In affective responses, learners express emotions, humor, and feelings, including the use of paralanguage like emojis, punctuation, and conspicuous capitalization (Swan & Shih, 2005). In interactive communication, learners respond to and engage with others while cohesive responses speak to the group and invite interaction (Swan & Shih, 2005). As postulated in the peer support hypothesis, strong peer connections limit isolation in e-learning and therefore may address persistence in online STEM students (E. K. Faulconer et al., 2018; Sinclair, 2017). It is important to note that the influence of social presence on persistence is debated within online education (Hart, 2012; Pattison, 2017).

Teaching presence includes design, direction, and facilitation of social and cognitive interactions in an online course, including formative and summative feedback. Furthermore, students report perceived value of strong instructor presence in online courses (Joyner et al., 2014), with studies correlating teaching presence to learner satisfaction and perceived learning (Shea & Bidjerano, 2009). Elements of teaching presence in non-STEM (Gaytan, 2015) and STEM (Hegeman, 2015) online courses have been correlated to persistence.

The construction of meaning through communication is referred to as cognitive presence. Cognitive presence is grounded in the Practical Inquiry Model (Garrison et al., 2001). The four phases of cognitive presence are triggering event (curiosity, puzzlement, or seeking clarification), exploration (stating unsubstantiated agreement/disagreement, sharing information, sharing a content-relevant personal story, or stating an opinion), integration (building onto arguments of others, drawing conclusions, presenting justified hypotheses, or presenting a supported agreement/disagreement), and resolution (synthesizing, thought experiment, or application and testing of a new thought) (Garrison & Arbaugh, 2007). Cognitive presence in asynchronous discussions tends to occur at the lower levels (triggering event or exploration) rather than at the higher levels (integration or resolution) (Y. Chen et al., 2019). Both course design and instructor facilitation of discussions can promote strong cognitive presence in asynchronous online discussions. Cognitive presence in online courses can be predicted by both social and teaching presence (Lee, 2014; Zhu, 2018). Even the teaching presence of instructors who are not course designers correlates to learner cognitive presence (Silva, 2018). Design and facilitation to promote cognitive presence has been shown to improve persistence and performance in non-STEM online courses (Ice et al., 2011; Jaggars & Xu, 2016).

Cognitive Load

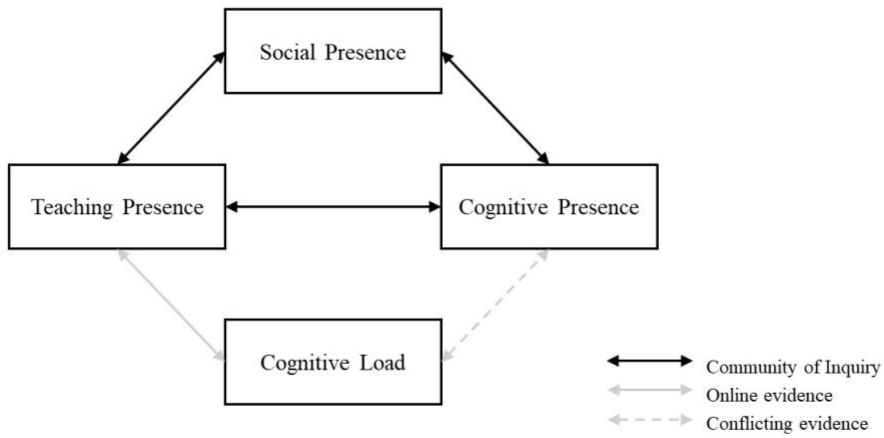
In online learning environments, as with all learning environments, tasks and activities demand working memory resources to process information. Intrinsic cognitive load is a product of mental processing necessary to understand a task and transfer new information to long-term memory. This can be due to task complexity, interactivity, and the learning environment in which the task takes place (Kalyuga, 2011; Mills, 2016). Extraneous cognitive load results from how material is presented and is not related to the learning process; extraneous cognitive load occurs when there are distractions (Kalyuga, 2011; Mills, 2016). Germane cognitive load is due to the intentional cognitive processing necessary for learning. Increasing germane load can enhance learning (Kalyuga, 2011). Intrinsic cognitive load may be expected for certain learning tasks, especially if the task or learning environment is new to the student, but it could be considered “bad” cognitive load if the task complexity results in too high of cognitive load. Germane cognitive load is “good” cognitive load as it is the effort to integrate and connect new knowledge with existing knowledge. Extraneous cognitive load is “bad” cognitive load and should be eliminated (or at least reduced) wherever possible (Kalyuga, 2011).

High cognitive load, referred to as cognitive overload, can inhibit learning by reducing the processing of new information. Cognitive overload is typically the result of extraneous and intrinsic load (Stiller & Koster, 2016). In online learning environments, cognitive overload has been correlated to attrition (Tyler-Smith, 2006) and reduced learner satisfaction (Bradford, 2011; Kozan, 2015). While the evidence is more robust in traditional STEM courses (Gillmore et al., 2015), there is preliminary evidence to support the influence of cognitive load on academic performance in online STEM courses (Stachel et al., 2013).

Relationship Between CoI and Cognitive Load

Careful course design can strengthen CoI presences while mitigating extraneous cognitive load. There is some tentative evidence of relationships between CoI presences and cognitive load. In a study of a graduate-level non-STEM online course, teaching presence reduced extraneous load (Kozan, 2015). The relationship between cognitive presence and cognitive load is uncertain, with a study in a non-STEM graduate course reporting a positive correlation (Kozan, 2015) while a study of an online STEM course reported no relationship (Mills, 2016). Further research is needed to investigate this possible relationship. No studies reported a connection between learner or instructor social presence and cognitive load. In summary, while the relationships between the Community of Inquiry presences are well explored in the literature, much less attention is given to the relationships between the CoI presences and cognitive load. A summary of the evidence for relationships between CoI Presences and Cognitive Load is provided in Figure 1.

Figure 1
Conceptual Framework for the Relationship Between CoI Presences and Cognitive Load



Material and Methods

Research Site and Course Context

The study population consists of students enrolled in an introductory undergraduate physics course and their instructors. The courses were held at a medium-sized private university located within the United States. Due to the online nature of the degree programs, students are geographically dispersed across the world.

The course was offered asynchronously online over a nine-week term, administered via Canvas, the learning management system. The institution used course templates, ensuring that across sections, students were presented with the same learning objectives, course materials, and assignments. The course template was developed via collaboration between a content expert and an instructional designer. The primary differences between sections of a course in each semester are the cohorts of learners engaged in each section and the instructor. Course instructors for this study were all contingent (adjunct) faculty.

The physics course was a survey course including topics in mechanics, heat, light, sound, electricity and magnetism, and modern physics. Topics were arranged into nine modules, one per week. Typical activities in each module were textbook reading, short problem solving and lecture videos, homework exercises (completed through the textbook publisher's platform), freely available online simulations (accessed through the same platform), discussion, two chapter quizzes, and two summative exams. There were nine discussion activities in the course, one in each module. The discussions accounted for 12% of the total course grade (1.33% each).
The discussion board activities required students to make an initial post providing a thoughtful, 500-word maximum, real-world application based on a topic from the current module. Posts that described a student's own experiences were welcomed and encouraged. Students also were required to post substantive responses to at least two peer or instructor posts. Initial discussion posts require an embedded graphic, image, video URL, or other resource.

Discussion post scoring used a rubric. Out of 100 points, 20 points were allocated to timeliness and participation, the initial post secured 35 points, the quality of the two peer responses earned 30 points, and general spelling, grammar, organization, ethics, and netiquette were addressed with the final 15 points.

Study Population and Sampling

The self-selected sample was drawn from the population (see Table 1). Census data (rather than self-selection) was used for learning management system (LMS) and institutional data. LMS data were collected confidentially, with data anonymized prior to analysis. Individual students and instructors were de-identified and given a numeric identifier. The sample for the survey data was drawn through a non-probability, self-selective sampling. Participants were recruited through initial and reminder announcements in the LMS. Survey participation was not incentivized. Survey data were collected anonymously. All data were reported in aggregate, with no individually identifying information. This study was reviewed by the Institutional Review Board and deemed "exempt" (Approval #20-114).

Table 1
Population and Sample Information

Term - Section	Enrollment (#)	Survey Respondents (#)	Response Rate (%)
June 2020	39	16*	14.0
July 2020	75		
August 2020	186	20	10.8
October 2020	181	25	13.8
November 2020	101	15	14.9
December 2020	17	2	11.8
January 2021	182	22	12.1

Note. *Survey for June/July 2020 ran simultaneously, and respondents were not distinguished.

Data Collection

This was a mixed methods study, using qualitative data (discussion transcripts) and quantitative data (survey and academic performance data). Discussion transcript collection, organization, and deidentification evolved over the first six months of the project. Initially, a research member manually copied every discussion post to a Word file, parsed each post into sentences, reviewed sentences to remove identifiers, and copied deidentified sentences into an Excel sheet. This process was extremely time-intensive and thus an expert in large-scale data analysis was brought on to the project.

The refined process used a plugin to extract the webpage discussion into a PDF file, used PDF to Word conversion software, and ran a Python script to parse the webpage conversion into sentences, deidentify the sentences, and correlate each sentence to the speaker in an Excel file. The Python script and example files are available in GitHub at https://github.com/Darryl-Chamberlain-Jr/CoI_Python_Database_Analysis. Figure 2 presents an example of a discussion transcript before and after automated cleaning is provided.

Figure 2

Example of Raw Discussion Data (a) and Outcome of Automated Cleaning (b)

Collapse Subdiscussion Full Name 1

Full Name 1
Oct 17, 2020 Oct 17, 2021 at 9:30pm

Class, Most of the material covered in Chapter 1 of the textbook was a welcome refresher from my high school physics class. The only topic that was new to me or I straight up don't remember was the information on centripetal acceleration. According to our textbook, centripetal acceleration is the acceleration of an object moving in a circular path and is always perpendicular to the object's instantaneous velocity. (Bord & Ostdiek, 2018) My favorite example is whenever I am driving my car by myself or on a roller coaster, I enjoy the feeling and force of taking turns at a good speed.

...

Reply Reply to Comment   Collapse Subdiscussion Full Name 2

Full Name 2
Oct 18, 2020 Oct 18, 2021 at 4:37pm

	A	B	C	D	E	F	G	H	I
1	Speaker ID	Analysis Unit							
2	KX5T8	Class,							
3	KX5T8	Most of the material covered in Chapter 1 of the textbook was a welcome refresher from my high school p							
4	KX5T8	The only topic that was new to me or I straight up don't remember was the information on centripetal acc							
5	KX5T8	According to our textbook, centripetal acceleration is the acceleration of an object moving in a circular path							
6	KX5T8	My favorite example is whenever I am driving my car by myself or on a roller coaster, I enjoy the feeling an							
7									

Survey data were collected using the NASA Task Load Index (NASA-TLX) instrument to measure cognitive load. This instrument is a subjective workload assessment tool. This use of the survey instrument was previously validated by the authors (Faulconer et al., 2022). The validated model established five discrete tasks involved in asynchronous online discussions: understanding expectations, crafting an initial post, reading posts from instructors and peers, creating *reply to* posts, and integrating instructor feedback. For each task, the validated model reported cognitive load associated with mental activity, time pressure, effort, and frustration. Because the subscales are independent and thus can be dropped, the validation of the model did not include the subscales of physical ability and perceived success. The surveys were administered online through Qualtrics. Academic performance was measured as final course grades as well as scores for each discussion assignment, graded through a rubric. The rubric categories include timeliness and participation, initial post, peer responses, and general requirements. Grades were reported as a percent mark from 0% to 100%. Final course grades were weighted, with discussions accounting for 12% of the overall course grade.

Data Analysis

Discussion Transcript Analysis. Discussion content generated by participants (instructors and learners) was analyzed for community of inquiry presences. To measure social presence of instructors and learners, posts were coded based on factors of affective responses (e.g. expression of emotion), interactive responses (e.g. quoting other messages), and cohesive responses (e.g. vocatives) using operational definitions for each (Hughes et al., 2007; Rourke et al., 1999). These presences were analyzed in two ways: by Presence Density and Correlation Coefficients.

Presence Density. Presence density is a common variable in measuring CoI in discussions (Baisley-Nodine et al., 2018; Darabi et al., 2011; Hughes et al., 2007; Lee, 2014; Rourke et al., 1999). Raw number of instances of a presence is skewed by the length of a message (Rourke et al., 1999). Thus, the results were analyzed by Presence Density (Equation (1) which represents the number of instances a code appears per 1000 words and is calculated by

$$PD = \frac{Subpresence(\#\ of\ sentences)}{Discussion(\#\ of\ words)} * 1000 \qquad (1)$$

where the number of words in a discussion refers to the number of either student words or instructor words written in response to a particular discussion topic. Social presence density (SPD) calculated the number of instances a social code appeared per 1000 student words and has been used to report results in the literature (e.g, Hughes et al., 2007). Similarly, teaching presence of instructors and cognitive presence of learners was coded using previously reported categories (Darabi et al., 2011), with results reported as teaching presence density (TPD) and cognitive presence density (CPD). Very infrequently, learner posts were identified by instructors and researchers as having been plagiarized. Because these posts cannot accurately represent the learner's social and cognitive presence, they have been removed from the study.
Each analysis unit (sentence) from the transcripts were evaluated by 2 trained raters who received the analysis units in a spreadsheet file where they documented their codes independently, then compared codes and discussed differences. Sometimes consensus was reached while other times separate codes were logged. Table 2 displays an example of the coding. Frequency of individual and categories of codes were examined.

Table 2
Example Coding of Analysis Units from the Introductory Undergraduate Physics Course

	Coder #1		**Coder #2**	
Analysis Unit	Type of Presence	Sub-category	Type of Presence	Sub-category
For this week's discussion, I would like to talk about acceleration.	Social	SS	Social	SS
Acceleration is the rate of change of velocity.	Cognitive	IS	Cognitive	IS
The quicker we turn the corner, the greater we accelerate.	Cognitive	CL	Cognitive	CL
In aviation, the acceleration is described in unit of "Gs."	Cognitive	IS	Cognitive	IS

Cohen's kappa (Equation(2) measures the agreement between two raters for multiple categories and is calculated by

$$\kappa = \frac{n_a - n_e}{n - n_e} \qquad (2)$$

where n_a is the number of agreements between the coders, n_e is the number of agreements if codes were randomly applied, and n is the total number of items coded (Cohen, 1960). Our kappa for the October 2020 discussion transcripts is $\kappa = 0.992$, which suggests extremely high reliability between the two coders (Landis & Koch, 1977).

Correlation Coefficient. A correlation coefficient measures the strength of a relationship between two variables. To identify the trends in presence densities across modules and between sections of the discussion activities, we calculated correlation coefficients using the Excel function CORREL. We categorized correlation strengths according to (Dancey & Reidy, 2007) as presented below:
None: $|r| = 0$
Weak: $0 < |r| < 0.4$
Moderate: $0.4 \leq |r| < 0.7$
Strong: $|r| \geq 0.7$
Note the sign of the correlation corresponds to direction of the relation and does not affect the strength of the relation. If a correlation coefficient is negative, it means as one variable increases the other decreases. A positive value indicates that as one variable increases, so does the other.

Survey and Performance Data Analysis. Results from the survey measuring students' perceived cognitive load were paired with students' performance in discussions to analyze the effects of various parts of a discussion on students' perceived cognitive load through the calculation of Instructional Efficiency.

Instructional Efficiency. Instructional efficiency (Equation (3) is a measure of the effects of instructional conditions on student learning and is calculated by

$$E = \frac{1}{n}\sum_{i=1}^{n} \frac{Z_i(P_{test}) - Z_i(E_{test})}{\sqrt{2}} \qquad (3)$$

where n is the number of participants in each group, $Z_i(P_{test})$ is the standardized test performance for student i, and $Z_i(E_{test})$ is the standardized test mental effort of each cognitive factor for student i (van Gog & Paas, 2008). Essentially, Instructional Efficiency standardizes the performance and mental efforts for each student, then calculates the difference between the standardized performance and each mental effort score. In our study, $Z_i(P_{test})$ is the discussion grade per student and $Z_i(E_{test})$ is the survey responses per student. Since our data were anonymous rather than confidential, we cannot match a specific discussion grade to a survey response and thus sum all standardized discussion grades in the calculation.

As this sum is 0, the term falls out of the equation, and we are left with the Anonymous Instructional Efficiency equation (Equation (4) calculated as

$$AE = \frac{1}{n}\sum_{i=1}^{n}\frac{-Z_i(E_{test})}{\sqrt{2}} \tag{4}$$

Note the $Z_i(E_{test})$ does not sum to zero as we standardized across a task and sum for each factor within a task. A negative anonymous instructional efficiency suggests the extraneous cognitive load is higher for this item compared to others.

Results

The results section will present data addressing our research questions. The first section summarizes Community of Inquiry presence densities and corresponding correlation coefficient strengths to describe the consistency of each category of presence either between cohorts or across the modules. The second section summarizes aggregated presence densities for each category to address the identification of predominant factors within each presence. The final section presents the anonymous Instructional Efficiencies among the four tasks to address which tasks influenced cognitive load.

Consistency of Community of Inquiry Presences

Student Social Presence Density. Student interactive and cohesive subpresence densities commonly were between 10 and 15 throughout the nine modules for all four cohorts while affective subpresence density was relatively constant between 0 and 2 (see Figure 3). These patterns were weak, however, based on the weak correlation both between cohorts and between modules.

Student social presence density weakly correlates between cohorts, as seen by 67% of the Student SPD having weak correlation (see Table 3). Affective subpresence has the lowest correlation between cohorts with 100% of correlations being weak. Cohesive subpresence has the highest correlation between cohorts with 83% of cohesive subpresences being moderate. Student social presence densities weakly correlate across modules. Affective, interactive, and cohesive subpresences were weakly correlated across modules (-0.13, -0.17, and -0.38, respectively). Note the negative correlation coefficient for each subprence suggests such instances decrease as the term goes on and suggests early discussions may Have been designed to ellicit social responses from students.

Figure 3
Student Social Presence Density Throughout the Course (Cohorts 1 through 4)

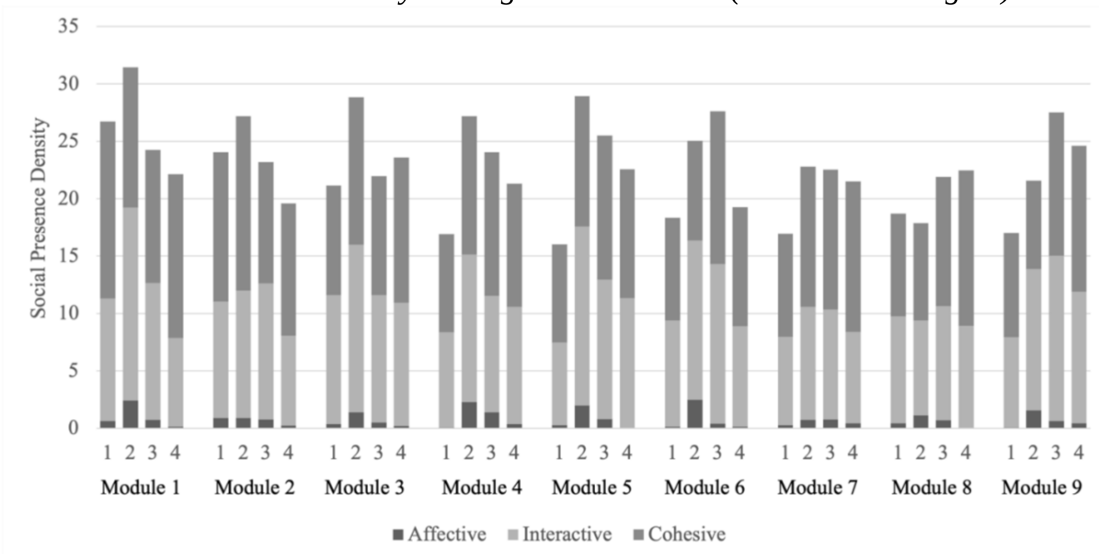


Table 3
Correlation Coefficients for Student Social Presence Density between cohorts.

Correlation Strength	Affective %	Interactive %	Cohesive %	Student SPD %
None	0%	0%	0%	0%
Weak	100%	83%	17%	67%
Moderate	0%	17%	83%	33%
Strong	0%	0%	0%	0%

Student Cognitive Presence Density. Student exploration subpresence densities showed a linear increase from 20-30 in early discussions to 30-40 in later discussions. All other cognitive subpresences had relatively constant densities between 0-10 (see Figure 4). These patterns are confirmed with the strong correlations between cohorts and especially strong correlations for the exploration subpresence. Note more than half of the correlation coefficients for all cognitive presences combined are in the moderate to strong correlation range (see Table 4). Resolution subpresence has the lowest correlation between cohorts with 83% of correlations being weak. Exploration subpresence has the highest correlation between cohorts with 83% of correlations being strong. Moreover, correlations for the subpresences across modules were strong for the exploration subpresence (0.70) and weak for triggering event, integration, and resolution subpresences ($-0.32, 0.27$ and -0.27, respectively).

Figure 4

Student Cognitive Presence Density Throughout the Course (Cohorts 1- 4)

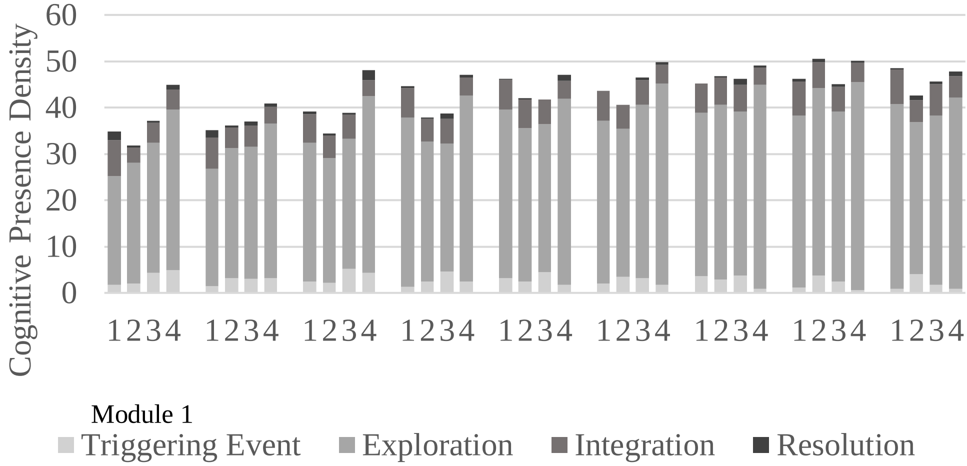


Table 4

Correlation Coefficients for Student Cognitive Presence Density

Correlation Strength	Triggering Event %	Exploration %	Integration %	Resolution %	Student CPD %
None	0%	0%	0%	0%	0%
Weak	17%	0%	33%	83%	33%
Moderate	50%	17%	50%	17%	33%
Strong	33%	83%	17%	0%	33%

Instructor Social Presence Density. In contrast to student social presence densities, instructor social presence densities do not appear correlated in any way, as each instructor had vastly different teaching densities (see Figure 5).Note 88% of the correlation coefficients for all instructor social presence combined are in the weak to no correlation range (Table 5). As with the students, affective subpresence has the lowest correlation between cohorts with 83% showing no correlation due to some instructors not illustrating any affective subpresence. Again, similar to the students, cohesive subpresence has the highest correlation between cohorts, though 83% of these correlations are weak. Correlations across modules were also weak for affective, interactive, and cohesive subpresences (0.24, −0.07, and 0.14, respectively). Note that the affective subpresence is relatively uncommon, making the rare occurrences hard to discern in the graphical representation of the data (as denoted with the asterisk*).

Figure 5
Instructor Social Presence Density Throughout the Course (Cohorts 1 – 4)

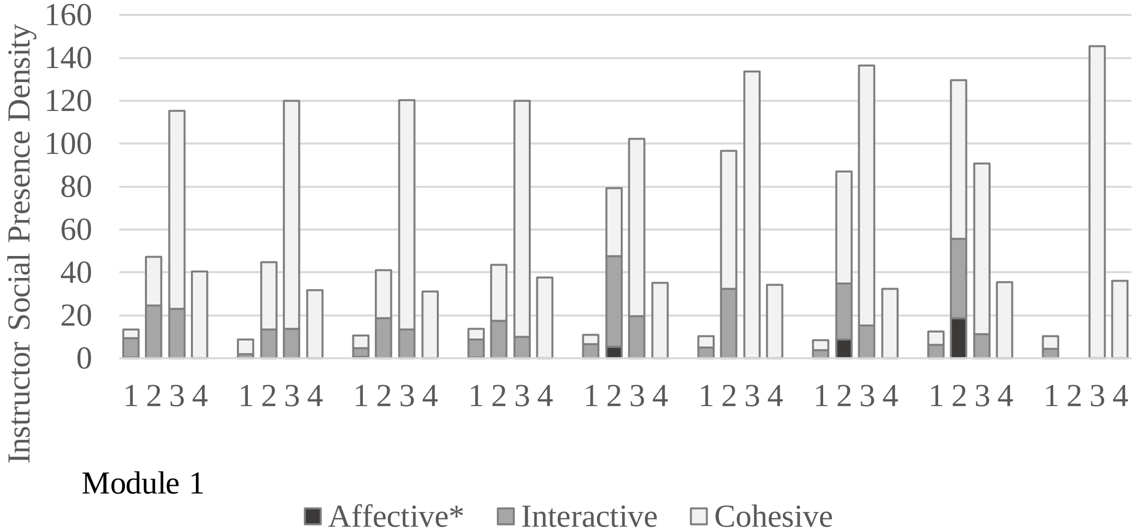


Table 5
Correlation Coefficients for Instructor Social Presence Density

Correlation Strength	Affective %	Interactive %	Cohesive %	Instructor SPD %
None	83%	50%	0%	44%
Weak	0%	50%	83%	44%
Moderate	17%	0%	17%	11%
Strong	0%	0%	0%	0%

Instructor Teaching Presence Density. Instructor teaching presence density also appears weakly correlated between cohorts and across modules (see Figure 6). Approximately three-quarters of the correlation coefficients for all teaching presences combined are in the weak to no correlation range (see Table 6). Instructor Design & Organization subpresence has the lowest correlation between cohorts with 50% showing no correlation and the other 50% showing weak correlation. Facilitating Discourse subpresence has the highest correlation between cohorts with 50% of correlations being moderate to strong. Correlation across modules is weak for Facilitating Discourse, Instructional Design & Organization, and Direct Instruction (0.23, 0.01, -0.07, respectively).

Figure 6
Instructor Teaching Presence Density Throughout the Course (Cohorts 1 – 4)

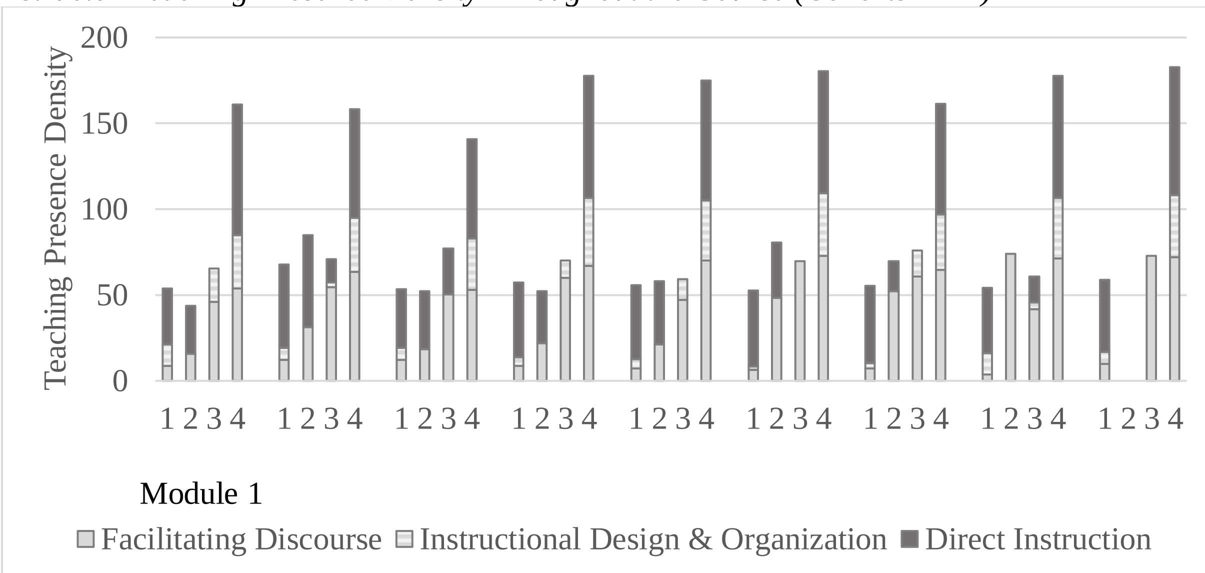


Table 6
Correlation Coefficients for Instructor Teaching Presence Density

Correlation Strength	Facilitating Discourse %	Design & Organization %	Direct Instruction %	Instructor TPD %
None	0%	50%	0%	17%
Weak	50%	50%	67%	56%
Moderate	33%	0%	17%	17%
Strong	17%	0%	17%	11%

Predominant Community of Inquiry Presence Results

Average presence density of the aggregated data for each student and instructor subpresence is presented in Table 7. Within the student presences, Information Sharing (24.98) dominates all other subpresences and is almost five times more frequent than the next two highest subpresences: Natural Expression (5.38) and Vocatives (5.10). No other social subpresences were higher than 5 instances per 1000 words. Within the instructor presences, Encouraging (21.31), Vocatives (16.01), and Clarification (13.26) predominate. Of special note is the fact that no other instructor social subpresence density beyond encouragement has density above 3 while the top five teaching subpresence densities are above 6.

Table 1
Emergence of Predominant Community of Inquiry Categories in Each Presence

Student Social Presence Density		**Instructor Social Presence Density**	
Natural Expression	5.38	Vocatives	16.01
Vocatives	5.10	Greetings and Salutation	2.72
Social Sharing	4.15	Expressing Appreciation	1.95
Expressing Appreciation	3.60	Natural Expression	1.74
Greetings and Salutation	1.11	Information Exchange	1.46
Student Cognitive Presence Density		**Instructor Teaching Presence Density**	
Information Sharing	24.98	Encouraging	21.31
Personal Narrative	3.92	Clarification	13.26
Opinion	3.91	Resource Sharing	9.78
Building On	2.77	Expectation Setting	9.09
Clarification	2.40	Questioning	6.96

Anonymous Instructional Efficiency Results

Anonymous Instructional Efficiency by cognitive factor and task are presented in Table 8. Recall that a negative anonymous instructional efficiency suggests the extraneous cognitive load is higher for this item compared to others. High extraneous cognitive load was found across all four cognitive factor subscales for the tasks “Understanding what is expected” and “Crafting your initial discussion post.” Low extraneous cognitive load was found across the four cognitive factors for the tasks “Critically reading posts from your instructor and peers” and “Integrating instructor feedback into future discussion posts.” Extraneous cognitive load appeared relatively neutral for the task “Creating reply to posts.”

Table 8
Anonymous Instructional Efficiency by Cognitive Factor and Task

	Mental Demand	**Temporal Demand**	**Effort**	**Frustration**
Understanding what is expected	-0.169	-0.170	-0.253	-0.119
Crafting your initial discussion post	-0.263	-0.226	-0.164	-0.111
Critically reading posts from your instructor and peers	0.159	0.112	0.157	0.079
Creating reply to posts	0.052	0.058	0.045	0.001
Integrating instructor feedback into future discussion posts	0.221	0.227	0.215	0.149

Discussion

We organize the discussion around interpreting the results presented to answer our research questions sequentially. Limitations and implications are also explored in this section.

Consistency of Community of Inquiry Presences

A summary of the previously presented correlation coefficients between cohorts and across modules are presented in Table 9. Student Community of Inquiry presences (social and cognitive presences) moderately to strongly correlated across the four cohorts. This suggests future research can analyze discussion transcripts of some cohorts to understand how presences are distributed for all sections of the course in each time frame. However, student presences overall were weakly correlated across modules. This result is intuitive as the presences may be reliant on the types of tasks assigned for the discussion (i.e., the discussion prompt). Therefore, future studies should include transcript analysis for Student CoI presences in all modules within the course in the analysis, but census sampling of cohorts may not be necessary.

In contrast, Instructor Community of Inquiry presences (social and teaching presences) were weakly correlated across the four cohorts and across modules. Future research will require that every instructor discussion transcript be analyzed as there is wide variation instructor to instructor and even module to module for the same instructor. However, with a larger sample size for instructors, this should be re-evaluated. This finding highlights unique instructor approaches to facilitating discussions. This finding also underlines the potential for targeted professional development to promote stronger community of inquiry presences and reduce cognitive load through strong facilitation of asynchronous online discussions.

Table 9

Summary of Correlation Coefficient Strengths both between Cohorts (left) and across Modules (right)

Cohort Correl. Strength	**St. SPD %**	**St. CPD %**	**Inst. SPD %**	**Inst. TPD %**
None	0%	0%	44%	17%
Weak	67%	33%	44%	56%
Moderate	33%	33%	11%	17%
Strong	6%	33%	0%	11%

Module Correl. Strength	**St. Soc.**	**St. Cog.**	**Inst. Soc.**	**Inst. Teach.**
None	0	0	0	0
Weak	3	3	3	3
Moderate	0	0	0	0
Strong	0	1	0	0

Predominant Community of Inquiry Presence Factors

Understanding the predominant factors for each CoI presence provides an important baseline, especially if an instructor or course designer wishes to execute an intervention to promote a specific factor or presence. Recall this is evaluated as Presence Density, which indicates the number of instances a CoI code appears per 1000 words. Regarding student social presence densities, the factors that predominated were natural expression (5.38), vocatives (5.10), and social sharing (4.15), representing both interactive and cohesive responses. For instructor social presences, the factors that predominated were vocatives (16.01) and greetings and salutations (2.72). This suggests the emphasis on cohesive responses and less interaction. This is supported by other studies evaluating social presence density, which have found vocatives to be a large component of student posts in online discussions (Baisley-Nodine et al., 2018; Lee, 2014). Interestingly, affective responses were much less common for both students and instructors. It would be interesting to explore how important affective responses are to student perceptions of community. There is some evidence that social presence correlates with performance (Hostetter, 2013). One study also reported a positive correlation between social presence and cognitive presence (Lee, 2014).

Student cognitive presence density was highest for information sharing (24.98), which occurred much more frequently than the next two most common codes of personal narrative (3.92) and opinion (3.91). These fall into the Exploration phase of cognitive presence, which is a lower level. This means that students are sharing information with little evaluation, analysis, synthesis, or resolution. These results reflect previous work that suggest Triggering Event and Exploration would be the most prevalent without an intervention (Kovanovic et al., 2016; Lee, 2014).

Instructor teaching presences were predominantly encouraging (21.31), clarification (13.26), and resources (9.78). Encouraging falls into the category of facilitating discourse while clarification and resources both are types of direct instruction. The exploration of teaching presence density in the existing literature is scant. A dated paper reported teaching presence density for two courses, with both courses showing well over three-quarters of teaching presence codes in the direct instruction category (Anderson et al., 2001). Multiple studies report that student cognitive presence is predicted by teaching presence (Ice et al., 2011; Lee, 2014; Silva, 2018; Zhu, 2018). Social presence has also been connected to critical thinking (Rovai, 2007), which could be viewed through the lens of cognitive presence. However, our results show student cognitive presence as moderately to strongly correlated across cohorts while teaching presence was weakly correlated across instructors, suggesting that cognitive presence and teaching presence were not correlated. More instructor data are required to examine the relationship between student cognitive presence and teaching presence.

The Foundation for Designing Interventions

From this data, we can identify specific discussion design (e.g., prompt, instructions, or rubric) implications. Small discussion groups can promote closer connections and less ambiguous roles in the discussion (Akcaoglu & Lee, 2016; Qiu et al., 2014). A significant weighting for discussions in the overall course grade can spur motivation and may increase the number of posts and self-reported sense of community (Rovai, 2003). Importantly, this study confirmed that students tend to only reach lower levels of cognitive presence. Design of discussion prompts that target the highest levels of thinking (e.g., analysis, synthesis, and evaluation), those that consider divergent (open-ended) questions, and real-world scenarios can encourage strong cognitive presence (Darabi et al., 2011; Ertmer et al., 2011; Howell et al., 2017).

Furthermore, these data provide key implications for designing professional development to promote strong Community of Inquiry presences for both instructors and students. Instructor engagement occurs on a spectrum, ranging from "ghosting" to "swamping" the discussion. Informing instructors of the benefits of moderate engagement could be a critical piece to professional development. The research shows that instructor time on task is a stronger predictor of student grades on discussions than the number of instructor posts (Cranney et al., 2011), students report a preference for active instructor engagement in discussions (Hosler & Arend, 2012), and the research suggests that a moderate amount of instructor involvement results in stronger student engagement (Aloni & Harrington, 2018; Goode et al., 2018). With this knowledge, instructors can focus their efforts on providing a moderate number of meaningful contributions that further the conversation and encourage students to reach integration and resolution, the higher levels of cognitive presence.

Instructor actions like providing formative feedback within in the discussions followed by summative feedback post-discussion demonstrates strong teaching presence and can promote learner cognitive presence (Stein et al., 2013). Additionally, instructors can use strategies like Socratic questioning to promote conceptual learning and to push students to clarify their thinking and make judgements about their reasoning, which models how to ask probing questions and reduces their reliance on the instructor for furthering the conversation (Aloni & Harrington, 2018). Instructor emphasis on areas of disagreement or misconception promotes engagement (G. Chen & Chiu, 2008). If instructors identify the level of cognitive presence demonstrated by a student, they can engage with the student to promote student demonstration of more complex thinking skills (Giacumo & Savenye, 2019). Instructor facilitation can also encourage metacognition by asking reflective questions to increase student interaction with learning objectives (Faulconer, 2017). It is important to note that instructor posts with high cognitive presence may limit student demonstration of high levels of cognitive presence (Ice et al., 2011; Jaggars & Xu, 2016).

High Cognitive Load Tasks in Asynchronous Online Discussions

Based on the anonymous instructional efficiencies, the tasks "Understanding what is expected" and "Crafting your initial discussion post" posed the highest extraneous cognitive load for students. This result confirms previously published results by the authors using the same course during a preceding time frame (Faulconer et al, 2022). For these two tasks, the highest extraneous cognitive load was associated with effort for understanding what is expected while both temporal demand and mental demand were highest for crafting the initial discussion post. Aligned with the previous study, the lowest extraneous cognitive load was reported for integrating instructor feedback. This is a very interesting finding. It is unclear why students are not experiencing cognitive load here. One might hypothesize that students do not experience cognitive load from this because they are skilled at understanding and applying feedback, so that they do not need to exert much mental effort or time and therefore experience little frustration with the task. One might also hypothesize that students do not report cognitive load here because they do not effectively perform this task but are unaware of this and therefore do not experience the associated extraneous load. One might also hypothesize that students do not report cognitive load here simply because they do not do this task. Further qualitative and quantitative exploration is warranted.

The research consistently suggests that cognitive load is an important criterion in designing high-quality online courses (Bradford, 2011; Caskurlu et al., 2021). With the highest extraneous cognitive load reported in this study falling on the tasks of understanding expectations and crafting the initial post, discussion design efforts can be focused, keeping in mind that students perceive high load for both time and mental demand for these two tasks. As with any type of educational technology tool, there is an ever-growing selection of new platforms, both free and fee based. While it may be attractive to try new tools, course designers must consider the extraneous cognitive load placed on students in learning to navigate a new tool. Aimed at the highest cognitive load area of understanding expectations, course designers can use tabs and other design features to scaffold instructions in the learning management system (Darabi et al., 2011; Darabi & Jin, 2013; Gašević et al., 2015; Kanuka et al., 2007; Mayer & Moreno, 2003). For example, “Big Picture” instructions could establish the context of the discussion assignment in the course, academic career, or professional career by emphasizing transferable skills developed in the activity and the real-world relevance. This is an area where instructors could also emphasize expectations for social and cognitive presence as well as engagement. A “Summary” tab could provide main tasks without minutia, limiting cognitive load for students who have a strong understanding of the basic expectations but want to ensure their work meets all criteria. A “Detailed Instructions” tab could provide step-by-step, explicit, encouraging instructions. This level of support could help students who are less confident in the tasks required to engage in the discussions. In this area, instructors could provide example posts that demonstrate higher levels of cognitive load or creativity. In any instruction format, course designers should apply word economy and eliminate extraneous materials where possible (Mayer & Moreno, 2003). Textual and graphical signaling cues can be used to further address extraneous load (Mayer & Moreno, 2003; Schneider et al., 2018).

Rubric design is another aspect that can address extraneous load associated with understanding expectations, ensuring that expectations within the rubric align clearly and deliberately with community and engagement expectations communicated in the instructions (Alfauzan & Tarchouna, 2017). As with other aspects of discussion design, rubrics should be evaluated for word economy and clarity (Mayer & Moreno, 2003). When deciding expectations, research suggests that the best predictor of learning is not the number of posts a student makes but the number of posts read, the time spent reading, and the time delay before responding (Goggins & Xing, 2016). Furthermore, the actual discussion prompt itself can significantly influence student engagement and achievement of higher levels of cognitive presence, as seen by the module-to-module variability in this current study.

Instructors can implement strategies to address cognitive load when facilitating discussions. In discussions, students may focus on just a few posts and miss the bigger picture, connections, and corrections of misconceptions or inaccuracies (Kwon et al., 2018). Because graphic organizers reduce cognitive load (Stull & Mayer, 2007), providing one may increase cognitive presence in future discussion posts (Kwon et al., 2018). Another strategy to reduce extraneous cognitive load when facilitating discussions is to consistently use formatting for attention guidance (Eryilmaz et al., 2012, 2015), such as using bold font and/or highlighting when asking a question for anyone to respond to. The previous suggestion to provide both formative and summative discussion feedback discussed implications for teaching presence and cognitive presence, but this could also address the cognitive load for students uncertain of expectations.

Limitations

One of the predominant limitations of this study is nonresponse error for the cognitive load measure. The cognitive load survey was not incentivized and was voluntary, which may have reduced participation. Because this study measures cognitive load, among other variables, it is reasonable to think that some students opted out of participation based on the nature of the topic. Furthermore, those who experienced the highest cognitive load may have withdrawn from the course prior to completing the research survey, thus skewing results. Similarly, another limitation of this study is the few instructors evaluated and inherent instructor variability present in discussion facilitation, grading, and feedback. Thus, the small sample size may reduce generalizability.

Another limitation of this study is a result of anonymous versus confidential data for student perceptions of cognitive load. However, the purpose of this study is to explore instructional efficiency. Future research exploring learner-level correlations between cognitive load and CoI presences and their influence on outcomes including persistence, performance, and perspectives is warranted. Furthermore, more investigation into these variables and their potential relationships in other online STEM courses is suggested. It is unknown if the instructional efficiency and hypothesized relationships are consistent throughout introductory undergraduate STEM or are more discipline specific.

Conclusions

This study provides key insights for researchers and practitioners interested in cognitive load and the Community of Inquiry framework. Of importance to researchers, this study presented key methodology for measuring CoI presences and cognitive load. First, the methodology employed here supports the use of an author-generated, open-source Python script for efficient cleaning and organization of transcript data retrieved from the LMS. Second, the instructional efficiency calculation can be applied to anonymous survey data. Furthermore, a sampling of student CoI Presence Densities can be evaluated as representative of the population, though each module must be evaluated in the cohorts of the course included in the sample.

Preliminary results indicate the instructor’s Presence Densities must be evaluated as census data as there is significant variability between instructors.

Of importance to researchers and practitioners, this study reaffirms the emerging trend in the literature for cognitive presence and cognitive load. The key takeaways from the results of this study are as follows:

1. Confirming previous reports, students tend to engage in discussions at lower levels of cognitive presence.
2. Confirming the authors’ previous study, discussion tasks with the highest extraneous cognitive load are understanding expectations and crafting the initial post, with high mental and temporal demand.
3. Students reported the lowest extraneous cognitive load for the task of applying instructor feedback to future discussion engagement. These findings warrant further quantitative and qualitative investigation.
4. Collectively, these results support further investigation to address the unclear relationships between Community of Inquiry and Cognitive Load.

With methodological uncertainties addressed, future researchers can more effectively explore correlations between cognitive load, CoI presences and subpresences, performance, persistence, and perspectives.

Declarations

The authors declared no conflicts of interests.

This work was funded by the National Science Foundation's Division of Undergraduate Education through the Improving Undergraduate STEM Education and Human Resources (IUSE:EHR) award, Level I (NSF Proposal Number 2044302).

Ethics approval for this work was granted by the Embry-Riddle Aeronautical University

Acknowledgements

Dr. Carey Witkov provided key insight into the current course design of the PHYS 102 course.
Funding: This work was supported by the 2020 Faculty Seed Grants program, Embry-Riddle Aeronautical University, Worldwide Campus, College of Arts and Sciences, Daytona Beach, FL

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Teaching and Learning with AI-Generated Courseware: Lessons from the Classroom

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Abstract
While research in the learning sciences has spurred advancements in educational technology, the implementation of those learning resources in natural learning contexts advances teaching and learning. In this paper, two faculty members at the University of Central Florida used courseware generated with artificial intelligence as the primary learning resource for their students. The selection and enhancement of this courseware is contextualized for each course. Instructor implementation practices over multiple semesters are described and related to resulting student engagement and exam scores. Finally, benefits of the adaptive courseware are discussed not only for student outcomes, but the qualitative changes faculty identified and the impact that iterative changes in teaching practice had on instructors as well as students.

Keywords: Courseware, Artificial Intelligence, Formative Practice, Learn by Doing, Automatic Question Generation, Automatically Generated Questions, Student Engagement, Learning Outcomes, Implementation, Teaching Practice

Schroeder, K., Hubertz, M., Van Campenhout, R., Johnson, B. G. (2022). Teaching and learning with AI-generated courseware: Lessons from the classroom. *Online Learning*, 26(3), 73-87.

Teaching and learning research are at the heart of moving educational practices forward, as it is knowledge of what works in natural learning contexts that benefits students. While there is enormous benefit in efficacy research that uses controlled experiments to produce results with high internal validity, effectiveness research that applies treatments to classroom settings provides external validity (O'Donnell, 2008). Both efficacy and effectiveness research have benefits, but effectiveness research is particularly beneficial for teaching and learning research as it is the application of a learning technology or pedagogical approach within a specific classroom that matters to the students learning in that instance. Effectiveness research in the classroom has generated new insights into teaching and learning with the rise of digital learning resources which generate a wealth of high-quality data (Goldstein & Katz, 2004; Singer & Bonvillian, 2013) that can provide valuable information to students, instructors, and researchers (Baker & Inventado, 2016). As noted by Koedinger et al. (2016), "the availability of process and outcome data from online courses makes it possible to investigate the generalizability of associations between learning method and outcomes" (p. 388). In this case, adaptive courseware was used as the primary learning resource, which generated engagement data that could be combined with exam grades and instructor observations to evaluate the effectiveness of this resource in their classrooms.

New learning technologies that are based in the learning sciences and able to generate new data insights are not a stand-alone solution for teaching and learning, but rather tools whose success depends on their implementation (Kessler et al., 2019; Sullivan et al., 2020). Implementation has long been an area of focus for the successful application of pedagogical interventions in the classroom (Fullan & Pomfret, 1977), and has been closely tied to effectiveness research (O'Donnell, 2008). Implementation in natural learning settings must also consider the contextual factors specific to each classroom setting, such as teaching model and modality, course subject, and student characteristics (Van Campenhout & Kessler, 2022). Effectiveness research in teaching and learning has the added benefit of identifying successful instructor strategies for implementation that can be put to practical use by other educators. In this paper, we present the implementation practices and student outcome results from two courses at the University of Central Florida wherein the faculty (and first authors) chose to use AI-generated courseware as the primary learning resource (Schroeder et al., 2021). The goals of this paper are to discuss the context for the use of the courseware, the implementation practices for each course across multiple semesters, and the resulting student courseware engagement and exam scores.

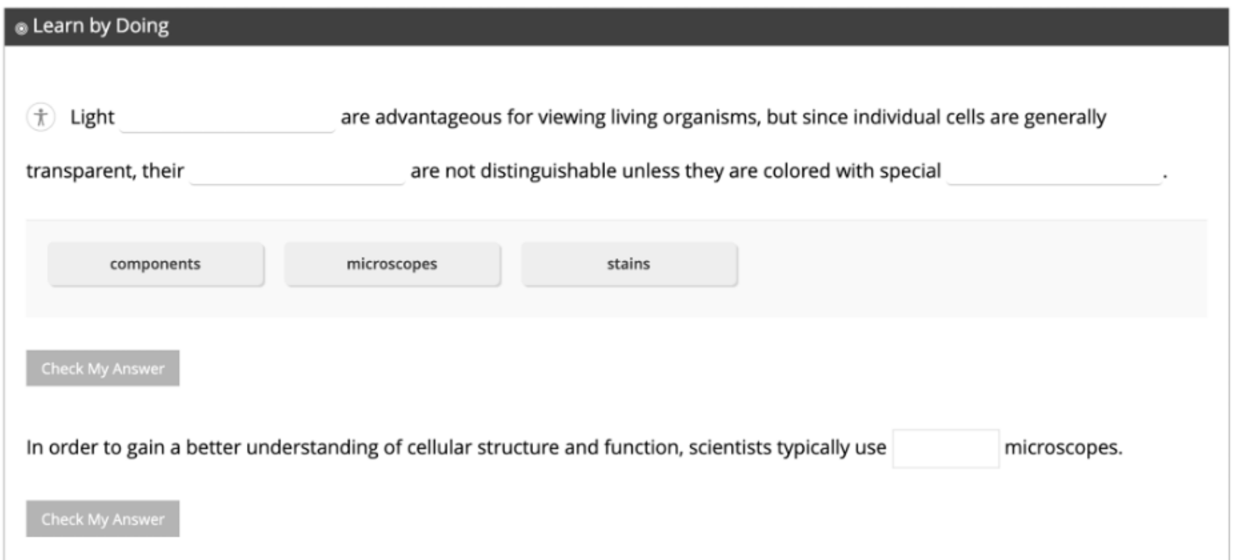
Literature Review

Learn by Doing

Courseware is a learning resource that integrates expository content with formative practice questions in short, objective-aligned lessons while also offering adaptivity and assessments within the flow of the student's learning path. The primary learning strategy employed in the courseware used in this study is the integration of formative practice into the text at frequent intervals in a learn by doing method, as seen in Figure 1. Students can answer the questions, receive immediate feedback, and continue attempts if they were incorrect at first. Formative practice is well known to benefit learning across many contexts and for all students but is especially beneficial to students who struggle (Black & William, 2010). By providing students with practice that they can use while they study, these questions act as no-stakes practice testing, which was found to have high utility and broad applicability relative to other study methods (Dunlosky et al., 2013). This close integration of text with foundational practice engages students in a cognitive process to receive, organize, store, and retrieve information (Ertmer & Newby, 2013). From Piaget's theory of cognitive development (1926) to more recent cognitive and constructive theories such as generative learning theory (Fiorella & Mayer, 2016), the role of the student as an active participant in the learning process is foundational to this learn by doing approach.

Figure 1

Automatically Generated Matching and Fill-in-the-Blank Questions Used as Formative Practice.



The application of this *learn by doing* method in online learning resources, such as the courseware described here, was studied at Carnegie Mellon University's Open Learning Initiative. This learn by doing environment was found to accelerate learning, increase learning outcomes, and support learners in both asynchronous and instructor-led settings (Lovett et al., 2008). Koedinger et al. (2015) found that doing practice while reading had an average of six times the effect size on learning outcomes compared to solely reading. This learning science principle was called "the doer effect," and follow-up research identified a causal relationship between doing this practice and higher learning outcomes (Koedinger et al., 2016). Causal doer effect research was replicated using courseware data from other natural learning contexts, extending the generalizability of results (Van Campenhout, Olsen, & Johnson, 2021). The doer effect has also been found when accounting for student prior knowledge and demographic characteristics, showing its utility for all learners (Koedinger et al., 2015; Van Campenhout et al., in press).

Instructor Implementation. Yet even though spending more time completing activities has a larger impact on learning outcomes than spending more time reading, students often underestimate the value of practice and overestimate the value of reading (Carvalho et al., 2017). In addition to student perception of practice, while instructors assign textbooks with the goal that students will read the assigned sections, it is known that students often do not use the textbook as intended (Fitzpatrick & McConnell, 2008). The learning science-based approach of the courseware itself does not guarantee that it—like traditional textbooks—will be used as intended by instructors. This is when the combination of platform data and instructor intervention is key. The combination of text and formative practice offers instructors a practical means by which to monitor student engagement and learning within courseware. Data dashboards with learning analytics on student engagement and performance act as a type of "course signal" for instructors that can be used for intervention and has been shown to increase retention in courses (Arnold & Pistilli, 2012; Baker, 2016). In this learning environment, the platform provides the data analytics but relies on the instructor to interpret and act appropriately based on the context of their teaching and learning environment (Baker, 2016; Van Campenhout & Kessler, 2022). The proper utilization of the educational environment and the learning technology together should produce better results than either could produce on its own (Ritter et al., 2016).

O'Donnell (2008) identified that implementation is a key aspect of effectiveness research to understand how well an intervention performs in natural settings, and the importance of this cannot be understated for educational technology. Research that compared instructors who received the same training and instructions and used the same courseware in their courses identified that differing instructor implementation policies had a large impact on overall student engagement with the courseware (Van Campenhout & Kimball, 2021). Given the influence of instructors over student use of their learning resources, it is valuable to investigate specific instructor implementation practices from naturally occurring learning settings that benefit student learning (Hubertz & Van Campenhout, 2022). In addition to identifying successful teaching practices that optimize student use of technology, it is critical to focus on the natural iterative improvement cycles that are part of this teaching and learning process (Sullivan et al., 2020; Van Campenhout & Kessler, 2022).

Methods

Courses and Participants

Two faculty members self-selected Acrobatiq SmartStart courseware (described below) for their courses, Microbial Metabolism (Microbe) and Psychology of Sex and Gender (Psychology). The Microbial Metabolism course is taught by a Burnet School of Biomedical Sciences faculty member and is typically populated by fourth-year students. Five years ago, the Microbial Metabolism course had been taught in a traditional face-to-face, lecture-style teaching model. Before the pandemic, the instructor then changed the course to a hybrid model (mix-mode) using some of the same traditional lecture format before finally adopting a flipped-blended hybrid model where all the lectures were prerecorded, and active learning exercises were implemented during face-to-face classroom sessions. After a year of using the flipped-blended hybrid model, the AI-generated courseware was adopted to help students learn the material better because moving from traditional lectures to the flipped-blended hybrid model without courseware only slightly increased the student's learning outcomes.

The Psychology of Sex and Gender course had previously been called Psychology of Women and used a different text. The instructor's choice to switch to Acrobatiq courseware was largely driven by the need to have a textbook with more contemporary content and research, and to have adaptive courseware with that title. The UCF Center for Distributed Learning and Pegasus Innovation Lab aided in identifying the courseware options and the ability to turn the Psychology of Sex and Gender e-textbook into courseware through Acrobatiq's SmartStart process was an advantage. This type of niche subject—much like the Microbe textbook—does not typically come with custom courseware, so the ability to create it was ideal. The learn by doing approach of courseware would also be beneficial for this textbook in particular, as historically the psychology students struggled more with the biology-intensive content included in this new textbook compared to the previous title. This Psychology course was taught entirely online with synchronous class sessions, but in a flipped blended model. Students were primarily third- and fourth-year students but also nearly 70% of students were transfer students from other smaller schools.

Courseware. The courseware used for both courses was generated using the SmartStart process (Dittel et al., 2018) that applies artificial intelligence to an e-textbook to transform it into courseware (Jerome et al., 2021). The development of automatic question generation systems has become a popular research area, given the broad potential for application in education (Kurdi et al., 2020), including for use as formative practice. This automatic question generation system uses the e-textbook to create the volume of formative practice needed to engage students in the learn by doing method. Two different types of questions are generated (as seen in Figure 1): fill-in-the-blank (FITB), where students must type in a missing term, and matching, where students drag and drop three available terms to the correct locations in a sentence. The FITB questions are a recall cognitive process dimension on Bloom's Taxonomy while the matching are a recognition type (Anderson et al., 2001), and both of these types have been long researched for their learning benefits (Andrew & Bird, 1938). The Psychology of Sex and Gender textbook (Bosson et al., 2019) was used for the SmartStart process and produced over 600 formative practice questions. The Microbe textbook (Swanson et al., 2016) was used to produce over 400 questions. Research on these automatically generated questions compared them to human-authored questions and found no meaningful difference in engagement, difficulty, and persistence performance metrics (Van Campenhout, Dittel, et al., 2021) as well as question discrimination (Johnson et al., 2022).

To take full advantage of other features of the courseware platform (i.e., predictive learning estimates and adaptivity), the initial courseware produced with SmartStart was further enhanced by the instructors. For the Psychology course, additional human-authored multiple choice and true/false questions were taken from the textbook ancillary material and added as formative practice. For Microbe, some additional questions were added from ancillary materials and some were written by the instructor. In addition to the research that did not indicate a difference in performance of the automatically generated and human-authored questions (Van Campenhout, Dittel, et al., 2021), the instructor noted that it became difficult to distinguish which questions were generated and which were written (with the exception of the extraordinarily difficult questions written specifically to challenge students). Adaptive activities were written for the most challenging chapters of content in both courses. Designed to scaffold based on each student's predictive learning estimate, the adaptive activities have been shown to improve outcomes (Van Campenhout et al., 2020). The faculty and instructional designers wrote the adaptive activities to assist students with the most challenging content where they would most need scaffolded support. Creating the adaptive components was also made more feasible in a short time because the bulk of the formative practice was automatically generated. Instead of spending copious amounts of time writing and implementing the foundational reading comprehension questions, the instructors and instructional designers could focus on the scaffolding and conceptualization of the adaptive activities.

Implementation and Results

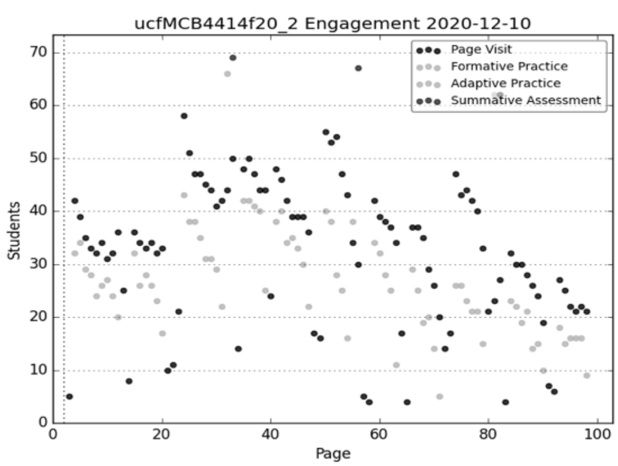
Microbe

The Microbe course had historically been taught as a face-to-face, lecture-style course attended by a large class of students as a part of their program of study. This approach is common and likely familiar to most faculty members. However, research has shown a significant benefit to student learning when a flipped-blended model is used for teaching and learning, where students use technology outside the class to learn the content and in-class time is led by instructors to expand student knowledge and provide feedback (Margulieux et al., 2015). Therefore, as the instructor changed to a hybrid (virtual and in-person) approach and flipped the classroom, the learning resource needed to provide more engagement for students and resources for the instructor.

The courseware was first used was the Fall of 2020. Students were assigned the courseware as they would have been assigned the e-textbook. During this first semester, the instructor did not provide any incentivization in the form of points or a grade for the courseware's "Learn by Doing" formative practice activities on the lesson pages (Figure 1), expecting that because students had the courseware, they would take advantage of it. Points were assigned in the first semester for completing the summative chapter quiz and the Personal Practice (adaptive activity) questions. Data gathered by the courseware platform were used to create engagement graphs that showed how many students (x-axis) read and did practice on each lesson page of the courseware (y-axis). In Figure 2, the fluctuation of the blue dots on the vertical axis means students chose to read some pages but not others in an inconsistent pattern. The lower red dots show that of the students who did read the lesson pages, only some of those students did the practice available. General attrition is seen over the course of the semester, which is typical as students use their learning resources less over time.

Figure 2

The Microbe Fall 2020 Engagement Graph.



Prior to the next semester, Spring of 2021, the instructor made some changes to how the courseware was implemented, with a goal of increasing student engagement. Thirty points were assigned to completing a minimum threshold of 80% of the formative practice in the courseware. This incentive had a visible change in student engagement, as seen in Figure 3. Student engagement was more consistent for both reading and doing throughout the courseware than the previous semester. While some students still did not do practice on pages, this proportion is visibly smaller than the previous semester.

Figure 3

The Microbe Spring 2021 Engagement Graph.

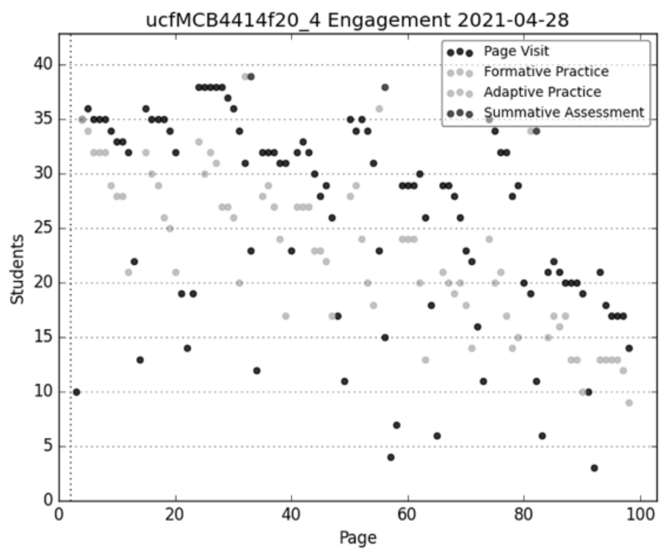


Table 1 presents the raw scores for the three exams and the final in the Microbes course. The Fall 2020 course was the largest of the semesters included, and first to use the courseware. The Spring 2021 course shows lower mean scores than the previous term. However, as a course that has been run every spring and fall term, the lower mean scores for the spring semester are consistent with prior spring courses and so therefore are not particularly unusual. The Fall 2021 course shows similar mean scores to those of Fall 2020 with the notable trend of higher low scores on ranges. When students took their time on the formative assessments, summative quizzes, and adaptive activities, students' exam scores and outcomes tended to improve. Unfortunately, not all students took their time and those who rushed through the assignments had exam scores that reflected this.

Table 1
Raw Exam Scores from the Microbial Metabolism Course from Fall 2020 to Fall 2021.

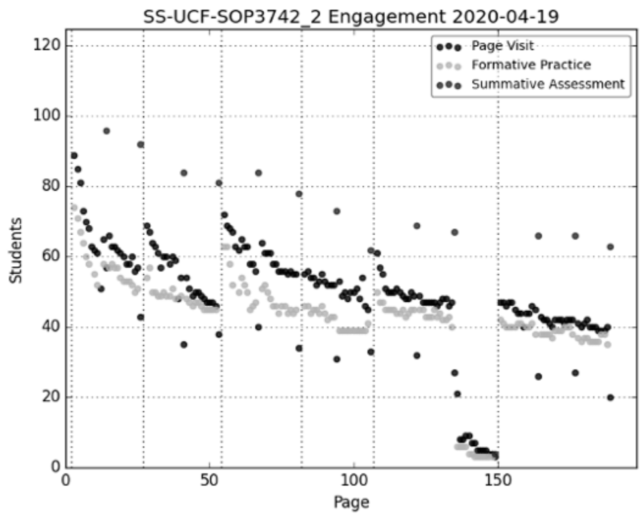
		Exam 1	Exam 2	Exam 3	Final
Fall 2020	Mean Score	82%	66%	69%	71%
	Score Range	48–96%	22–92%	28–96%	42–99%
	n Students	67	67	68	68
Spring 2021	Mean Score	77%	60%	60%	63%
	Score Range	52–94%	28–88%	26–86%	28–95%
	n Students	38	37	37	37
Fall 2021	Mean Score	81%	66%	70%	72%
	Score Range	60–98%	34–92%	32–96%	38–96%
	n Students	33	32	33	31

Students also verbalized to the instructor increased confidence on the exams after having done the courseware practice, a marked shift in attitude toward assessments from previous years. In addition, the quality of student engagement in class and online increased. Students asked more in-depth questions and responded to peers in discussion boards with more detail. Exams provide one measure of student learning, but the qualitative observation of student interactions both in virtual and in-person settings can also reveal a change in the depth of understanding students acquire.

Psychology

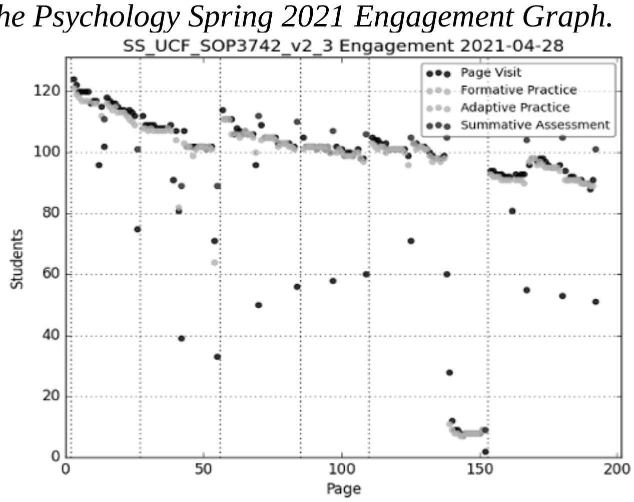
The Psychology of Sex and Gender course had been taught in an entirely online format with large sections, so the instructor was accustomed to teaching and learning with a flipped-blended format and interactive digital resources. The first section of the Psychology course taught with the courseware was in the Spring of 2020. The instructor assigned sections, posted reminders in the learning management system, and reminded students to do the courseware in class as well. In addition, two percentage points were assigned to completing a minimum of 85% of the practice in the course. The engagement graph (Figure 4) shows overall attrition in student engagement as the course progresses as well as within units, which, as noted previously, is typical engagement behavior. A small number of students read the pages but did not do the practice. The green summative assessment dots floating well above the nearest blue reading dots indicate a large portion of students entered the courseware only to take the assessments.

Figure 4
The Psychology Spring 2020 Engagement Graph.



The Psychology instructor similarly updated implementation practices for the following run of the course in the Spring of 2021. In addition to increased emphasis on the benefit of practice, 20% of the students' grade would be accounted for by completing a minimum of 85% of the practice. As seen in Figure 5, the engagement graph is closer to a horizontal line; the majority of students engaged with almost the entire courseware. The red practice dots are also next to or on top of the blue reading dots, which means nearly all students who read the pages also did the practice.

Figure 5
The Psychology Spring 2021 Engagement Graph.



In addition to increasing student engagement, exam scores also rose over the semesters. As seen in Table 2, the Fall 2019 semester—when only the e-textbook was used—shows the lowest mean scores for each exam. The Spring 2020 semester when the courseware was first used shows an increase in exam scores, while the Spring 2021 semester (when more points were assigned and more students did the practice) shows even higher mean exam scores. As seen in the Microbe course, the lowest scores in the ranges also increased for each semesxter. These results strongly relate to the dramatic changes in student engagement visible in Figure 5.

Table 2
Student Exam Scores for Psychology from 2019 through 2021.

		Exam 1	**Exam 2**	**Exam 3**
Fall 2019	Mean Score	60%	63%	71%
	Score Range	39–101%	12–104%	19–104%
	n Students	97	78	71
Spring 2020	Mean Score	70%	68%	78%
	Score Range	23–98%	24–104%	39–104%
	n Students	98	86	71
Spring 2021	Mean Score	77%	78%	79%
	Score Range	43–102%	42–102%	42–99%
	n Students	106	105	104

Discussion

Students are best served when educators use learning technology as a tool. While advances in the learning sciences have led to more comprehensive and effective learning resources, they are best optimized by instructors for each specific learning context. The AI-generated courseware combines textbook content in niche subjects with large volumes of formative practice questions, enabling students to engage in learning by doing. The AI-generated courseware was beneficial to instructors first in that courseware for these niche titles did not exist previously, but second in that the automatically generated questions allowed them to spend their development time on targeted adaptivity. Years of teaching experience give faculty members unparalleled insight into where and how students struggle with content, and both instructors were able to apply their knowledge to tailor the courseware. Even the context of the teaching model and student characteristics were considered when instructors considered how to utilize the courseware in their teaching practice.

Iterative improvement is also a natural process of teaching and learning. Both faculty members believe in changing various components of teaching over time to better student outcomes—whether that is a new textbook, a new teaching model, or a new learning technology. The changes made in the implementation of the courseware over several semesters impacted student engagement and learning outcomes. Natural learning contexts differ greatly from controlled experiments; in these environments it is the instructor who is in the best position to identify the unique circumstances and provide the best conditions for learning. Iterative changes over time are an indication of student-centered teaching practices. It is also worth noting that though the addition of courseware as a learning resource and the changes in teaching practice were done to benefit students, faculty members also found that adding the courseware to a flipped-blended model had surprising advantages. Work-life balance improved and enjoyment of teaching increased. Research in teaching and learning often focuses more on learning, but future research should also focus on iterative improvements that can benefit instructor satisfaction as well. Given how impactful educators are on student engagement and outcomes, instructor perceptions and satisfaction deserve increased consideration.

Finally, this paper showcases the advances in teaching and learning research that can be identified when educational institutions and educational technology companies partner to share data and findings. The courseware platform provides enormous quantities of data for analysis that can advance what is known about the science of learning. Yet not all meaningful data can be collected via technology. Faculty members were able to identify qualitative changes in their students, such as increased engagement, preparedness, and satisfaction. Student-to-student interactions in online discussion boards improved, indicating that there are secondary benefits to a learn by doing approach outside of assessments. Instructors were also able to monitor data through dashboards and take steps to identify struggling students not previously available, which can have a meaningful impact on those specific students. Those same data dashboards identified where the entire class struggled with course content, which allowed the instructors to specifically target that content for additional explanation and practice. Combined data sources reveal how instructor implementation practices can change student engagement and scores. Further collaboration on future research could include investigating the impact of learning by doing for specific groups of students, the benefits of prerequisite adaptive testing, and methods of increasing instructor enjoyment and satisfaction during teaching and learning.

Acknowledgements

We would like to thank the UCF Pegasus Innovation Lab for their help identifying new teaching and learning solutions, the UCF instructional designers Joe Lloyd and Jessica Tojo for their work on enhancing the courseware, and Emily Svara for her assistance writing questions for Microbes.

Declarations

The authors declared no conflicts of interests.

The authors declared that they received no funding.

Ethics approval for this work was granted by the University of Central Florida.

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Introduction to OLJ Volume 26, Issue 3

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In addition to the papers presented at OLC conferences this past year, this third issue of OLJ for 2022 also contain a selection of papers from our regular submission and review process. These papers investigate a range of issues including the definitions of terms in the field, undergraduate students' anxiety, culturally responsive teaching, social presence, and faculty concerns in online learning environments.

Ask a few people at a conference the meaning of phrases such as online learning, hybrid learning, and blended learning and you will likely get some similar answers, but you may also find some differences. In the research literature, more disputes arise regarding definitions. Interacting with federal agencies raises even deeper differences with divisions within the same agency using different terminology about distance education, for example. This lack of agreement on basic definitions of key terms in the field of online learning is potentially problematic for research, administration, policy, and practice. The first paper in this section, "Defining Different Modes of Learning: Resolving Confusion and Contention through Consensus" by Nicole Johnson of the Canadian Digital Learning Research Association, Jeff Seaman of Bayview Analytics, and Russ Poulin of the WICHE Cooperative for Educational Technologies investigate this issue. The authors review the literature to reveal that there are some basic disagreements. They then describe the development of a questionnaire based on definitions found in the literature which they administered to a sample of 987 faculty and 1,051 administrators representing a full range of institutional types in the U.S. Contrary to the literature they find a relatively high level of consensus around "big bucket" definitions in which learning modes are described in terms of their most basic characteristics. The study provides a footing for instituting common language and shared understandings about online and hybrid learning and course offerings.

The second paper in Section II is "Exploring the Factors Associated with Undergraduate Students' Online Learning Anxiety: Development of the Online Learner Anxiety Scale (OLAS)" by Albert D Ritzhaupt, Muhammad Rehman, of the University of Florida; Matthew L Wilson of Kennesaw State University; and Krista Ruggles of Utah Valley University. Anxiety is a very common phenomena in educational settings and can be especially problematic in online settings that may lack social support. The forced adoption of online learning in response to COVID-19 only intensified the potential for anxiety among learners in an already stressful time. This study investigates the measurement of anxiety in online education settings first developing a conceptual framework then an anxiety scale based on this model. Using a sample of 297 undergraduate students the researchers analyzed data for descriptive statistics, internal consistency reliability, exploratory factor analysis, and correlational analysis. The resulting Online Learner Anxiety Scale (OLAS) produced reliable scores that validly measure online learning anxiety among undergraduate students.

In "Culturally Responsive Teaching in an Undergraduate Online General Education Course" authors Alison Lockman and Barbara Schirmer of Walden University investigate faculty pedagogy that seeks to make learning more relevant and effective for diverse students in online settings. This is an important topic given that culturally responsive teaching has the potential to support success among students who may struggle to persist in college coursework. The authors' note that this is an underexplored area of research and employed a qualitative coding approach to analyze data from 24 online discussion sections across 12 faculty. Findings indicate inconsistent use of culturally responsive teaching strategies in online classrooms. Results reveal non-differentiated responses, overlooked opportunities for addressing linguistic or cultural differences, and limited encouragement for collaboration or sense of community. The authors note that culturally responsive teaching was employed at times, despite the lack of training around this approach. They conclude that more research and professional development is warranted.

Authors Richard Fendler and Craig Ruff of Georgia State University take on a common issue affecting college students in their paper, “Advising Sleep Deprived Students to Take Online Classes.” Sleep deficiency affects a majority of students and has negative consequences on academic performance. The authors review biological, societal, and technological factors associated with poor sleep and conclude that, for many students, the flexibility of asynchronous online learning may be a solution to better sleep and better grades. Controlling for a number of variables the authors find that perceived sleep deprivation has a significant negative impact on the performance of student in face-to-face classrooms but the same is not true of students in online asynchronous settings. The study concludes that academic advisors can benefit from understanding that sleep issues might be ameliorated by advising students to take more online courses.

The COVID-19 pandemic impacted institutions of higher education in different ways depending on the experience and resources to which they had access. There were also likely disciplinary differences in making a successful transition to distance education and the authors of “Transitioning to Online Learning Amid COVID-19: Perspectives in a Civil Engineering Program” Munjed Maraqa, Mohamed Hamouda, Hilal El-Hassan, Amr El Dieb, and Ashraf Aly Hassan outline unique challenges and success confronted by engineering students and faculty in United Arab Emirates University. The authors surveyed both learners and their instructors about barriers to the online transition. Results from students indicated that low student engagement and challenges associated with online exams are significant areas that need improvement. Nonetheless more than half of the students preferred online learning to face-to-face instruction, especially as they grew accustomed to it. Faculty had a difficult time developing and administering tests and struggled with the short period of time to prepare to teach online generally. The authors conclude that more training is needed to address these issues.

Social presence is a complex concept and researchers seem to disagree as to exactly what it means. Based on communications research conducted in the 1960s and 1970s this construct was taken up by scholars in the field of distance learning in the 1990s and continues to be a topic of interest. The next paper in this section is “Creating the Projecting a Social Presence Measure: Self-Rated Behaviors that Indicate Mediated Presence” by Scott Christen of Tennessee Technological University, and Michelle Violanti and Jennifer Morrow of the University of Tennessee. In this study the authors present a new instrument to measure social presence in online education settings. Through two phases the authors describe the development of the instrument and its validity and reliability testing. Unlike previous measure of social presence that typically rely on three domains (affect, cohesion, and interaction) the current paper adds two additional categories to the social presence construct. Affective communication was divided into sharing of emotions/feelings and paralinguistics. Cohesive communication was split into small talk and use of first names while excluding the use of inclusive pronouns found in other measures of social presence.

Numerous strategies exist that may help students to engage in active learning and the collaborative construction of knowledge. The next paper “Using Online Tools to Develop Higher Order Learning Among Tertiary Students” by Angela Page of the University of Newcastle, Australia investigates one such strategy—students in developing their own multiple-choice questions on course content. The author examines an online platform that allows student to both author multiple choice questions on the topic they are studying and engage with each other about the questions and their rationales for answers. Through an analysis of student work, which indicates growing complexity throughout the period of the study, the author concludes that this platform helps promote deeper learning through scaffolded interaction.

Another strategy for encouraging more active and collaborative learning is through well designed group projects. Despite evidence indicating their effectiveness many students have had negative experiences in group work and therefore may not fully engage in the group activities when encountering them in subsequent classes. In “Enhancing College Students’ Online Group Work Perceptions and Skills Using a Utility-Value Intervention” Alison Kelly, Virginia Clinton-Lisell, and Kendall Klein of the University of North Dakota investigate a solution to this issue. The authors review literature indicating both the value of group projects and the benefits of improving student attitudes toward this pedagogy in facilitating deeper engagement with group learning. Using an experimental design (which prior investigators of this topic have called for) the authors implemented an intervention with one group of students designed to enhance their understanding and appreciation of the benefits of group work. Results of the intervention were promising but mixed with improvement in attitudes but not overall performance. This may not be surprising given the limited duration of the treatment.

Universities depend on contingent labor to function. Part-time faculty provide a large share of instruction in higher education and many institutions employ non-tenured, part-time faculty to teach a majority of their online offerings. Clearly the professional development needs of adjunct faculty are an important issue and are investigated in “Exploring the Pedagogical Struggles and Professional Development Needs of Online Adjunct Professors: A Case Study” by authors Dennis Butters and Courtney Gann of Amridge University. Using a qualitative case study approach the author surveyed and interviewed experienced online adjunct faculty about their challenges and the kinds of professional development opportunities that would help address these. Results indicate that participant responses about professional development were very consistent within this case study. All of the respondents needed more training in course preparation and technology awareness; access to course materials and online resources; and improved communication, interaction, and engagement.

Advisors play an essential role in connecting with students and engaging them with the institution, especially in online settings. In the next paper, “Get Connected: A Scoping Review of Advising Online Graduate Students,” by Holly Meyer and Anita Samuel of the Uniformed Services University of the Health Sciences and Kristi Preisman of the College of Saint Mary, the authors investigate research that has been conducted on this key role using systemic review methods. They reveal that the literature on online graduate advising can be structured into five themes: (a) communication and feedback, (b) building community, (c) program policies, (d) advisee’s personal and academic growth, and (e) technical issues. Three recommendations are proposed including building trusting relationships with advisees, building a community of students, and knowing program policies, requirements, and technology platforms.

Faculty attitudes toward technology and online learning shape adoption, use, and effectiveness of online instruction. In “Faculty Perceptions of Online Education and Technology Use Over Time: A Secondary Analysis of the Annual Survey of Faculty Attitudes on Technology from 2013 to 2019,” Nicole Johnson, George Veletsianos, Olga Belikov, and Charlene VanLeeuwen of Royal Roads University provide a longitudinal view of these important issues. Results disclosed small change over time in some areas and a large degree of change in others such as growth in proportion of faculty who believe that online courses can achieve the same learning outcomes as in-person courses. These findings, collected prior to the pandemic, clearly show increasingly positive perceptions of online learning efficacy across a broad segment of faculty over the past seven years.

We hope that these recent investigations provide direction for researchers and practitioners seeking insights about 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.

Defining Different Modes of Learning: Resolving Confusion and Contention Through Consensus

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Abstract
There has been longstanding contention about how terms related to online and hybrid learning should be defined. In this study, we report survey findings on how administrators and faculty apply the following terms in practice: online learning, hybrid learning, hyflex learning, in-person learning, synchronous learning, and asynchronous learning. Drawing upon the literature, the research team developed survey definitions for each of these terms. The survey then asked participants to rate the extent to which they agreed with the survey definitions. A total of 987 faculty and 1,051 administrators participated in the study. Participants represented the full range of higher education institutions in the United States. The key finding from the study is that there was widespread agreement with the survey definitions, which is contrary to much of the literature that indicates confusion and contention about how online and hybrid learning terms should be defined. In light of the findings, we provide a framework for categorizing common learning modes and the variations that exist within these modes. This study provides a foundation for establishing common language and shared understandings as online and hybrid course offerings (and learning technologies, in general) continue to evolve.

Keywords: Definitions, online learning, hybrid learning, hyflex learning, teaching modes

Johnson, N., Seaman, J., Poulin, R. (2022). Defining different modes of learning: Resolving confusion and contention through consensus. *Online Learning, 26*(3), 91-110.

Finding consensus when defining online learning has been challenging for scholars, higher education institutions, and faculty for over two decades (Singh & Thurman, 2019). As technology has evolved, the integration of technology into teaching and learning practices has increased. New words such as blended learning, hybrid learning, and hyflex learning have emerged to describe the various ways institutions can deliver learning experiences to students. There continues to be a lack of consensus among institutions, their policies, and individuals regarding what these words mean and the type of learning experiences these terms describe.

The onset of the COVID-19 pandemic added to the confusion as phrases like "emergency remote teaching" (Hodges et al., 2020) entered the broader vernacular as many educators with no previous online teaching experience had to deliver their courses online (Johnson et al., 2020). In the wake of the pandemic, there now appears to be more receptiveness toward online learning as a mode of instruction (Seaman & Johnson, 2021), leaving institutions wondering how to best name and describe their changing instructional practices. Agreement on modality definitions also have deep policy implications. In the United States, the term "distance education" is defined differently by the Veterans Administration, armed forces, accrediting agencies, and states. The U.S. Department of Education has at least three versions of definitions. This causes confusion and does not even consider the different variations of digital learning that have emerged. The purpose of this study is to move beyond the longstanding scholarly debate about how the terms online learning, hybrid learning, hyflex learning, and in-person learning "should" be defined and to investigate the application of these terms in higher education settings. The research questions guiding the study are as follows: What is the level of agreement on the meanings of commonly used terms related to online and hybrid learning? Where is there disagreement and what are the reasons for any disagreement? What does the data related to agreement and disagreement tell us about the ability of higher education to coalesce on the meanings of terms related to online and hybrid learning?

Literature Review

Online learning and hybrid learning (and the offshoots of these terms) have their origins in distance education. The U.S. National Center for Education Statistics (NCES) defines distance education as "education that uses one or more types of technology to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor synchronously or asynchronously" (para 1). In the 1990s, higher education institutions in the USA gained access to the Internet (Saba, 2011). Distance education materials could then be accessed via the Internet rather than through communications technologies or mailed to students, creating a learning experience commonly referred to at that time as e-learning or online learning.

At the turn of the millennium, as Internet technologies advanced and became part of people's everyday lives, e-learning gradually became the predominant form of distance education. There was also an increasing interest in combining elements of online learning with a traditional on-campus learning experience which led to the rise of learning experiences referred to, mostly interchangeably, as either hybrid or blended learning (Garrison & Vaughan, 2008). As faculty and institutions experimented with different ways that learning experiences could be delivered and accessed, new terms like hyflex and multi-access learning appeared in the vernacular (Beatty, 2019; Irvine et al., 2013). A side-effect of having an expansion in delivery modes over a relatively short span of 30 years was the simultaneous eruption of naming conventions to describe idiosyncrasies in course delivery. Despite decades of scholarly debate on how terms like online learning and hybrid learning should be understood and applied, there has been no clear consensus (Johnson, 2021; Singh & Thurman, 2019; Smith & Hill, 2019).

Ample literature offers opinions on how online learning should be defined; however, research investigating how online learning and related terms are put into practice is lacking. We begin the literature review with an overview of four research studies focused on defining online and hybrid learning, then progress into a discussion of prominent scholarly perspectives on how to define different learning modes.

Specific to online learning, Moore et al. (2011) used a mixed-methods approach, combining an analysis of the literature on e-learning, online learning, and distance learning with a small-sample survey to investigate whether the scholarly community was using these terms consistently. They found “great differences in the meaning of foundational terms that are used in the field” (p.134). They noted that loose meanings lead to challenges when comparing similarly-named learning environments for research or scholarly collaborations. Singh and Thurman (2019) conducted a systematic literature review of the definitions for online learning over a 30-year span. They identified “forty-six definitions of online learning with 18 synonymous terms,” which they added “is indeed a fertile ground for confusion among scholars and researchers” (p. 301). They noted that scholars often used in-person learning as a point of contrast in defining online learning.

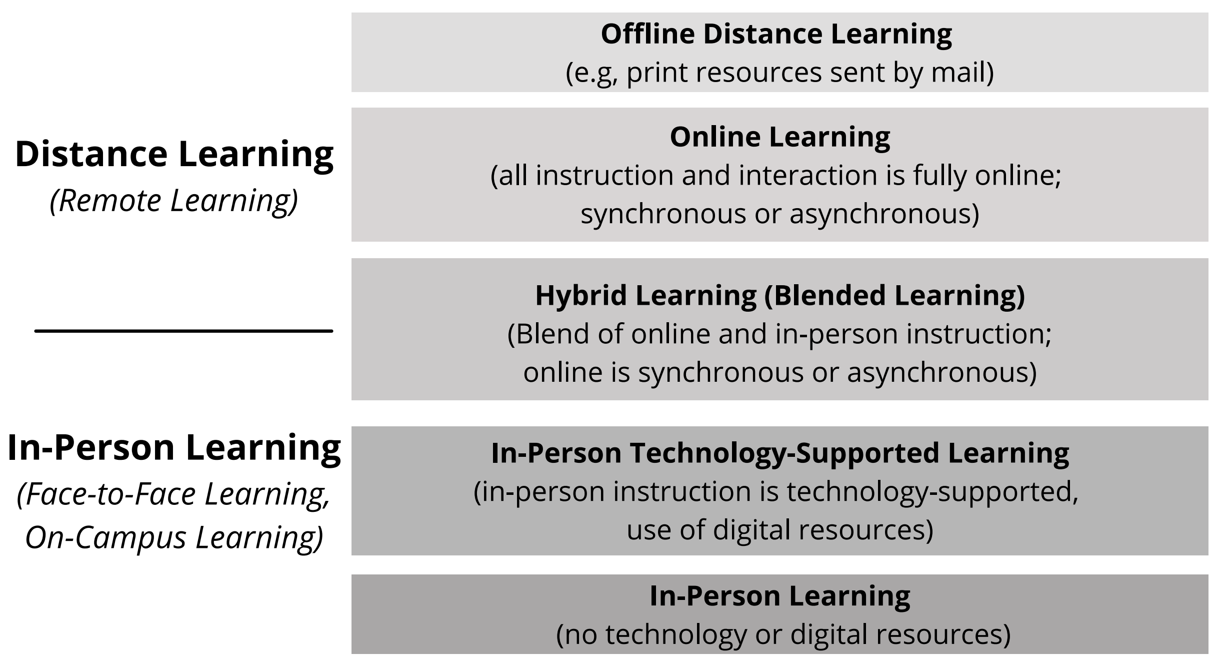
Specific to hybrid learning, Smith and Hill (2019) performed a systemic review of the literature on the definition of blended learning, acknowledging that the word *blended* is often used interchangeably with hybrid learning. Through their analysis, they identified the four most frequently cited definitions of blended learning, three of which simply defined it “as the combination of face-to-face and online learning” (p.387). The fourth frequently cited definition identified by Smith and Hill (2019) was a definition put forth by Allen and Seaman (2014) that stated, “30-79% of content is delivered online” (p.7). This definition is based on Allen and Seaman’s (2003) earlier work on defining online learning to track online enrollments. As Dr. Seaman is a co-investigator and co-author of the present study, he offers the following comment about the percentage approach to defining blended learning being a widely cited definition:

> The percentage-based definition for blended/hybrid learning in the 2014 report stems from our early work tracking online enrollments. When we piloted the first survey in 2003, asking about online enrollments, we used the term “fully online.” This was the first time that most institutions were being asked for online enrollments, and most did not have tracking mechanisms in place. We found that institutions needed far more guidance to know which courses qualified as “online.” A large proportion of institutions responded with questions if a particular instance would qualify or not. The “fully” portion of the definition caused the confusion—any item that was not online might, therefore, eliminate a course as online. For instance, some institutions questioned whether students using a printed book caused the course not to be online. We decided to use a percentage-based approach to distinguish “fully online” from other learning modes so that ANY small exception could be included and still be considered an online course. The decision to use “course content” was critical, as many questions were about non-course-related items. On the other hand, the choice of 80% or more to differentiate online learning from blended/hybrid learning was arbitrary. While the results from later surveys showed that virtually all the reported “online” courses were 100% online, we did not know this at the time. The percentage approach proved unsuccessful for tracking blended/hybrid courses, and the blended course definition was never used for data reporting.

Smith and Hill (2019) concluded that the literature related to blended learning showed “a lack of definition, clarity, and consistency” (p. 390), varying practices, and a tendency for such practices to be developed by individual instructors rather than at an institutional level. They identified a “need for shared understandings across the sector of what blended learning looks like in practice” (p.393).

Examining definitions related to digital learning more broadly, Johnson (2021) conducted a research study designed to identify and understand the inconsistencies, varying terms, and definitions for online and hybrid learning. In response to the variance in how terms were being applied (within and across institutions), Johnson introduced the Modes of Learning Spectrum (Figure 1) to categorize commonly used terms for digital learning. Johnson defined digital learning as “an overarching term that captures all kinds of technology-supported learning” (p.2). According to Johnson (2021), the Modes of Learning Spectrum uses definitions provided by institutions to provide a framework that offers “clarity where there has previously been confusion, contradiction, and ambiguity” (p.10). She added that the Modes of Learning Spectrum is “deliberately broad and enables consistent clarification of different modes of learning based on the characteristics of that mode, despite what that mode might be called at an individual institution” (p.7).

Figure 1
Modes of Learning Spectrum (Johnson, 2021)



Note: Johnson (2021), the lead author of this report, is the creator of the Modes of Learning Spectrum, which was published in a report by the Canadian Digital Learning Research Association (CDLRA) under a “CC BY-ND” license. Dr. Johnson and the CDLRA have granted permission to publish the revised version of the Modes of Learning Spectrum (above), a derivative work of the original. https://creativecommons.org/licenses/by-nd/4.0/

Collectively, the authors mentioned above make the point that there are a variety of meanings attached to these terms and that the lack of consensus within the scholarly community creates problems for conducting and communicating research and for collaborative efforts. Different types of online learning (e.g., asynchronous online, synchronous online) and hybrid learning (e.g., flipped learning, hyflex learning) add to the confusion.

Hyflex learning is a term that is currently gaining popularity in the post-pandemic higher education landscape, and it warranted special investigation as part of this study. According to Beatty (2019), a hyflex learning experience allows students to choose their mode of learning on any given day and move fluidly between attending their classes in-person, synchronously online, and asynchronously online as they see fit. A key characteristic of hyflex learning is that the locus of control lies with the student.

Similarly, Irvine et al. (2013) and Irvine (2020) described multi-access learning, which is sometimes used synonymously with hyflex learning (Beatty, 2019). Irvine (2020) positioned multi-access learning as a model with four possible levels of access (that are driven by student choice): face-to-face learning, synchronous online learning, asynchronous online learning, and open-access learning. She clarified, “While the first three are modalities, the fourth is concerned with open access to course materials and/or discourse. Full choice of modality or inclusion of open access is recognized as not always being possible to implement” (para. 8). Irvine’s multi-access model allows for only some access options to be made available to students in any given course. In contrast, Beatty’s hyflex model requires that all the possibilities (in-person, online synchronous, and online asynchronous) be made available to the students for every class within the course.

Ultimately, the varying definitions for key terms related to online and hybrid learning have come into being in a “top-down” manner with individual scholars assigning meanings to these terms based on theoretical and philosophical discourse. The present study takes a “bottom-up” approach, exploring how these terms are being used in practice and investigating the extent to which consensus exists for these terms within the broader higher education community.

Methods

WCET (the WICHE Cooperative for Educational Technologies) funded the survey and analysis. Bay View Analytics conducted the survey in partnership with the co-authors, WCET, the Canadian Digital Learning Research Association (CDLRA), Online Learning Consortium (OLC), Quality Matters, and the University Professional and Continuing Education Association (UPCEA). The research team, listed as the authors of this report, had sole responsibility for the survey design and data analysis. Only the research team had access to the raw data.

Participants

The data for this report comes from survey results of two complementary national samples of higher education administrators and teaching faculty. The primary sample for the study used email lists from a commercial source, Market Data Retrieval. The sample selection process was multi-stage, beginning with selecting all records that matched the criteria for this study (faculty teaching at least one course and academic administrators). Individuals were then randomly selected from the master list to match national proportions by the size of the institution, control of institution, and Carnegie Classification to produce a second-stage selection of teaching faculty and academic administrators representative of the higher education universe. All records in this primary sample included full contact information for the individual and identification of the institution. The resulting list was checked against opt-out lists, as well as for non-functioning email addresses.

Additionally, a secondary sample was constructed from open calls for participants sent to the memberships of WCET, OLC, Quality Matters, and UPCEA. Each organization was provided with a survey link that they shared through member communications and newsletters. Respondents for the secondary sample were asked to provide the name and location of their institution. To ensure that the respondents came from U.S. higher education institutions, their institutional responses were matched to the National Center for Educational Statistics' IPEDS database, and their email address was checked to ensure they matched the correct pattern for that institution. The final analysis file excluded records that did not pass these tests. As a further check, the pattern of responses from each partner was checked to ensure that they did not significantly differ from the patterns observed in the primary sample. In addition, all records that were incomplete or that had an excessive number of missing entries were excluded from the analysis file.

General personal information (such as name, email address, and IP address) was removed from all survey responses prior to analysis. Only the lead researchers holding human subject research certification had access to the survey responses—they were not shared with other researchers, sponsors, or any other organizations. Open-ended survey responses are quoted if and only if the respondent explicitly granted permission. All such responses were reviewed and edited to ensure that no personally identifiable information is included.

The final analysis file included a total of 987 faculty and 1,051 administrators. The respondents represent the full range of higher education institutions (two-year, four-year, all Carnegie classifications, and public, private nonprofit, and for-profit). Respondents represent 870 different institutions from all fifty states, Puerto Rico, and the District of Columbia.

Materials

Since 2017, the CDLRA has been conducting research on defining key terms related to online and hybrid learning. The present study used past survey instruments and findings from the CDLRA as a foundation for developing the survey instrument. The survey instrument used in this study included a series of questions related to learning modes directed to faculty and administrators about whether their institution had definitions for key terms (online learning, remote learning, distance learning, hybrid learning) as well as the extent to which they agreed with definitions put forth by the research team for the following terms: online learning, hybrid learning, hyflex learning, in-person learning, synchronous learning, and asynchronous learning. The survey was primarily quantitative; however, participants were invited to provide an open-ended comment if they disagreed with one or more of the survey definitions.

The research team developed the definitions used for the survey by drawing upon the existing literature. The survey definitions for online, hybrid, and in-person learning were from the Modes of Learning Spectrum (Johnson, 2021). Johnson developed these definitions using the data describing the various definitions used at Canadian post-secondary institutions. For hyflex learning, Beatty's (2019) stated characteristics of that learning mode formed the survey definition. The researchers generated definitions for synchronous and asynchronous learning based on the general usage of these terms concerning online learning. The exact wording of each survey definition is shared in the findings.

Procedures

The questionnaire was purposefully kept short to encourage the widest possible participation; the median time to complete was 5.25 minutes. Respondents could skip any question they wished, with question skip rates of 0.5% to 1.5% depending on the question. Data were collected from May 11th to June 3rd, 2022.

The research team checked the numeric data for completeness, missing values, or erroneous codes. The frequency of responses is presented in aggregate and summary statistics to ensure confidentiality. To protect anonymity, the research team removed any identifiable information from the qualitative data (open-ended comments related to disagreement with survey definitions). The survey asked participants whether the research team could quote their comments. Any comments included in this report are from participants who provided consent to be quoted anonymously.

The qualitative data were analyzed using a constant comparative method to generate codes that captured the various reasons for disagreement with the survey definitions. The iterative process of identifying reasons for disagreement and assigning codes continued until a list of codes emerged that described all the data. The frequency for each code was then calculated to determine the prevalence for each reason for disagreement. The research team lightly edited some comments for grammar, punctuation, or spelling to improve readability.

Results

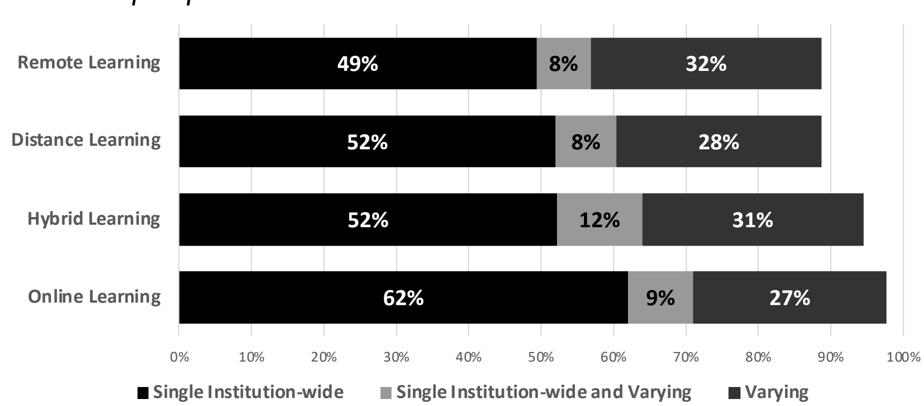
The research team analyzed 2,024 participant responses by role, institution type, and institution size. Except where noted otherwise, the findings were consistent across participant roles and different types and sizes of institutions.

Presence of Definitions

The survey asked participants whether they had a single institution-wide definition or varying definitions (by department, program, or individuals) for the following terms: online learning, remote learning, distance learning, and hybrid learning. Approximately one-half of participants had a single institution-wide definition for remote learning, distance learning, and hybrid learning, and nearly two-thirds had a single institution-wide definition for hybrid learning. Roughly 10% of participants indicated that they had both a single institution-wide definition in addition to varying definitions (e.g., by departments, faculty, etc.) at their institution.

Figure 2

Presence of Definitions



The findings varied by type of institution. Two-year institutions were more likely than four-year public and private institutions to have a single institution-wide definition for each term, with 75% of two-year institutions having a single institution-wide definition for online learning.

Agreement with Survey Definitions

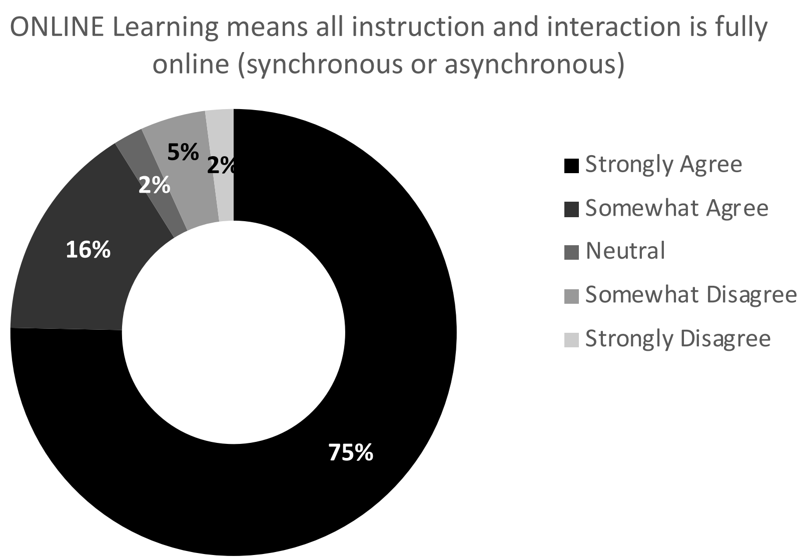
The survey provided participants with definitions for the following terms: online learning, hybrid learning, hyflex learning, in-person learning, synchronous learning, and asynchronous learning. Participants rated the extent to which they agreed with the definitions. If a participant reported disagreement with a definition, the survey gave them the option to write an open-ended response to share how they would define that term instead.

Online Learning

Nearly all participants agreed with the survey definition of online learning: "ONLINE LEARNING means all instruction and interaction is fully online (synchronous or asynchronous)." Three-quarters of participants strongly agreed with this definition, and an additional 16% somewhat agreed. Less than 10% of participants reported neutrality or disagreement.

Figure 3

Agreement with Online Learning Definition



Analysis of Disagreement. Within the 7% of participants who disagreed with the survey definition of online learning, 118 provided comments answering how they would define online learning instead. The reasons for disagreement were scope of the definition (e.g., participants' definitions were either broader or more granular than the survey definition), phrasing of the definition, and other.

Most participants who disagreed with the survey definition of online learning provided an alternate definition that differed in scope (n=102). Of this group, 46 participants provided a definition with a broader scope, and 56 provided a definition with a more granular scope.

Definitions that were broader in scope suggested that online learning is an overarching term inclusive of hybrid learning and the use of digital technologies (e.g., learning management systems, video recordings, online learning resources) in on-campus learning contexts. For example, one participant from a four-year private institution wrote, “Online learning occurs even in F2F classes at my institution; it isn't unusual for instructors to utilize Blackboard courses and other online resources to a large extent. I wouldn’t limit this terminology to online-only courses.” Conversely, of the 56 participants that provided definitions that were more granular in scope, most (49) held the position that the term online learning should only describe learning that is asynchronous and delivered in a fully online context.

Seven participants, although they reported disagreement with the definitions, provided comments that defined online learning in the same way as the survey definition but using different phrasing. One faculty member from a four-year public institution, who strongly disagreed with the survey definition, described online learning as “ANY class that is totally online, asynchronous or not,” which is nearly identical to the definition put forth in the survey.

An additional nine participants provided responses that the research team categorized as “other.” Within the “other” category, several participants described online learning as not being fully online but having a certain percentage of the course online (e.g., 50-100% of the course online, 75% or more online, or 80% or more online, according to these participants). A couple of participants defined online learning as being completely asynchronous and self-paced (without any deadlines). The final few participants in the other category provided responses that tended to be very specific and did not easily fit into another category, as seen in the examples below:

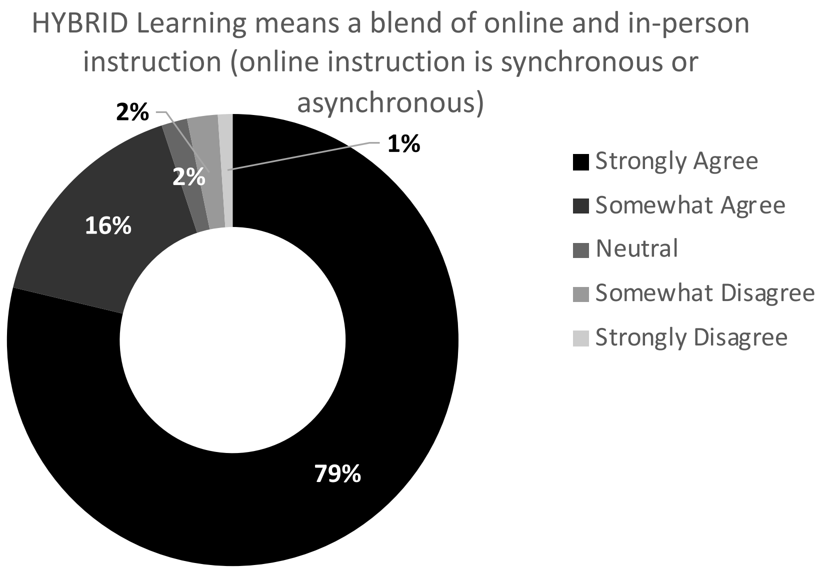
> All course content, resources, assignments and assessments are online (usually via Moodle). There are no required meeting times on campus or on Zoom (the courses are asynchronous). Student-to-student interaction, teacher-to-student interaction and social community are hallmarks of online learning. [Faculty, two-year institution]

> Online learning is a form of credit-generating instruction offering instruction by an authorized, qualified instructor that a business employs. Learners who enroll or register have access to the resources of that instruction via sponsored electronic portals, usually with controlled access (passwords, user names, etc.). [Faculty, four-year private institution]

Hybrid Learning

Similar to the definition for online learning, there was mostly agreement (95%) with the definition put forth in the survey that hybrid learning “means a blend of online and in-person instruction (online instruction is synchronous or asynchronous).” Only 3% of survey participants responded that they disagreed with the definition.

Figure 4
Agreement with Hybrid Learning Definition



Analysis of Disagreement. Within the minuscule minority of participants who disagreed with the survey definition of hybrid learning, 54 provided comments answering how they would define hybrid learning instead. The research team analyzed and categorized these remarks, which naturally fell into the same categories as the ones that emerged in the analysis of disagreement for online learning: the scope of the definition, the phrasing of the definition, and other.

As with online learning, most of the disagreement related to the scope of the definition for hybrid learning: a total of 31 participants commented that they either held a broader definition (18 participants) or a more granular definition (13 participants) for hybrid learning. Nine participants with a broader definition for hybrid learning suggested that the term hybrid should also encompass a mix of synchronous and asynchronous learning in a fully online learning context (with no in-person component). The participants with a more granular definition for hybrid learning agreed that hybrid learning involved a mix of online and in-person instruction. Contrary to the survey definition, some participants held strong views that the online elements could only be asynchronous. Other participants argued that the online elements in a hybrid course could only be synchronous.

Seven participants also provided alternate definitions for hybrid learning that essentially held the same meaning as the survey definition but had different phrasing. One administrator from a four-year public institution wrote the following alternate definition for hybrid learning:

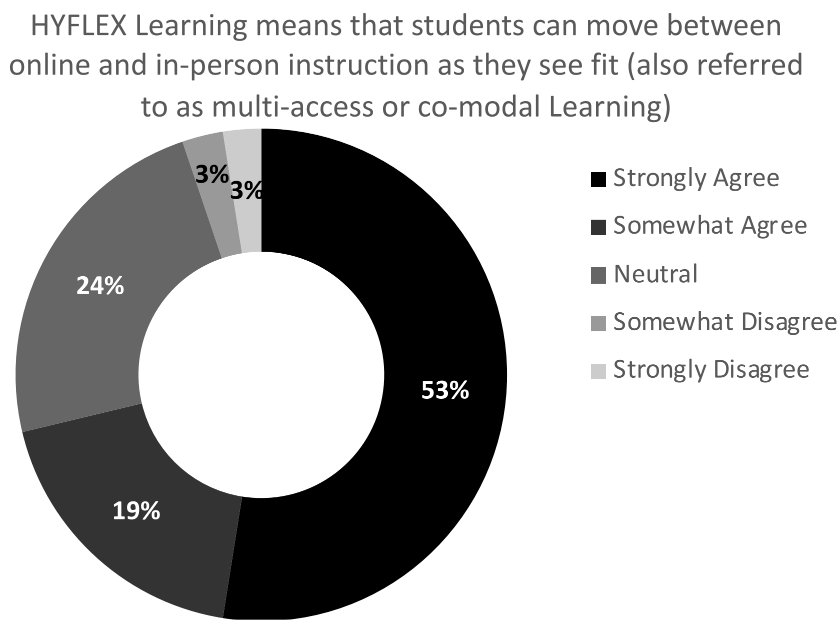
> A portion (0.01% – 99.9%) of the direct instruction of the course section's curricular content is delivered to the student via an online communication method, and the remaining portion of the direct instruction is required to be delivered face-to-face.

Another 16 participants disagreed with the survey definition of hybrid learning and provided comments that the research team placed in the "other" category. These comments tended to center on participants' opinions about hybrid learning rather than offering an alternative definition to the survey definition. As an example, one teaching and learning leader at a four-year public institution said, "This is the most problematic term—since the administration defines it and uses it quite differently than the faculty . . . the faculty advertise HYBRID but are not in support of its use."

Hyflex Learning

There was little disagreement (6%) with the definition put forth in the survey for hyflex learning, that it "means that students can move between online and in-person instruction as they see fit (also referred to as multi-access or co-modal learning)." Most participants (72%) agreed to some extent with the survey definition of hyflex learning; however, a substantial minority (24%) reported that they neither agreed nor disagreed.

Figure 5
Agreement with Hyflex Learning Definition



Analysis of Disagreement. The reasons for disagreement with the terms online learning and hybrid learning fell into the same categories; however, different categories emerged when analyzing 93 comments provided by those who disagreed with the survey definition for hyflex learning. These comments mainly fell into two categories: not fluid and opinion.

There were 27 participants whose comments fell into the "not fluid" category. These participants gave alternative definitions for hyflex learning that lacked the fluidity characteristic of hyflex learning according to the original definition put forth by Beatty (2014). Within the "not fluid" category, four additional sub-categories emerged that captured how these definitions deviated from Beatty's definition: hybrid learning, limited movement, no asynchronous, and sections. The "hybrid learning" sub-category consisted of seven comments describing hyflex learning as a prescribed mix of in-person and online learning. The "limited movement" sub-category had five comments that indicated that students had some choice of learning mode and the ability to switch between modes, but not to the full extent of the survey definition. The "no asynchronous" sub-category had six comments stating that hyflex learning could only include in-person and synchronous online learning. The “sections” sub-category had nine comments that said that hyflex learning requires students to select either a fully online or fully in-person learning environment upon registration and to remain in that learning environment for the duration of the course.

An additional 34 participants who reported disagreement with the survey definition of hyflex learning offered an opinion about hyflex learning rather than an alternate definition. The opinions shared included participants stating their dislike of the concept of hyflex learning or sharing their experiences with hyflex learning (and their subsequent attitudes toward it). A teaching and learning leader at a four-year public institution wrote, “This format was attempted in my institution, and it was rejected by the students and faculty.”

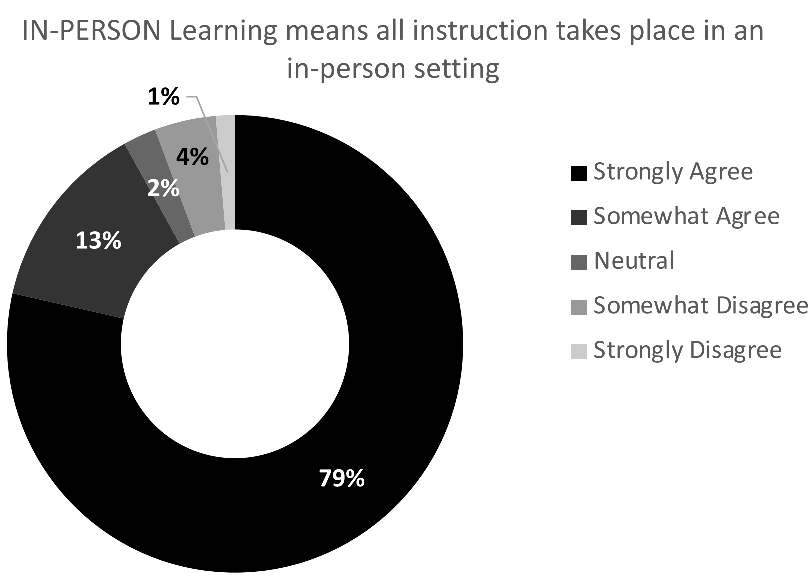
Some participants also left comments indicating unfamiliarity with the term hyflex learning (11 participants). Others remarked that they held an alternate definition for hyflex learning that was unique (12 participants). For example, one faculty member defined hyflex learning as “Learning that is done at the instructors’ wish. More online than face-to-face.” Nine participants also provided alternate definitions for hyflex learning that were the same as the survey definition, despite reporting disagreement with that definition.

In-Person Learning

The vast majority of participants (92%) agreed to some extent with the survey definition for in-person learning, which stated that “IN-PERSON LEARNING means all instruction takes place in an in-person setting.” There was minimal disagreement (5%) or neutrality (2%).

Figure 6

Agreement with In-Person Learning Definition



Analysis of Disagreement. For the other terms included in the survey, there were multiple reasons for disagreement among the minority participants who disagreed with the survey definition. For in-person learning, the disagreement mainly centered on a single topic: integrating technology into the in-person learning experience. Of the 5% of participants who disagreed with the survey definition of in-person learning, 104 wrote comments describing how they would define in-person learning instead. Most of these participants (75) remarked that online materials and technologies (such as a learning management system) would supplement in-person learning. For example, a teaching and learning leader at a four-year public institution said:

> Even when students and faculty come together in person, they also collaborate, share resources, complete assessments, etc., using online services and tools. The definition offered here does not include this. For instance, looking at log files for our digital learning services, we see the same level of use for in-person and online courses. On the other hand, our system administration provides funding as if only online courses use these services, which is highly problematic.

The remaining 29 comments describing disagreement with the survey definition included seven definitions describing in-person learning as having components that occur remotely and seven that required in-person learning to have a prescribed percentage of on-campus classroom time. Eight alternate definitions provided by participants held the same meaning as the survey definition. Another seven comments were opinion-based or had a very different meaning from the usual use of the term (e.g., in-person learning means “one-to-one teaching”).

It is important to emphasize that hardly any participants reported disagreement with the survey definition of in-person learning. Among those who disagreed, there is a clear pattern of disagreement, which centers on whether using technology or online materials in an in-person learning context impacts the term’s meaning.

Synchronous and Asynchronous Learning

Most participants strongly agreed with the survey definitions for synchronous and asynchronous learning seen in the figures below. Only 2% of participants disagreed with the survey definitions for both terms.

Figure 7
Agreement with Synchronous Learning Definition

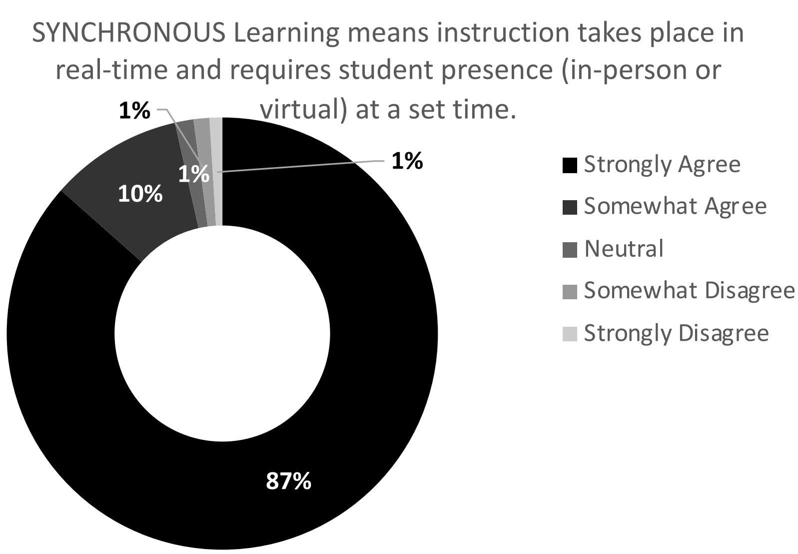
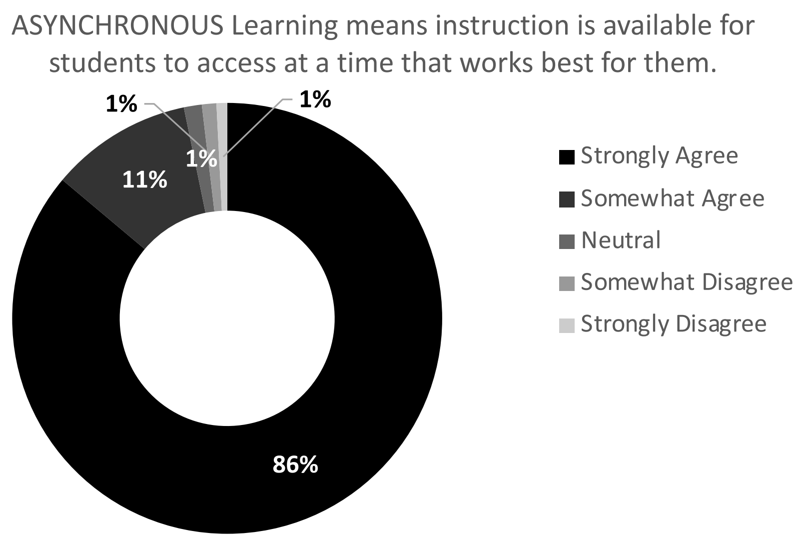


Figure 8
Agreement with Asynchronous Learning Definition



Analysis of Disagreement. Any disagreement with the survey definitions for synchronous and asynchronous was almost non-existent. Of the participants who reported disagreement, 34 provided comments for disagreement with synchronous learning and 28 provided comments for disagreement with synchronous learning.

The most common reason for disagreement with the survey definition of synchronous learning, as stated by 18 participants, was the conviction that one should only label learning as synchronous if it took place in an online context. In other words, those who disagreed with the survey definition took the position that in-person learning was inherently synchronous and that synchronicity should not need to be stated. Since another six participants provided an alternate definition that was the same in meaning as the survey definition, the majority of those who disagreed with the survey definition (24 participants) did not actually disagree with the essence of what synchronous learning means.

For asynchronous learning, the most common reason for disagreement was the issue of having a set schedule for the course (e.g., assignment deadlines) (13 participants). Again, the comments revealed that these participants did not actually disagree with the survey definition of asynchronous learning. Instead, they wanted it stated that asynchronous learning included both courses with deadlines and self-paced courses.

Summary

For each term, only a small proportion of the participants disagreed with the stated definition (ranging from 2% to 7%). Except for in-person learning, no patterns related to the disagreement suggested that an alternate definition would be more appropriate than the survey definition. For instance, with online and hybrid learning, the number of participants wanting a broader definition is nearly matched by those who wanted a narrower one. In contrast, disagreement with the survey definition of in-person learning centered on using technology and online materials within this learning mode. The categories and distribution were consistent regardless of whether the participant disagreed or strongly disagreed.

Discussion and Implications

This study investigated how digital learning terms are understood by faculty and administrators. Instead of confusion and contention about what these terms mean (as suggested by the literature), the findings revealed widespread agreement. We begin the discussion by asserting how the findings indicate a need for a "big bucket" approach to definitions. We then present a method for addressing the ever-evolving nomenclature when categorizing digital learning terms. We conclude by providing recommendations for future research.

A "Big Bucket" Approach

Most attempts to define key terms related to online and hybrid learning have been top-down, with scholarly opinions about how others "should" name different learning experiences dominating the literature (Moore et al., 2011; Singh & Thurman, 2019). Conflicting views within the academic community have led to the perception that there is not much consensus about what these terms mean. In contrast, the present study's findings provide clear evidence that there is widespread agreement when learning modes are described in terms of their most basic characteristics.

Although the survey findings show overwhelming agreement with the meanings put forth for common terms, there are several contradictions in practice. For example, the results related to the presence of a single institution-wide definition for online learning showed that 62% of participants had a single definition at their institution, 27% had varying definitions, and 9% had both a single definition and varying definitions. Similarly, only 52% of participants reported having a single institution-wide definition for hybrid learning (with 31% reporting varying definitions and 12% reporting both). These findings tell us that although there is broad consensus, it does not necessarily result in the use of common language to describe course offerings at the institutional level.

Regarding the presence of a definition for distance learning, only 52% of institutions reported having an institution-wide definition for the term. This finding highlights an interesting paradox since virtually all the institutions represented by the sample of participants are required to report enrollments for distance learning to the Integrated Postsecondary Education Data System (IPEDS) survey conducted by the National Center for Education Statistics (NCES) using the NCES definition (stated in the literature review).

Consequently, we cannot ignore the expansive list of labels that describe online and hybrid learning experiences already being used in practice. There is a pressing need to end the debate that any one label is conclusively the correct term and to enter into discussions about definitions from the level at which there is consensus. For this reason, we propose a "big bucket" approach that builds upon the Modes of Learning Spectrum put forth by Johnson (2021).

Although there are many terms in use that describe various implementations of learning modes, these terms can be easily sorted into the "big buckets" of online learning, hybrid learning, and in-person learning. Each big-bucket learning mode (online learning, hybrid learning, in-person learning) captures the location of instruction. The "when" and "how" aspects of instruction can be seen as "variations" within each bucket that represent the different ways that institutions can deliver online, hybrid, and in-person learning experiences.

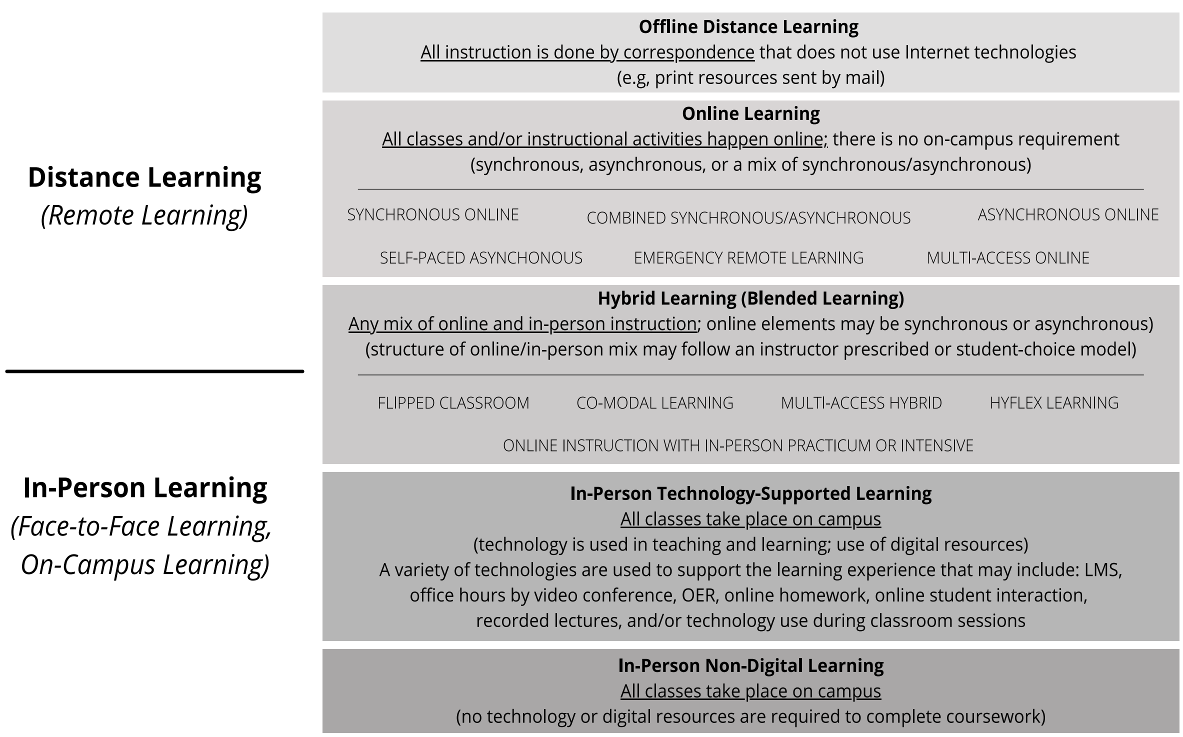
Revised Modes of Learning Spectrum

The revised version of the Modes of Learning Spectrum (Figure 9) follows the same format as the original put forth by Johnson (2021). Distance learning is separate from in-person learning (deemed interchangeable with face-to-face and on-campus learning). The extreme end of distance learning is "offline distance learning" also called correspondence learning, which is consistent with the original version; however, the extreme end of in-person learning has been changed from "in-person learning" to "in-person non-digital learning." This change aims to address the points raised by the participants who disagreed with the survey definition of in-person learning based on the use of technologies within an in-person learning context. The literature and survey findings collectively indicate that these extremes are a rarity in practice: most learning experiences fall into the big buckets of online, hybrid, and in-person technology-supported learning.

Different online or hybrid learning forms and institution-specific course labels are considered variations within the buckets. The sorting of different variations into overarching buckets provides a path toward shared terminology. The approach also matches how terms are being used in real-world settings while still accommodating idiosyncratic course offerings and granular naming conventions to describe highly-specific types of learning experiences. Importantly, the learner's location is a key determinant in naming the mode.

Figure 9

Revised Modes of Learning Spectrum



Note: Johnson (2021), the lead author of this report, is the creator of the Modes of Learning Spectrum, which was published in a report by the Canadian Digital Learning Research Association (CDLRA) under a "CC BY-ND" license. Dr. Johnson and the CDLRA have granted permission to publish the revised version of the Modes of Learning Spectrum (above), a derivative work of the original. https://creativecommons.org/licenses/by-nd/4.0/

The variations included in each big bucket represent examples, not an exhaustive list. To generate the examples in the figure, the research team took commonly mentioned variations from the literature and sorted them by learning mode. With terms such as multi-access learning (Irvine et al., 2013; Irvine, 2020), which encompass a range of possible offerings, we added identifiers to the term to demonstrate how these terms can be categorized. For example, “multi-access online” refers to a multi-access learning experience where the only choices of learning mode available to the student exist in an online context. “Multi-access hybrid” describes a learning experience, like hyflex learning (Beatty, 2019), where the choices of learning mode include both online and in-person options. Open-access options, also mentioned by Irvine, can fall into any of the big buckets, depending on the nature of the learning experience. As technology continues to evolve and new types of learning experiences emerge, they can be added to the appropriate big bucket.

In using the Modes of Learning Spectrum as a tool for categorizing learning experiences by mode, it is critical to acknowledge that the defining lines from one mode to another are somewhat blurred. While the extremes are easy to delineate, the lines between online and hybrid learning, and hybrid and in-person technology-supported learning are harder to pinpoint. In other words, within any modality, assignment completion, study, and informal communications will likely all include work at a distance, Internet use, and technology work except at the extreme ends of the spectrum. Thus, we encourage scholars and policymakers to refrain from casting online and in-person learning as binaries. Further, we discourage using percentages to distinguish between online, hybrid, and in-person technology-supported learning. Essentially, percentages are an indicator that a course is, in fact, hybrid because it includes a mix of online and in-person instruction.

Future Research

The present study provides a starting point for developing shared understandings of commonly used terms related to online and hybrid learning. Knowing that most participants agreed with the survey definitions for online and hybrid learning enables researchers to use these terms with the confidence that participants do not hold vastly different interpretations of the meaning. With this in mind, researchers may want to explore how faculty are incorporating technologies and online materials into their courses and how faculty label these practices. Similarly, how do students describe the different learning experiences they encounter? Do they agree with the survey definitions? To what extent are students familiar with these terms.

Lastly, there is a pressing need to investigate the policy implications of definitions. For example, the finding that roughly two-thirds of participants have institution-wide definitions for distance learning, despite the requirement by NCES’s IPEDS to submit data using a specific definition, highlights the need for further research to explore the gap between policy definitions and those used in practice. Do the definitions used for policy purposes match the definitions used in practice? Does applying a framework, such as the Modes of Learning Spectrum, help narrow the gap between policy and practice, or are other factors at play that need addressing?

Conclusion

Given the discussion about how to best label online and hybrid learning experiences, it is critical to understand that the understanding of these terms is exceptionally consistent among administrators and faculty. Any contention related to key terms appears to be related to the variations within each big bucket rather than the big-bucket terms themselves. As evidenced by the literature, scholarly debates over semantics are counter-productive, and such debate creates confusion and hampers collaboration amongst institutions and researchers. As a solution, the revised Modes of Learning Spectrum is rooted in the consensus that exists for the broader terms (online learning, hybrid learning, in-person learning) while accommodating the emergence of new variations over time.

We recommend that academic leaders place a greater emphasis on which big bucket a unique learning experience fits into rather than labelling emerging variations as entirely new categories. When administrators, faculty, and students can communicate with a shared understanding of common terms, we (as researchers) can better investigate day-to-day digital learning practices and how these are evolving over time. Those who teach and administer these courses do not typically pay attention to the finer points in the academic articles about the philosophical and theoretical underpinnings of naming conventions. Rather, these act as a distraction and add confusion when the focus needs to be on the clear articulation of the nature of the learning experience for students. Any method or framework for defining or categorizing digital learning terms must accommodate and encompass differing institutionally-situated offerings and their respective labels. Policy leaders would also be well advised to examine the definitions they use in compliance rules and data collections. Without more commonality across agencies, both the compliance expectations and the statistics gathered will be of questionable reliability.

We acknowledge the issue of there being multiple and competing definitions related to online learning: it will take time and effort for these systemically ingrained definitions to be replaced. Although there is substantial agreement on the meanings of the key terms discussed in this report, we expect that the mere act of sharing the existing agreement through this report will likely lead to more agreement. There may always be individuals who want definitions for key terms stated in their own way (e.g., in accordance with their personal philosophical or theoretical opinions) or institutional reporting requirements that demand the use of specific terms. However, the current state of widespread consensus leaves us with the hope that confusion resulting from divergent meanings will diminish over time.

Declarations

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

The authors assert that personal information of the participants was always protected. Only the lead researchers holding human subject research certifications had access to the survey data.

The authors gratefully acknowledge the support of WCET (the WICHE Cooperative for Educational Technologies) for this research. However, the contents represent the views of the authors, and do not necessarily represent those of WCET or its parent organization, the Western Interstate Commission for Higher Education.

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Exploring the Factors Associated with Undergraduate Students' Online Learning Anxiety: Development of the Online Learner Anxiety Scale

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Abstract

The purpose of this research was to explore the factors associated with online learning anxiety by carefully designing, developing, and providing preliminary validity and reliability evidence of a scale to measure undergraduate students' online learning anxiety. We created a conceptual framework to organize the literature surrounding online learning anxiety and used this framework to develop an initial item pool of 30 items. The researchers recruited $N = 297$ undergraduate student participants from four public universities in the southeastern United States from whom we collected and analyzed data for descriptive statistics, internal consistency reliability, exploratory factor analysis, and correlational analysis. Following systematic analytic procedures, we arrived at a three-factor model explaining approximately 65% of the variability in these data and retained 24 items in the final model with minimal cross-loadings in the pattern matrix. We labeled the identified factors as (1) online learner feelings of negativity and inadequacy, (2) online learner apprehension towards personal communication, and (3) online learner discomfort with instructor capacity and communication. The final instrument was named the Online Learner Anxiety Scale (OLAS). Scores on the OLAS were correlated with five other measures hypothesized to relate to online learning anxiety thereby providing stronger construct validity evidence. The OLAS was found to produce reliable scores that can be validly inferred as measures of online learning anxiety among undergraduate students in institutions of higher education. These findings are discussed and framed in light of current literature on online learning and possible future research directions.

Keywords: online learning anxiety, online learning

Ritzhaupt, A., Rehman, M., Wilson, M. L., & Ruggles, K. (2022). Exploring the factors associated with undergraduate students' online learning anxiety: Development of the Online Learner Anxiety Scale (OLAS). *Online Learning, 26*(3), 111-131.

How do we measure online learning anxiety and why is there a need to focus on measuring this construct in educational research and practice? Prior research studies have endeavored to address various aspects of online learner anxiety. Moreover, the existing body of literature contains various tools for the measurement of aspects of online learning anxiety. However, the majority of these studies lacked a theoretical foundation or a direct approach to exclusively measure this construct (Abdous, 2019; Alibak et al., 2019; Bolliger & Halupa, 2012; Conrad, 2002; Hauser et al., 2012; Heckel & Ringeisen, 2019). With the changing dynamics of the learning ecosystem and the increasing acceptance of online learning, we, as researchers and educational practitioners, must focus on addressing the factors contributing to online learning anxiety among students.

The American Psychological Association (APA) dictionary of Psychology defines anxiety as "[A]n emotion characterized by apprehension and somatic symptoms of tension in which an individual anticipates impending danger, catastrophe, or misfortune…" (APA, 2020a). Anxiety is a common reaction to life events such as taking a final exam or speaking in front of a crowd. It is a prevalent mental health condition, that can also signify a more serious mental health disorders such as generalized anxiety disorder or social anxiety disorder. It is important to differentiate what is "normal" anxiety from what is an anxiety disorder. Severe anxiety and anxiety disorders can lead to other serious mental health issues such as depression, post-traumatic stress disorder, or obsessive-compulsive disorder that can harm people and create adverse effects such as the risk for suicide, school dropouts, and abuse of drugs and alcohol (Nepon et al., 2010). Anxiety is more common issue than an average person assumes. One in every fourteen people around the world has an anxiety disorder, and each year anxiety sufferers spend over $42 billion to address this mental health problem (Devane et al., 2005).

Online learning is an applied and evolving paradigm in contemporary educational research and practice (Benson, 2002; Carliner, 2004; Conrad, 2002; Martin et al., 2020). As an evolving concept, there are multiple features of online learning that can potentially contribute to online learning anxiety among students, such as the newness of technology, feelings of apprehension in an online environment, communication barriers, preparation of the online instructor, etc. These factors of online learning anxiety can impact various aspects of a student's learning process, learning outcomes, and performance. In this fifth generation of distance education (i.e., online learning), the advancement of technology has enabled learning to occur through a wide range of information and communication technologies, such as audio/video-conferencing, Learning Management Systems (LMSs), asynchronous learning platforms, etc. (Moore & Kearsley, 2011). The use of these new online learning systems and technologies affects the level of anxiety experienced by online students (Saadé & Kira, 2009). Students who are new to technology may feel uncomfortable working with these tools, and they can experience higher anxiety as a result (Helms, 2014).

Learners may experience feelings of isolation in their online learning environment and often feel apprehensive about communicating their ideas (Autman & Kelly, 2017). These feelings can upsurge during global emergencies, like the COVID-19 pandemic, when students are forced to switch to the modality of online learning. Lack of familiarity and comfort with the style of instruction and learning is another factor that can create feelings of anxiety within students (Hammond, 2006). All these factors contributing to a learner's anxiety can potentially impact academic performance in an online learning environment. As a general construct, learning anxiety can often negatively impact a student's educational experience and academic success by blocking cognitive processes connected to learning (Slovák & Fitzpatrick, 2015).

Research shows the general trait of anxiety and academic performance have a negative correlation (Hauser et al., 2012). For example, anxiety can reduce a learner's cognitive efficiency, and they often experience thoughts of self-evaluation, self-doubt, and general worry related to their academic performance (Saade et al., 2017). It is critical for the design of online learning experiences to identify and address factors that can intensify learner anxiety so that no student is put at a disadvantage academically due to design choices (Cinquin et al., 2019). Monitoring these factors influencing online learner anxiety can help us generate practical guidelines to reduce the feelings of anxiety in online learning environments. Still, first one must be able to measure online learner anxiety.

Prior Research on Online Learning Anxiety

The existing literature on online learning and learning anxiety in online environments, such as self-paced online training, online exams, synchronous and asynchronous online courses, etc., suggests that online learning anxiety is not a novel construct. Although researchers have attempted to study various aspects of anxiety that occur during online learning experiences, the literature on the assessment of factors influencing online learners' anxiety based on a theoretically grounded framework is fairly limited. Abdous (2019) conducted a study to assess the influence of factors such as demographics, prior experience, satisfaction, and preparedness on the feeling of online learning anxiety among students. The study relies exclusively on a single item measurement for the dependent variable and concludes that factors such as demographics, prior online learning experience, and sense of preparedness impact online students' feelings of anxiety (Abdous, 2019). The reliance in this study on a single item may have resulted in underrated feelings of anxiety reported by students. Building upon this study, we have included items in our scale that represent the feelings of online learning anxiety caused by learner satisfaction and prior experience with online learning. Another study conducted by Bolliger and Halupa (2012) examined the relationship between online course anxiety and learner satisfaction. The study used an 18-item anxiety tool with domains including computer, internet, and online course anxiety. The results of the study show a negative correlation between learner anxiety and satisfaction (Bolliger & Halupa, 2012). However, the anxiety tool design did not take into consideration other domains that can induce anxiety, such as feelings of isolation in an online learning environment or instructor-to-student or student-to-student communication barriers. We have attempted to include these additional domains into our scale to provide an accurate assessment of factors inducing anxiety among online learners.

Alibak (2019) presents an online test anxiety inventory (OTAI) scale to monitor test anxiety among online students. The OTAI is an 18-item multidimensional scale comprising three factors: online, psychological, and physiological. The findings of the study indicate that student anxiety during online exams can be related to factors such as working with technology, lack of communication, and the quality of teaching. Although this study provides preliminary validity evidence for the OTAI scale, it does not take into account other known measures related to online learning anxiety and focuses intentionally on online test anxiety (Alibak et al., 2019). Similarly, Conrad (2002) assesses learners' perceptions about online courses, and in this study, the learners responded to the survey with a description of fear and anxiety in starting an online course coupled with statements of apprehension. The factors contributing to the feelings of anxiety discussed in the study include comfort and familiarity, comprehensiveness of the website, and preparation time in advance of the course (Conrad, 2002). We have built upon this study to include these factors in our scale.

Conceptual Framework

We have designed the Online Learner Anxiety Scale (OLAS) guided by these existing research studies and theories. The first step in the process of creating the OLAS was to operationally define online learning anxiety, which includes perceptible expressions of the feelings of anxiety, the situations it is experienced in, and the factors that cause it. We operationally define online learning anxiety as "The feelings of fearfulness, apprehension, and uneasiness that learner experiences in an online learning environment, while interacting with content, instructor, and/or fellow students." There are a couple of important aspects of this definition that we need to consider. First, the definition is connected back to the American Psychological Association's definition of anxiety to include various forms of feelings of anxiety such as fearfulness, apprehension, and uneasiness experienced by the learner. Second, we have carefully defined the factors that cause this feeling of anxiety, such as interacting with content, instructor, and other students in an online learning environment. These dimensions are grounded in the interactions described by Moore (1989).

A learner can experience a range of feelings while interacting with the online learning environment and during the learning process. These feelings, when experienced during the learning process, can impact their cognition and learning outcomes. The Control Value Theory (CVT) provides a conceptual framework for facilitating this work (Pekrun et al., 2007; Pekrun & Stephens, 2012). CVT argues that emotions, such as anxiety, are elicited by human cognition when they are involved in the learning process. CVT assumes that when a learner anticipates failure or low control in their learning environment, they may experience negative emotions, like anxiety. These perceptible expressions of the feelings of anxiety and the factors causing it are derived from the existing literature that is discussed above and form the basis of our item pool for the OLAS.

Feelings of Negativity and Inadequacy

A learner's feelings of negativity and inadequacy in an online learning environment are of particular importance to explore the multidimensional construct of online learning anxiety. A learner's perception of an online learning environment is based on their past experiences, their personality, and on the information that they receive through their interactions within their community. Unfortunately, the perceptions and experiences surrounding online learning are not always favorable among students (Lowenthal et al., 2015). These perceptions and experiences can often create feelings of negativity and inadequacy toward online learning (Abdous, 2019). A study investigating the relationship between learning outcomes and achievement emotions such as pride and anxiety concluded that anxiety was negatively associated with learner self-efficacy and satisfaction in an online learning environment which leads to feelings of negativity and inadequacy (Heckel & Ringeisen, 2019). Similar findings are reported in a Bolliger and Halupa (2012) study that showed a negative correlation between learner anxiety and satisfaction. Other research, including a study by Abdous (2019), shows that demographics, prior online learning experiences, and sense of preparedness impact online students' feelings of anxiety. Building upon this literature and consistent with CVT, we have included items in our scale to monitor experiences of negativity and inadequacy in online learning environments caused by perceptions and past experiences about online learning, feelings of lack of control, feelings of performance failure, and reductions in self-efficacy and satisfaction.

Discomfort with Instructor Capacity and Communication

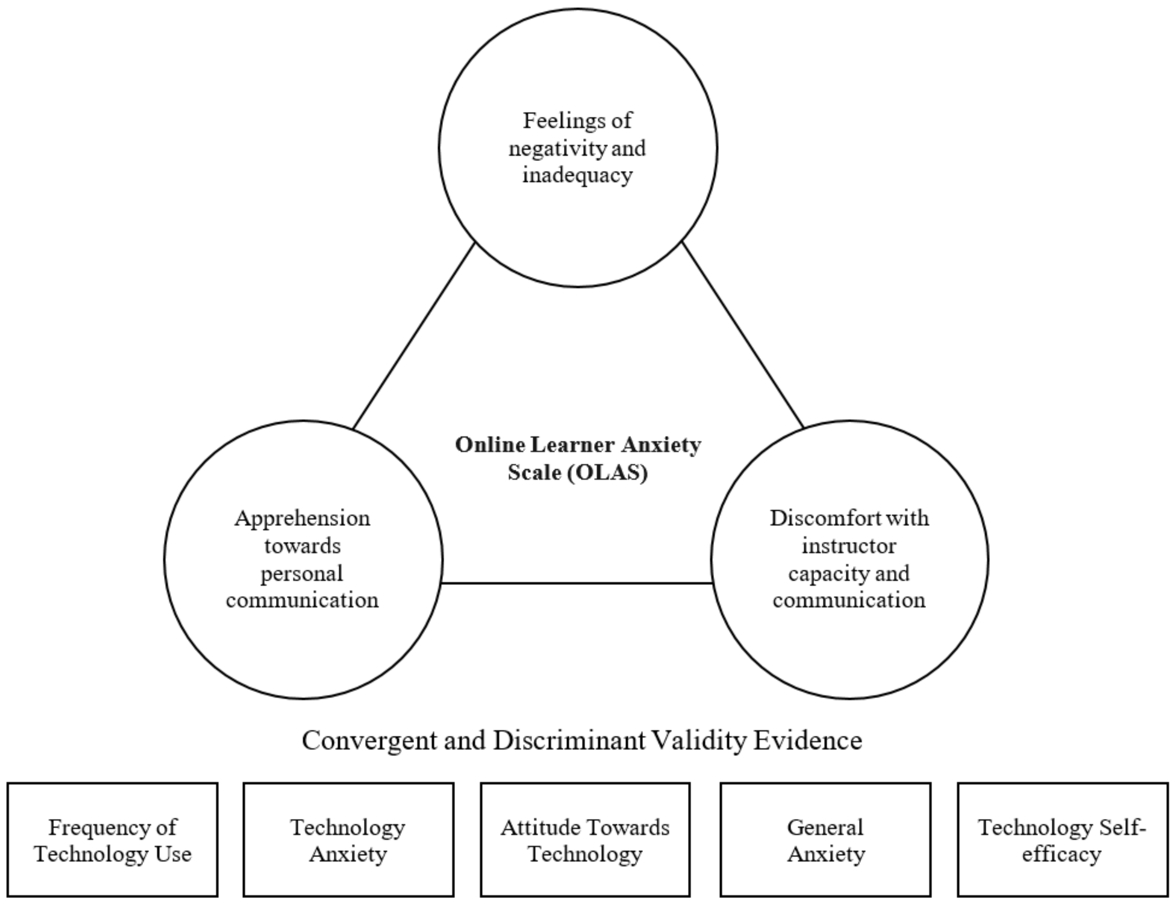
To understand online learner discomfort with instructor capacity and communication, we build upon the theory of transactional distances by Moore (1993). The theory defines "transactional distance" as "a psychological and communication space to be crossed, a space of potential misunderstanding between the inputs of instructor and those of the learner" (Moore, 1993, p. 23). This transactional distance can increase in an online learning environment based on various factors, resulting in a learner's discomfort with instructor capacity and communication. The theory argues that pedagogy has a greater impact on learning outcomes than the physical or temporal distance between the teacher and student. Many instructors who are asked to teach in an online learning environment may not be prepared for it in terms of the skills and strategy to design and deliver effective online learning experiences (Cutri & Mena, 2020; Martin et al., 2019). These experiences can frame how students perceive their capacity and connection with their online instructors. Hauser (2012) studies this construct by examining the relationships between computer self-efficacy and computer anxiety and their impact on performance in online learning. The study concludes that lower transactional distance (Moore, 1993) is an anxiety-reducing mechanism (Hauser et al., 2012). Related to the theory of transactional distance, instructor presence has long been recognized as a critical aspect of online learning and connected to student learning outcomes (Baker, 2010). Building upon the tenets of this theory, we have included items in our scale to identify the impact of the effectiveness of pedagogy and instructor-student and student-student communication on learner anxiety.

Apprehension towards Personal Communication

Online learners may experience apprehension towards personal communication due to various factors. Where an online environment can provide the comfort of learning in your own space and time, there are various elements that may make a learner feel apprehensive. These elements potentially include fear of communicating with a new acquaintance in an online course. Students who are camera conscious worry about other people seeing them in videoconferencing. Hence, they may feel anxious to express themselves in an online course. A learner's feelings of worry about communicating effectively with other learners in an online course may result in anxiousness. Prior research studies have suggested that the feeling of apprehension in personal communication can lead online learners to develop feelings of isolation or hopelessness from online courses that are not properly designed and facilitated to build presence and community among the instructor and students (McInnerney & Roberts, 2004; Zembylas, 2008). As discussed in the theory of transactional distance, the application of effective pedagogy can reduce the "transactional distance," but if the pedagogy in the online course does not provide opportunities for learners to express and communicate and does not create a sense of community among the learners it can adversely impact their experiences causing feelings of negativity and apprehension and hence increasing the "transactional distance." Thus, feelings of apprehension towards personal communication can potentially induce anxiety among online learners, and consequently, we have included various items in our pool as an expression of such feelings.

The OLAS presented in this study is built upon our operational definition and factors possibly leading to online learning anxiety, as identified in previous studies. We built upon existing theory, including the Control Value Theory (CVT) and Theory of Transactional Distances, as well as relevant studies on online learning and anxiety to develop an initial item pool of 30 items for the OLAS. Our item pool includes statements representing factors such as feelings of isolation, feelings of apprehension, self-doubt in interaction with technology, and difficulty in student-student and student-instructor communication, as shown in Appendix A. The design of OLAS is aimed at bridging the research gap by systematically operationalizing and measuring this emerging and possibly evolving construct using a scale that can be used by researchers for low-stakes research and evaluation purposes to assess this potentially multidimensional construct. A conceptual map of the online learner anxiety scale is shown in Figure 1.

Figure 1
Conceptual map of the Online Learner Anxiety Scale (OLAS)



Convergent and Discriminant Validity Evidence

Dating back to the seminal work of Campbell and Fiske (1959), our development and validation procedures for the online learning anxiety scale included the correlation of the multidimensional construct with five factors assessed using the same method (e.g., survey response scales) that we theorized would relate to online learning anxiety among undergraduate students in a specific way. As illustrated in Figure 1, our research plan included five other measures: (1) frequency of technology use, (2) technology self-efficacy, (3) attitudes towards technology, (4) general anxiety, and (5) technology anxiety. Specifically, we anticipated significant inverse relationships with frequency of technology use, technology self-efficacy, and attitudes towards technology, and significant positive relationships with general anxiety and technology anxiety. Our intentions were to provide stronger evidence of construct validity as operationalized by both convergent and discriminant validity evidence of the OLAS.

Purpose and Research Questions

The purpose of this research was to design and develop a scale to measure undergraduate students' online learning anxiety supported by initial validity and reliability evidence. The guiding research questions were:

1. What are the factors and relationships among those factors associated with online learning anxiety among undergraduate students in higher education?
2. What evidence of construct validity exists for scores from the OLAS in relation to hypothesized measures expected to relate to online learning anxiety?

Method

Participants

Two-hundred ninety-seven participants (*N* = 297*)* were recruited from four different public universities in the southeastern United States. Sixty-four percent of the sample were female participants, 33% were male, seven indicated non-binary/third-gender/other, and two preferred not to answer the gender item on the survey. More than 80% of the undergraduate student participants reported their age within the range of 18 to 22, indicating a sample of mostly traditional undergraduate students. The participants represented a range of racial diversity with 63% classified as White, 15% classified as Hispanic, 6% classified as Black, 11% classified as Asian, and the remaining indicating Other or a preferred non-response. The participants were from a variety of academic majors, including education, computer science, business administration, mathematics, and more.

Instruments

Online Learner Anxiety Scale

The OLAS was developed from our conceptual framework, which structures the research from the online learning community and prior attempts to measure similar constructs in the context of online learning. The team consisted of three university professors within the realm of educational technology, and one educational technology doctoral student. Following a systematic procedure, the research team developed an initial item pool of 30 items relating to the anxious feelings an undergraduate student might have towards different aspects of online learning. Our conceptual framework served as a blueprint for the item writing, which is a necessary step to establish content validity. Each item intentionally included words to express anxious feelings. We attempted to incorporate items employed in similar research endeavors, such as a study that provided a scale to measure online learning text anxiety (Alibak et al., 2019) or other attempts to measure anxiety in the context of online learning research (Bolliger & Halupa, 2012; Hauser et al., 2012). The full list of items from the initial item pool can be gleaned in the Appendix A. The items made statements about a student's anxious feelings towards aspects of online learning, such as communication with the instructor (e.g., "Lack of student-instructor communication in an online course is stressful for me") or peers (e.g., "I worry if I can communicate effectively with other learners in an online course") in the online course, and general negative personal feelings about online learning (e.g., "Online courses scare me."). The initial item pool of 30 items was intended to capture the anxieties associated with online learning experiences that have been documented in the online learning research literature. As the purpose of this study is to examine the structure of internal and external validity evidence of the OLAS, the results provide the measurement details associated with the final items retained and factors identified from the analyses.

Technology Self-Efficacy

The *technology self-efficacy* measure contains 19 items related to common tasks an individual would perform using technology (e.g., Delete a computer document or file). The scale uses a four-point response set that relates to self-efficacy: 1. I don't know what this means, 2. I know what this means but I cannot do it, 3. I can do this with help from someone, and 4. I can do this very well by myself. The respondents are asked to rate how well they can do each of these tasks using this response scale. The technology self-efficacy has been used in prior works that reported various pieces of validity and reliability evidence (Hohlfeld et al., 2010; Hohlfeld et al., 2013; Huggins et al., 2014; Ritzhaupt et al., 2013) and demonstrated acceptable internal consistency for these data with a Cronbach's $\alpha = .78$. We hypothesized an inverse relationship between technology self-efficacy and the factors on the OLAS.

Frequency of Technology Use

The *frequency of technology use* measure has ten items stated as questions (e.g., "The Internet to look up information about people, things, or ideas?") in which the respondents are asked how frequently they use technology to address the question. The frequency of technology use measure uses a standard five-point scale with the following response set: 5. Almost every day, 4. A few times each week, 3. Between once a week and once a month, 2. Less than once a month, and 1. Never. The *frequency of technology use* measure has been used in prior research that has reported various pieces of validity and reliability evidence (Hohlfeld et al., 2010; Hohlfeld et al., 2013; Huggins et al., 2014; Ritzhaupt et al., 2013) and demonstrated data with a moderate degree of internal consistency at $\alpha = .63$. We expected the frequency of technology use measure to negatively relate to the factors on the OLAS.

Attitudes Towards Technology

The *attitudes towards technology* measure contains five positively stated items about an individual's attitudes (e.g., Using a technology helps me with my work) and asks the respondents to indicate the extent to which they agree with each of the five statements using a standard five-point Likert scale: 5. Strongly agree, 4. Agree, 3. Neither Agree nor Disagree, 2. Disagree, and 1. Strongly disagree. The *attitudes towards technology* scale has been used in prior research that reported various pieces of validity and reliability evidence (Hohlfeld et al., 2010; Hohlfeld et al., 2013; Huggins et al., 2014; Ritzhaupt et al., 2013), and demonstrated data with an acceptable level of internal consistency at $\alpha = .74$. We expected the *attitudes towards technology* measure to inversely correlate with the factors associated with an undergraduate students' online learning anxiety.

Abbreviated Technology Anxiety Scale

The *technology anxiety* measure was operationalized using the Abbreviated Technology Anxiety Scale (ATAS), an 11-item scale designed to assess an individual's level of technology anxiety. The ATAS asks respondents to indicate their level of agreement with negatively stated sentences about technology (e.g., "I feel technology complicates simple tasks") using a standard five-point Likert scale of agreement: 5. Strongly agree, 4. Agree, 3. Neither Agree nor Disagree, 2. Disagree, and 1. Strongly disagree. The ATAS has been previously evaluated in prior research and was deemed appropriate for research and low-stakes evaluation purposes based on multiple pieces of validity evidence (Madley et al., 2015). The ATAS demonstrated a high level of internal consistency for these data with a Cronbach's $\alpha = .91$. We projected that online learning anxiety would positively relate to technology anxiety as measured by the ATAS.

Generalized Anxiety Disorder scale

The *general anxiety* measure employed in the present study includes seven unique items designed to gauge an individual's general anxiety at a given point in time. The scale is referred to as the Generalized Anxiety Disorder scale (GAD-7) and asks participants to indicate how frequently they have experienced statements related to anxious feelings (e.g., "Feeling nervous, anxious, or on edge") in the past two weeks. The GAD-7 uses a four-point scale of frequency: 4. Nearly every day, 3. Over half the days, 2. Several days, and 1. Not at all sure. The GAD-7 has been evaluated in prior research as a measure of general anxiety (Spitzer et al., 2006). The scale resulted in a high degree of internal consistency for these data at $\alpha = .92$. We hypothesized a positive relationship between general anxiety and online learning anxiety.

Data Collection

We recruited participants by reaching out to our professional network of colleagues in institutions of higher education in the southeastern United States. After making prior arrangements with course instructors and securing IRB approval, the OLAS was released to an audience of undergraduate students enrolled in four public institutions of higher education in the southeastern United States. All of the students were currently enrolled in online courses as these data were collected during the COVID-19 pandemic. Since the survey was anonymous, course instructors were encouraged to share the survey with other instructors at their institutions of higher education presently teaching online courses—a snowball sampling approach. The online battery of measures was accessible for a 3-week period, and during this time two reminder emails or notifications were sent out to all course instructors who agreed to invite their students to complete the study. Since the battery of measures administration was anonymous, exact response rates cannot be determined for these data. The battery of measures was administered using the Qualtrics online survey platform with automated reminders for missed items before advancing in the survey and took participants an average of approximately 10 to 15 minutes to complete. Only participants that completed all of the items were retained because of our data analysis plan. A total of $N = 369$ participants had at least opened the informed consent page. After removing non-responses, our total dataset had $N = 297$ participants retained.

Data Analysis

These data were subjected to a variety of analyses, including descriptive statistics analysis, internal consistency analysis, exploratory factor analysis (EFA), and correlation analysis (i.e., Pearson *r* correlations among factors and hypothesized variables). Since this was the first draft of the OLAS and there is uncertainty about the factor structure, EFA was an appropriate choice to examine the structure of the items in relation to our conceptual framework. Specifically, EFA was conducted to explore the underlying structure of the data collected using the OLAS and to assist the researcher team in providing meaningful labels to the factors on the OLAS, thus providing internal validity evidence. Factors were ultimately labeled by carefully studying the pattern matrix, the contents of each item, and the review of theory and literature that inspired our conceptual framework. Factors were formed into composite variables using the arithmetic average of the responses to the items forming the construct. Descriptive statistics analysis was conducted to examine the patterns in this cross-sectional dataset, and to characterize the various factors underlying the OLAS data. Internal consistency for the data was examined with Cronbach's alpha. Correlation analyses were employed to examine the internal structure of the measures and to relate the resulting factors to other hypothesized variables expected to relate to online learning anxiety for both convergent and discriminant validity evidence. The underlying assumptions of the various statistical methods were evaluated. All quantitative analyses were conducted using SPSS version 26. An alpha level of .05 was used for all statistical tests.

Sampling Adequacy

The initial item pool for the OLAS included 30 unique items generated by the research team using the conceptual framework. The descriptive statistics for these 30 items can be found in Appendix A for review. Bartlett's test of sphericity for these data had a chi-square of 5,330.29 ($p < .001$), which suggested the intercorrelation matrix contained adequate common variance. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.961, which is above the 0.50 recommended limit (Kaiser 1974). The participant-to-item ratio for the data was approximate ~10:1. This participant-to-item ratio is consistent with the 10:1 ratio suggested by Kerlinger (1974), which is more than adequate based on prior research about maintaining factor stability (Arrindell & Van der Ende 1985; de Winter, Dodou, & Wieringa, 2009; Guadagnoli & Velicer, 1988). The skewness and kurtosis for each of the individual items were within acceptable ranges at -1 to 1, and -2 to 2, respectively, suggesting no severe departures from univariate normality. Thus, these data appeared to be well suited for EFA.

Results

Exploratory Factor Analysis

The EFA models were executed using principal axis factoring and an oblique (promax) rotation, as the factors were anticipated to be represent the larger construct of online learning anxiety. The number of factors retained was based on the Kaiser criterion (Eigenvalue > 1) and inspection of the Scree plots generated for the EFA models. Items were assigned to factors based on the greatest coefficients in the pattern matrix. The EFA data from the initial unconstrained model showed three factors, and data were extracted in five iterations. The data from the initial model did not exhibit a truly simple structure in the pattern matrix with cross-loadings on items 5, 13, 14, 26, 29, and 30. After careful review of these items, we decided to remove them from the EFA model and run a new EFA model in an attempt to secure a simple structure in the pattern matrix. The resulting model showed a far simpler pattern matrix structure with only one mild cross-loading from these data. After the EFA model and removal of items, 24 items were retained in the final OLAS. Appendix B shows the pattern matrix, which was the final model adopted for this research.

Table 1 provides the factors identified from the EFA model, the associated Eigenvalues, the cumulative percent of variance explained, Cronbach's alphas, and the number of items. As can be gleaned, the three-factor EFA model explains approximately 65% of the variability in these data. Also notable is that the Cronbach's alpha for each factor is quite high, suggesting internal consistency of the data comprising each factor. The three factors identified were carefully labeled based on the essence of the items within each factor, the pattern matrix, and the literature and theory that inspired our conceptual framework, which resulted in the following factor names: (1) Online learner feelings of negativity and inadequacy, (2) Online learner apprehension towards personal communication, and (3) Online learner discomfort with instructor capacity and communication.

Table 1
Factor Names and Associated Eigenvalues, Cumulative Variance, Cronbach's α, and Number of Items from OLAS

Factors	Eigenvalues	Cumulative %	Cronbach α	# of Items
1. Online learner feelings of negativity and inadequacy	12.994	54.141	.94	10
2. Online learner apprehension towards personal communication	1.534	60.535	.90	8
3. Online learner discomfort with instructor capacity and communication	1.132	65.253	.89	6

Table 2 provides the descriptive statistics associated with each of the factors. As can be gleaned, when we computed the average item response across the items within each factor, we found the largest average to be (3) Online learner discomfort with instructor capacity and communication, followed by (1) Online learner feelings of negativity and inadequacy, and (2) Online learner apprehension towards personal communication.

In a quick review of the skewness and kurtosis coefficients for each factor, there does not appear to be any severe departures from univariate normality for the factors, meeting the assumption of Pearson's correlation. **Table 3** provides the Pearson correlation coefficients among the three factors, which show strong, positive, and statistically significant correlations among the three factors on the OLAS.

Table 2
Descriptive Statistics Associated with Factors from the OLAS

Factors	M	SD	Skewness	Kurtosis
1. Online learner feelings of negativity and inadequacy	3.02	1.11	-0.13	-0.87
2. Online learner apprehension towards personal communication	2.93	1.06	-0.06	-0.69
3. Online learner discomfort with instructor capacity and communication	3.45	1.09	-0.58	-0.56

Table 3
Correlational Analysis of Factors from the OLAS

Factors	1	2	3
1. Online learner feelings of negativity and inadequacy	1		
2. Online learner apprehension towards personal communication	.755**	1	
3. Online learner discomfort with instructor capacity and communication	.798**	.730**	1

*$p < .05$; ** $p < .001$

Correlational Analysis with Other Measures

While the findings reviewed show sufficient evidence of internal validity for the OLAS, our second research question posed the issue of external validity evidence by correlating the scores of the OLAS with other known measures we hypothesized would relate to the identified constructs, or convergent validity evidence. Specifically, we provide the correlation coefficients between the OLAS factors and the following technology and anxiety constructs: (1) frequency of technology use, (2) technology self-efficacy, (3) attitudes towards technology, (4) general anxiety, and (5) technology anxiety. We provide these relationships in **Table 4** to provide the external validity evidence of scores on the OLAS for the target population of undergraduate students. As we hypothesized, both technology self-efficacy and attitudes towards technology are inversely and significantly related to the three factors from the OLAS. However, the construct of frequency of technology use has little to no relationship with the OLAS. Additional evidence is shown by the positive and significant relationships among the three factors of the OLAS and both general anxiety and technology anxiety.

Table 4

Convergent Validity Evidence of OLAS Factors and Other Hypothesized Measures

Factors	Frequency of technology use	Technology self-efficacy	General anxiety	Attitudes towards technology	Technology anxiety
1. Online learner feelings of negativity and inadequacy	0.013	-.229**	.319**	-.257**	.393**
2. Online learner apprehension towards personal communication	-0.005	-.181**	.410**	-.193**	.412**
3. Online learner discomfort with instructor capacity and communication	0.053	-.141*	.359**	-.131*	.280**

*$p < .05$; ** $p < .001$

Discussion

Limitations and Delimitations

Interpretation of these results should be viewed within the limitations and delimitations of the current study. As our purpose was to explore online learning anxiety among undergraduate students by developing a scale and to provide initial validity and reliability evidence of this scale, our approach was to first read and review all prior works that had incorporated some aspect of online learning anxiety to inform our approach. Unfortunately, only a handful of prior works have addressed this construct intentionally, so we turned to the general online learning literature to form our conceptual framework to guide the process. It is possible that we missed an important dimension of online learning anxiety in the generation of the initial item pool and our guiding conceptual framework. Our sample of respondents is representative of a range of typical undergraduates within the four universities in which we recruited participants, but before generalizing our findings to a larger audience of undergraduate students, additional data should be collected with the OLAS from other regions of the United States and beyond. Finally, the temporal aspect of this work happening during the COVID-19 pandemic may also have influenced the results since many institutions of higher education had to swiftly pivot to online learning, which we know was not a smooth process for faculty and students alike. Regardless of these considerations, we do believe that we have identified some important findings.

OLAS and Online Learning Considerations

We believe that student impressions of online learning are formed from their personal experiences from prior online learning encounters (e.g., enrolling in a high school course online). Additionally, what students read on the internet about online learning, which in many cases can be limited and conflated with bias and misinformation, may play a role in their impressions. While online learning has seen tremendous growth in the past two decades, the growth has been uneven between different classifications of institutions of higher education, and only 14% of higher education students have enrolled in an online course for their program of study (Allen & Seaman, 2016). While the realities of the COVID-19 pandemic certainly changed these statistics for undergraduate students, we do not believe the experiences during the 2020 calendar year truly exhibit the qualities of effective online learning. Rather the term emergency remote teaching (Hodges et al., 2020) is a better description of what actually happened this past year. However, the typical undergraduate student on the receiving end of this situation likely does not see this distinction, which may have exacerbated their feelings of inadequacy or negativity towards online learning. Years of online learning research have suggested that online learners can develop feelings of isolation or hopelessness from online courses that are not properly designed and facilitated to build presence and community among the instructor and students (McInnerney & Roberts, 2004; Zembylas, 2008). That is, instructors must consider both the instructor-to-student and student-to-student interactions (Moore, 1989) beyond sheer student-to-content interactions in course design, as students often feel apprehension towards communicating in both synchronous and asynchronous online learning settings. These experiences can also frame how students perceive their capacity and connection with their online instructors. The harsh reality during the COVID-19 pandemic is that many instructors who suddenly had to pivot to an online course format. As such, many were not prepared for the realities of creating and facilitating effective online learning experiences (Cutri & Mena, 2020). Effective online learning requires a breadth of knowledge and skills that is not common knowledge among many instructors in higher education (Martin et al., 2019).

The final set of 24 items retained in the OLAS and the three factors identified in the EFA model were: (1) online learner feelings of negativity and inadequacy, (2) online learner apprehension towards personal communication, and (3) online learner discomfort with instructor capacity and communication. We remind our reader that we conducted an exploratory analysis within this study, and thus additional work (e.g., confirmatory factor analysis model on new data) is necessary to provide more concrete validity and reliability evidence of the OLAS. The three-factor model explains approximately 65% of the variance in these data and appears to have univariate normal distributions. As noted, we derived the items from an extant review of literature on online learning which was organized into our conceptual framework to define the contours of online learning anxiety. This conceptual framework ultimately serves as the evidence of content validity of the OLAS and is necessary to document the features used to write the initial items to operationalize online learning anxiety. The results also provide the evidence associated with the internal structure validity evidence of the OLAS data, which appears to be measuring three factors with a degree of internal consistency and strong, positive correlations among the factors identified as demonstrated by the correlation matrix. The strong and positive relationships among the factors of the OLAS suggest a cohesive yet distinct set of constructs manifest undergraduate students' online learning anxiety. Finally, we have provided strong evidence of convergent and divergent validity among the scores from each OLAS factor and other measures hypothesized to relate to online learning anxiety factors. The OLAS appears to reflect the themes that emerged from our extant review of literature organized into our conceptual framework. This alignment suggests a potentially stable theoretical grounding for online learning anxiety among undergraduate students in higher education and suggests the OLAS should next be subjected to a stronger theoretical structure using confirmatory methods.

Relationships Between OLAS and Theorized Related Measures

We anticipated substantive and meaningful relationships among the factors from the OLAS and other known measures related to online learning experiences, or what is sometimes labeled as convergent validity evidence. In the fifth generation of distance education (Moore & Kearsley, 2011), which we aptly call online learning, students use a wide range of information and communication technologies to learn, such as videoconferencing, Learning Management Systems (LMS), asynchronous discussion forums, video, and more. Thus, we anticipated that known measures of technology would meaningfully relate to the construct of online learning anxiety. In the present work, we provided correlational evidence among the OLAS factors and the measures of frequency of technology use, technology self-efficacy, attitudes towards technology, and technology anxiety. Our predictions were that the factors of the OLAS would have inverse relationships with frequency of technology use, technology self-efficacy, attitudes towards technology, and a positive relationship with technology anxiety. These hypotheses were all confirmed with statistically significant relationships except with the frequency of technology use construct, which appeared to have no relationship with online learning anxiety—a form of discriminant validity. We also anticipated that a student's general anxiety would positively relate to their notion of online learning anxiety, which was also confirmed by the significant correlations among the variables. Given that these data were collected during the COVID-19 pandemic, we felt that assessing a student's general anxiety was critical to providing the external validity evidence of the OLAS.

While we do not claim to be the first to identify the factors associated with online learning anxiety, we do believe the OLAS is the first solid and theoretically grounded attempt to operationally define and measure the construct as the primary focus of the research. Other scholars have attempted to describe and measure different aspects of anxiety among online learners (Abdous, 2019; Alibak et al., 2019; Bolliger & Halupa, 2012; Conrad, 2002; Hauser et al., 2012; Heckel & Ringeisen, 2019); however, to the best of our knowledge, none focused on developing a theoretically grounded scale to measure this elusive and increasingly important concept. For instance, Abdous (2019) focused on the notion of online learning anxiety as the primary dependent measure in his study, but only used a single item to measure the construct. Alibak, Talebi, and Neshat-Doost (2019) provided the design and preliminary validity evidence of a scale to measure online learning test anxiety, which did not address many other facets of online learning experiences among undergraduate students. Bolliger and Halupa (2012) related three forms of anxiety to learner satisfaction in online courses: (1) computer anxiety, (2) internet anxiety, and (3) online course anxiety. All of these prior works inspired the present study by incorporating the findings into our conceptual framework and preliminary item pool, but again, none of these studies address the operational definition and measurement of this potential multidimensional construct.

Recommendations for Future Research and Practice

There are myriad opportunities to employ the OLAS in future research involving online learning anxiety, and broadly for online learning experiences among undergraduate students in institutions of higher education. However, first, we believe a natural next step in scale development is to conduct rigorous confirmatory factor analyses on new data from undergraduates from different institutions of higher education. Additionally, as previously mentioned, testing the OLAS further outside a period of a global pandemic will better define how scores may or may not generalize to various contexts in which online learning is occurring. Any future validation studies would provide additional and generalizable evidence of validity and strengthen the conceptual framework and theoretical grounding upon which we based our exploration of the concept of online learning anxiety and initial tool development. Additionally, using the factors in statistical models to detect potential differences among sample demographics and other relevant characteristics (e.g., major) would be a valuable contribution to online learning scholarship. We recommend scholars of online learning administer the OLAS to different populations first within the United States with the intent of gathering additional validity and reliability evidence. Eventually, we would hope the OLAS would be translated into different languages and disseminated to other online learning students across the globe. The OLAS was intended for undergraduate student populations in institutions of higher education. However, the scale may prove promising with slight alterations and adaptations to other student populations, such as K-12 students or students enrolled in graduate programs. Given the highly cohesive nature of the correlations among the three factors of the OLAS, it might be evidence that a second higher-order measurement model would be appropriate, but as noted, we need to first collect additional data and use confirmatory factor analysis methods. In terms of educational practice in online learning, the OLAS may prove to be an important measurement system with the deployment of new online learning programs among undergraduate students. As an early measure in deployments of online learning, the data may assist educators and administrators in planning necessary interventions and supports for their students. An important question we cannot answer in this research is the extent to which online learning anxiety is a malleable construct subject to change with appropriate interventions with students. Again, only future research will help address some of these larger questions.

Closing Remarks

While the online learning research literature has provided some preliminary evidence of the existence of online learning anxiety and some disjointed attempts to assess the construct have been made, we believe this research provides a first and solid attempt at systematically operationalizing and exploring the measurement nature of this emerging and possibly evolving construct by providing a coherent conceptual framework for online learning anxiety based on relevant research in online learning, and an initial 24-item scale for further validation studies. Certainly, the results from the present study suggest the OLAS is measuring a highly internally consistent set of factors that have meaningful relationships with other known indices of online learning among undergraduate students in higher education. We do not claim the OLAS as the only, or even best, option for future research and practice, but it might eventually prove to be a helpful tool and starting point among the online learning community to better understand our students and their anxieties about online learning experiences, which have been exacerbated by the recent COIVID-19 pandemic. We hope this article serves as an impetus for the online learning community to better understand this issue.

Declarations
The authors declare no conflicts of interest.
Ethics approval for the study was granted by the University of Florida, USA.
The authors declared no funding was received for this work.

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Appendix A
Descriptive Statistics for all Items

Item #	Items	M	SD
1	Online courses scare me.	2.68	1.26
2	I do not have a lot of confidence when it comes to studying online.	3.03	1.36
3	I get a bad feeling when taking an online course.	2.81	1.32
4	I am anxious while taking an online course.	3.06	1.38
*5	Lack of social interaction with other students in an online course is stressful for me.	3.35	1.44
6	Lack of student-instructor communication in an online course is stressful for me.	3.63	1.36
7	The limited experience of some instructors with online learning is stressful for me.	3.81	1.29
8	Online exams are more stressful for me than in traditional face-to-face exams.	3.30	1.50
9	The lack of access to my instructor in an online course is stressful for me.	3.48	1.38
10	I feel apprehensive about learning in an online course.	3.14	1.36
11	I worry if I can tell others what I am honestly thinking in an online course.	2.87	1.36
12	I become tense and nervous while participating in discussions in an online course.	2.97	1.34
*13	I worry if I can accomplish the learning objectives in an online course.	3.23	1.40
*14	I fear making mistakes I cannot correct when learning in an online course.	3.27	1.44
15	I worry if I can communicate effectively with other learners in an online course.	3.31	1.36
16	I fear hitting the wrong key or clicking the wrong hyperlink in an online course.	2.57	1.43
17	I fear communicating with a new acquaintance in an online course.	2.74	1.34
18	I worry if I can gather needed information for my assignments in an online course.	3.19	1.38
19	I worry if I can properly operate the learning environment in an online course.	2.92	1.39
20	I am anxious when participating in real-time online discussions.	3.03	1.38
21	I worry about other people seeing me in video-conferencing in an online course.	3.15	1.42
22	I get lost in all of the tasks in an online course.	3.19	1.42
23	I am not an online learner.	2.99	1.30
24	Navigating online courses is bothersome.	3.04	1.35
25	I am anxious to express myself in an online course.	2.82	1.39
*26	I am intimidated by other online learners.	2.33	1.27
27	I worry that my instructor does not know how to teach online.	3.27	1.36
28	I am anxious to have to wait for feedback in an online course.	3.33	1.38
*29	I am uncomfortable being assessed in an online course.	2.87	1.36
*30	I worry about learning from the media (e.g., video) in online courses.	2.79	1.36

*Denote items removed after the exploratory factor analysis due to cross-loadings.

Appendix B
Pattern Matrix from Final Three-Factor EFA Model

Item #	Items/Factors	1	2	3
1	Online courses scare me.	**0.911**	0.04	-0.144
2	I do not have a lot of confidence when it comes to studying online.	**0.9**	-0.077	-0.002
3	I get a bad feeling when taking an online course.	**0.926**	-0.015	-0.043
4	I am anxious while taking an online course.	**0.819**	-0.018	0.035
8	Online exams are more stressful for me than in traditional face-to-face exams.	**0.346**	0.115	0.239
10	I feel apprehensive about learning in an online course.	**0.734**	-0.051	0.183
19	I worry if I can properly operate the learning environment in an online course.	**0.515**	0.246	0.036
22	I get lost in all of the tasks in an online course.	**0.545**	0.063	0.175
23	I am not an online learner.	**0.864**	-0.025	-0.019
24	Navigating online courses is bothersome.	**0.666**	0.101	0.04
11	I worry if I can tell others what I am honestly thinking in an online course.	0.134	**0.441**	0.222
12	I become tense and nervous while participating in discussions in an online course.	0.093	**0.742**	-0.03
15	I worry if I can communicate effectively with other learners in an online course.	0.309	**0.448**	0.116
16	I fear hitting the wrong key or clicking the wrong hyperlink in an online course.	0.049	**0.468**	0.069
17	I fear communicating with a new acquaintance in an online course.	0.067	**0.731**	-0.064
20	I am anxious when participating in real-time online discussions.	-0.051	**0.955**	-0.105
21	I worry about other people seeing me in video-conferencing in an online course.	-0.176	**0.801**	0.059
25	I am anxious to express myself in an online course.	0.118	**0.728**	-0.017
6	Lack of student-instructor communication in an online course is stressful for me.	0.216	-0.066	**0.712**
7	The limited experience of some instructors with online learning is stressful for me.	-0.141	-0.038	**0.965**
9	The lack of access to my instructor in an online course is stressful for me.	0.146	0.059	**0.679**
18	I worry if I can gather needed information for my assignments in an online course.	0.299	0.207	**0.312**
27	I worry that my instructor does not know how to teach online.	0.026	-0.039	**0.659**
28	I am anxious to have to wait for feedback in an online course.	0.047	0.291	**0.44**

Culturally Responsive Teaching in an Undergraduate Online General Education Course

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Abstract
While inclusive pedagogies such as culturally responsive teaching may be common in face-to-face learning, there is little published research regarding culturally responsive teaching and learning in higher education online settings. It is not known whether faculty members employ culturally responsive teaching strategies or what types of strategies they use in online courses. The purpose of this study was to determine whether online faculty members practice culturally responsive teaching and to explore the characteristics of culturally responsive teaching that are reflected in the responses of 12 instructors in a fully online undergraduate general education course required in the first few terms of enrollment. Qualitative methodology was utilized, involving deductive and inductive coding methods of analysis. Data were coded deductively based on four major categories of cultural competence: sociopolitical/cultural consciousness, community of learners, and high academic expectations. Data were coded inductively for culturally nonresponsive interactions. Findings from deductive analysis revealed partial use of culturally responsive teaching strategies in online classrooms. Results for inductive analysis showed themes of nondifferentiated responses, missed opportunities for addressing linguistic or cultural differences, and lack of encouragement for collaboration or sense of community. These findings indicate a need for further research in culturally responsive teaching in online learning as well as faculty professional development that focuses on culturally responsive teaching.

Keywords: Culturally responsive teaching, online instruction, college teaching

Schirmer, B. R. & Lockman, A. S. (2022). Culturally responsive teaching in an undergraduate online general education course. *Online Learning, 26*(3), 132-148.

Online learning has been a disruptive innovation in higher education since personal computers became commonplace and enabled instruction to be delivered at the learner's fingertips (Christensen et al., 2017). Given concerns about the high rate of attrition in online courses and lack of persistence to graduation in online degree programs (Bawa, 2016; Bettinger & Loeb, 2017; Shaw et al., 2016), teaching practices in online instruction have been a topic of great interest to researchers seeking to identify approaches with evidence of effectiveness for improving learner achievement and satisfaction. The body of research on online instruction is broad but not deep, with few studies that follow a line of research inquiry or replicate previous findings on topics such as course design, pedagogical practices, student engagement, and student success factors (Lockman & Schirmer, 2020), and very few studies address culturally responsive teaching specifically in higher education courses.

Given past and potential shifts in the terminology used to identify modalities of course delivery since the early days of online instruction, we have chosen to specify the terminology we use in this study. We use the term *face-to-face* to refer to courses offered in person in a brick-and-mortar classroom, *online* to refer to courses offered fully online, and *blended* to refer to courses with online and face-to-face components. We use the terms *synchronous* to mean that all students participate online in real time but in different locations and *asynchronous* to mean that students participate in an online learning course at different times.

Culturally Responsive Teaching in Higher Education

Ladson-Billings (1995) proposed a theory of culturally relevant pedagogy, positing that effective pedagogical practice must both address student achievement and help students accept and affirm their cultural identity. Gay (2002) used the term "culturally responsive teaching" to refer to pedagogy that incorporates cultural referents to make learning more relevant and effective for diverse students. Most of the research on culturally responsive teaching has focused on K-12 education and within this body of literature, descriptions of teacher behaviors that reflect principles of culturally responsive teaching predominate (e.g., Malo-Juvera et al., 2018; Thomas & Berry, 2019).

The research on culturally responsive teaching in higher education is sparse (Kono & Taylor, 2021). Most studies have involved explorations of the perceived knowledge and ability of instructors to implement culturally responsive teaching practices, although two studies focused on course structure factors that promote culture and diversity. Adams et al. (2018) examined the incorporation of culturally relevant pedagogy into six literacy courses taken by undergraduate and graduate students in education. They found a lack of emphasis on culturally responsive pedagogy that appeared to result from a lack of alignment between objectives, standards, and rubric assessments. Siwatu et al. (2016) examined the self-efficacy doubts of preservice teachers about their ability to implement culturally responsive teaching. Findings indicated teachers' overall confidence albeit with doubts about relating to their students' home lives and teaching about the historical relevance of diverse cultures. Heitner and Jennings (2016) investigated the knowledge and practices of online instructors toward culturally responsive teaching to meet the needs of diverse learners. Results showed that while instructors recognized the need for culturally responsive teaching, their knowledge fell short of addressing this need. Han et al. (2014) conducted a qualitative study to explore the perceptions of about their role as culturally responsive educators and found that participants struggled with defining culturally responsive pedagogy in higher education. Cook-Sather and Agu (2013) conducted a series of studies on the Students as Teachers and Learners program in which undergraduate students of color and international students work in partnership with faculty members for one semester. The authors reported that shared authority and responsibility between the student and faculty member promoted culturally sustaining pedagogy.

Discussion Forums as Sites for Culturally Responsive Teaching

Discussion forums are a staple of online instruction designed to engage students in sharing their insights and ideas about a topic and to encourage student-student and student-faculty interaction. Ringler et al. (2015) found statistically significant relationships, both between the number of student posts and number of instructor posts, and the number of student posts and the presence of higher-level thinking in the posts. Other studies have focused on the influence of instructors' discussion posts. Liu and Yang (2014) investigated the influence of instructor presence during asynchronous discussion forums on student learning. They found that discussions were most effective when instructor presence encouraged discussion of the students' personal lives rather than only discussion of factual material and theory. Hoey (2017) examined the effect of instructor discussion posts on student learning outcomes and found that the frequency of instructors' interaction during forums had no significant influence on students' perception of their learning and actual achievement; however, the content of the instructors' discussion post was significantly related to student satisfaction and achievement of learning outcomes.

Discussion forums offer a glimpse into faculty-student and student-student interactions. Such interactions are data sources in research involving class observations in face-to-face courses, but observational data are unavailable in asynchronous courses. Online discussion forums are like face-to-face classroom discussions focused on a prompt or question, yet different in that they can take place over a period of days. As they reflect turn-taking among participants, the content of posts that flow from one to the next can provide information about variables of interest, such as the inclusion of culturally response teaching.

The Current Study

As there had been no prior research on the interactions between instructors and students in college coursework from the perspective of culturally responsive teaching, our study offered the potential to identify characteristics that reflect culturally responsive teaching in instructors' discussion forum posts, characteristics of culturally responsive teaching that are absent in their posts, and characteristics of posts that reflect culturally nonresponsive teaching. The purpose of this study was to explore the following research questions.

1. What are the characteristics of culturally responsive teaching reflected in the discussion forum responses of instructors in a fully online undergraduate general education course required within the first terms of enrollment?
2. What are the characteristics of culturally responsive teaching that are absent in the discussion posts of instructors?
3. What are the characteristics of discussion forum responses of instruction that reflect culturally nonresponsive teaching?

Method

We used an exploratory qualitative design to examine the characteristics of culturally responsive teaching reflected in the responses of instructors in an undergraduate general education course required in the first few terms of enrollment at a fully online university. We selected this course because multiple sections are offered each term, taught by a variety of instructors, and utilizing discussion forums as the primary venue for instructor-student interaction. We chose an early term course because establishing a sense of community and engagement in course content have been found to be important factors in student persistence during early college coursework (Vayre & Vonthron, 2017).

Context and Participants

The course had a duration of six weeks and required weekly asynchronous discussions. We selected the week 1 and week 4 discussion forums for analysis as these would offer data at the earliest and near-end points in the course. The final week was excluded since discussions tend to be a wrap-up of the course. Therefore, by selecting week 1 and week 4, our data included all discussion posts at two key points during the course. Discussion prompts were identical in all sections for both week 1 and week 4.

Twelve faculty members taught this course during the Spring 2019 term. These instructors were not explicitly trained in culturally responsive teaching at this university, and most were adjuncts. The course was in the general education department and included content related to technology, art, and literature. In a typical year, more than 100 sections of this course are taught, each with an enrollment of 20-30 students. Student enrollment at this university is highly diverse, with students from a variety of geographic, ethnic/racial, and age/experience backgrounds. The course tends to have a high success rate.

Data Collection

As the discussion forums are the intellectual property of the university, we requested and received de-identified discussion forums for the 12 sections taught by various instructors, amounting to 24 total discussion boards, of which there were typically 100-200 posts. We received the de-identified data from the Director of Educational Assessment after obtaining IRB approval.

We then prepared the discussion forum data for analysis. We created a table for each discussion forum with columns for discussion posts, open codes, and notes. We cut each discussion post into a row of the table in the same sequence as in the transcript with a notation that it was from a student (S) or the instructor (I).

Data Analysis

We used deductive and inductive coding as approaches for data analysis. For deductive coding, we created an a priori scheme, shown in Table 1. The scheme is based on frameworks and evaluation tools of elements of culturally responsive teaching, including Ladson-Billings (1995), Gay’s (2018) framework of culturally responsive teaching, Rhodes’s (2017) culturally responsive teaching survey, culturally responsive teaching strategies described by Chen and Yang (2017), Hsiao’s (2015) culturally responsive teacher preparation scale, and Holgate’s (2016) culturally responsive classroom climate scale.

Table 1
A Priori Culturally Responsive Teaching Scheme

Cultural Competence	Provides examples from different cultural backgrounds to explain concepts Shows interest in students' cultural backgrounds Supports language acquisition by using language the students can understand to enhance comprehension of material and tasks Encourages student to share ideas related to their culture Uses culturally appropriate activities Encourages students to make cross-cultural comparisons
Sociopolitical/Critical Consciousness	Incorporates information about international past and current events Includes issues related to acculturation Reflects consciousness of personal culture Encourages students to develop cultural consciousness Encourages students to critique cultural norms, values, and institutions
Community of Learners	Maintains fluid student-teacher relationships Encourages students to engage in collaborative learning in groups reflecting different personal characteristics
High academic expectations	Fosters academic success through differentiated instruction

The deductive coding scheme included the four major categories of cultural competence, sociopolitical/cultural consciousness, community of learners, and high academic expectations, and the subcategories of each. This a priori scheme enabled us to identify characteristics of culturally responsive teaching that participants did and did not use in their discussion forums.

To identify characteristics that reflected culturally nonresponsive teaching, we then analyzed the same data inductively (Creswell & Creswell, 2018; Ravitch & Carl, 2016). We categorized data that were similar and coded each chunk. We reviewed the data in several phases of iteration, combined codes, built descriptions of the themes that emerged, and inferred meaning.

To address potential issues of trustworthiness, we employed the following strategies to assure credibility, transferability, dependability, and confirmability (Patton, 2015). We engaged in researcher reflexivity by considering our assumptions, beliefs, values, and biases that could influence our interpretation of the data. We kept an audit trail to track questions, insights, and decisions during data collection and analysis. Between the two researchers, we independently analyzed the corpus of data and then compared our findings, discussed discrepancies, and reached consensus for each discussion post. During each phase of analysis, we searched for other explanations for the same evidence and evidence inconsistent with emerging codes.

Results

We discuss results that emerged from the deductive analysis for the first two research questions and the results that emerged from the inductive analysis for the third research question. As themes, we identified culturally responsive teacher behaviors exhibited by instructors, culturally responsive teacher behaviors not exhibited, and culturally nonresponsive teacher behaviors in instructor responses. Overall, every instructor engaged in at least one type of culturally responsive teaching, but no instructor engaged in them all. Moreover, almost every instructor engaged in at least one culturally nonresponsive practice.

Characteristics of Culturally Responsive Teaching Reflected in Discussion Forums

Our first research question examined which characteristics of culturally responsive teaching are reflected in instructors' discussion forum responses. We found that most instructor practices fell within just one or two sub-categories within each of the categories of cultural competence, sociopolitical/critical consciousness, and community of learners.

Cultural Competence

While almost all instructors engaged in at least one subcategory of cultural competence, most engaged in only one or two subcategories. Instructors were most likely to provide examples from different cultural backgrounds to explain concepts; some also showed interest in students' cultural backgrounds or encouraged students to make cross-cultural comparisons.

Provides Examples from Different Cultural Backgrounds to Explain Concepts

Of the 12 instructors, 10 incorporated this subcategory in their discussion forum responses, as the following excerpts show.

> When I talk to my social group of friends I use a lot more slang or shorthand then [sic] I do when I talk to students or work colleagues. When I talk to other people who are part of a distinct co-culture I may use argot, the specialized language of that co-culture. (Participant B)

> I think it is mostly a cultural thing. I am amazed at how in the middle of the African desert, one will not have electricity, but can get a cell signal and internet on their smart phone and those living there use these devices a lot, but do not have and have never used a basic computer. (Participant K)

> Class, when I drive to Missouri to visit my brother and family I drive through Amish country. Though it is true they are closer to our ancestor's way of life by denouncing modern technology, they still have evolved and began using the tools of this generation. They utilize modern technology in the design of their harnessing horses as a mean [sic]of transportation. If we go farther back in our time horses were not used for transportation and the wheel had yet to be invented. (Participant C)

Shows Interest in Students' Cultural Backgrounds. This category was incorporated in the discussion forum posts of 4 of the 12 instructors.

> The virtual class that I am currently enrolled in has students from different states, culture, race and languages, so the chance of learning something new is reasonably higher than meeting the same people in everyday outdoor life. (Participant B)

> The advantage of being in the virtual space is greater than any would think of because it allows us to meet with different people from a variety of places, for example, the virtual class that I am currently enrolled in has students from different states, culture, race, and languages, so the chance of learning something new is reasonably higher than meeting the same people in everyday outdoor life. (Participant B)

> we should embrace the many aspects of our latest digital breakthroughs that enhance our humanness and allow us both to explore the world and to connect with so many people around the world and from different backgrounds, (Participant Z)

Encourages Students to Make Cross-Cultural Comparisons. This category was incorporated in the discussion forum posts of 6 of the 12 instructors.

> Just look at our class map! We can contact almost anyone on the planet at any time, which allows us as humans to be more connected than we would be without the aid of technology. (Participant C)

> As far as your answer, I will agree that online communication can be a blessing for the shy person or those who fear the immediate judgment of others. (Participant Q)

> So as you can read, I have some concern with some of the deception that is involved especially when some people hide their intentions behind a cloud of anonymity. (Participant K)

Sociopolitical/Cultural Consciousness

All instructors incorporated the five subcategories of sociopolitical/crucial consciousness in their responses. Of these, three were evident in the discussion forum posts of most instructors and one was used by just under than half: (a) incorporates information about international past and current events, (b) includes issues related to acculturation, (c) reflects consciousness of personal culture, and (d) encourages students to develop cultural consciousness.

Incorporates Information About International Past and Current Events

This subcategory was incorporated in the discussion forum posts of 10 of the 12 instructors.

> Twitter was instrumental in bringing forward social change in the Middle East but I can also say that from a dear friend and professor at the University at Alexandria few thought that the movement would have gone as far as it did. So can the social media be hijacked for political interests? (Participant F)

> In other countries the Internet is censored and sites are quickly taken down. In the US we have encountered little to no censorship on the Internet. According to our reading in the Wilson Quarterly if such liberties were to be censored Zuckerman states “the government risk brewing a revolution” (Participant B)

> In a sense, modern technology has shrunk the world. Today, people can get good information at the touch of the button. Of course, they must beware of misinformation, but if they are smart consumers, they have access to wonderful information that previous generation could only dream of, and this can help us at work and our personal lives. Yet, the same technology that can be used to help people can help swindlers and cyber thieves to steal and hurt. (Participant X)

Includes Issues Related to Acculturation

This subcategory was incorporated in the discussion forum posts of 4 of the 12 instructors.

> Many people say that our technologies are not going to rob us of our humanity because our technologies are part of what makes us human, [sic] and are the clear expression of our uniquely human minds. They both manifest and enable human culture; we co-evolve with them, [sic] and have done so for hundreds of thousands of years. (Participant C)

> What is certain is that the reach of technology has accelerated how we share ideas and the social issues that have been brought to the global forum. (Participant K)

Reflects Consciousness of Personal Culture. This subcategory was incorporated in the discussion forum posts of 7 of the 12 instructors.

> For I think that we are not fully aware of all the ways we are communicating when we speak f2f. Just think of the messages we send just by the clothes we wear or how we present ourselves. (Participant F)

> It is almost impossible to live within today's society like this, however there is value in "resting off the grid" in one or two ways when we feel "possessed" by technology. (Participant B)

> Have you ever tried to tie down your hands and see if you would communicate the same way. For I think that we are not fully aware of all the ways we are communicating when we speak f2f. Just think of the messages we send just by the clothes we wear or how we present ourselves. (Participant F)

Encourages Students to Develop Cultural Consciousness. This subcategory was incorporated in the discussion forum posts of 10 of the 12 instructors.

> The author discusses differences between political and social activism using Internet tools with physical social activism. What insights have you gained about this reading? (Participant P)

> speaking with culture sensitivity can help the speaker build trust and creditability. Another way is to avoid jargon with people who do not share the same knowledge. (Participant F)

> What could be added to an email to ensure a positive outcome, especially for our friends who are English Language Learners? (Participant Q)

Community of Learners

For the community of learners category, all participants incorporated the first subcategory and half the second: subcategory: (a) maintains fluid student-teacher relationships and (b) encourages students to engage in collaborative learning in groups reflecting different personal characteristics.

Maintains Fluid Student-Teacher Relationships

This category was incorporated in the discussion forum posts of 12 of the 12 instructors.

> I like your use of the term "facade." For many, that is exactly how they interact online, whether they are trying to phish or steal identities or just make themselves look better. (Participant H)
>
> We can be flexible and make it work in our schedule, and by "we," I mean students as well as professors! (Participant A)

Encouraging Students to Engage in Collaborative Learning in Groups Reflecting Different Personal Characteristics

This category was incorporated in the discussion forum posts of 6 of the 12 instructors.

> Think of this as a conversation between you and your colleagues. (Participant C)

Characteristics of Culturally Responsive Teaching Absent from Discussion Forums

Our second research question examined which characteristics of culturally responsive teaching were absent in the discussion posts of instructors. We found that one category (high academic expectations) was used by just one instructor, three of the six subcategories of cultural competence were used by one or no participants, and one of the five subcategories of sociopolitical/critical consciousness was used by just three participants. Community of learners was the only category for which all subcategories were included in the responses of most participants.

High Academic Expectations

As just one participant addressed high academic expectations by fostering academic success through differentiated instruction, this category was not sufficiently present in the repertoires of the participants, so we coded it as a discrepant case. The following is an excerpt for high academic expectations.

> These are all ways to say that you've touched the surface of a topic- which is an important first step. But, you need to, well, dig deeper. One of the best things about learning is the opportunity to really explore and take things in. (Participant C)

Cultural Competence

Three subcategories of cultural competence were incorporated by one or no participants. We found no examples of: (a) encouraging students to share ideas related to their culture or (b) using culturally appropriate activities. The subcategory of (c) supporting language acquisition by using language the students can understand to enhance comprehension of materials and tasks, used by just one instructor, was identified as a discrepant case.

> When we speak using contractions, many times our diverse audience may need to stop and think. I know that I do!!! And, English is my first-language! Consequently, our Audience may miss the entire message. (Participant Q)

Sociopolitical/Critical Consciousness

One subcategory of sociopolitical/critical consciousness was used by three participants: encouraging students to critique cultural norms, values, and institutions. Given this finding, we did not consider the strength of evidence to be sufficient and coded it as a discrepant case.

> People are now ”brands” that try to enhance image on Instagram/Twitter/Facebook and they are comparing themselves to other idealized representation. If you accept that all the other people you know have these wonderful lives, but we do know that social media doesn't reveal the totality of a person's life. (Participant C)

> The same technology that can be used to inform the world and connect us to love ones all over the world can distract us from meaningful relationships. It is up to each of us individually and collectively to use technology in a way that adds to humanity rather than detract from it and to use it to strengthen not weaken our personal relationships. (Participant X)

Characteristics of Culturally Nonresponsive Teaching Reflected in Discussion Forums

Our third research question examined the characteristics of discussion forum responses of instruction that reflected culturally nonresponsive teaching. Based on inductive data analysis, we found culturally nonresponsive posts among most participants. We categorized these as: (a) nondifferentiated responses (4-7 instructors), (b) missed opportunity for linguistic differences or cultural differences in communication (11 of 12 instructors), (c) stereotyped comments (3 of 12 instructors), (d) use of language not accessible to all (2 of 12 instructors), (e) pushes personal agenda (1 of 12 instructors), and (f) does not encourage collaboration or sense of community (9 of 12 instructors). Of these, only nondifferentiated responses, misses opportunity for linguistic differences or cultural differences for communication, and does not encourage collaboration or sense of community were included in the responses of more than half of the instructors. We identified these as themes of culturally nonresponsive instruction.

Nondifferentiated Responses

We identified responses from instructors that seemed disconnected from both content and student responses. These comments were extremely general rather than focused on individual student needs, and so did not reflect culturally responsive teaching.

Nonspecific Responses. Included in the responses of 7 of 12 instructors.

> Superlative feedback to my Secondary Q to you! Good sharing! Smashing effort! (Participant Q)

> Many instances of “thanks for sharing…” (Participant P)

General Praise Versus Precise Feedback. Included in the responses of 7 of 12 instructors.

> Stellar discussion post (Participant A)
> Fantastic thoughts and ideas (Participant B)

Nonresponse to Student Comment. Included in the responses of 7 of 12 instructors.

> Thanks for sharing your insights [no insights were shared by the student]. Please also consult the COURSE HOME thread for announcements. (Participant P)
>
> S: I played violin and viola from 5th grade to 10th grade; it was an elective at school. One of us called it a fiddle. Our instructor said no, we cannot call it a fiddle. She said we must learn to play it fully, do everything that can be done with it, and then we can call it a fiddle. I think that is a good way to look at life. Children should first learn all about being human, interacting with others, and then they can use technology to interact. Also, learn how to do everything to survive, every way to do a job, then use technology to make it easier.
> T: thank you for your answer and insight. You make some great points. In the end, electricity is the fuel of modern technology (Participant X)'

Redundant Posts. Identical responses were frequently repeated verbatim by the same instructor. Redundant posts were included in the posts of 4 of 12 instructors.

Missed Opportunity for Linguistic Differences or Cultural Differences in Communication

We identified responses from instructors that overlooked points that could have been addressed related to culture or language. These represented missed opportunities for culturally responsive teaching.

> I was right with you until you got to the very end. I have one question for you. Can I hug my grandchildren through the computer in virtual space? If not, then I can't be fully human in virtual space. (Participant M)
>
> Thanks for sharing the media story about Jesse Smollet [Jussie Smollett]. I remember reading that story online. (Participant P)
>
> I would love to live in Norman Rockwell's world again. I did as a child, but the world changes so fast these days. (Participant M)

Does Not Encourage Collaboration or Sense of Community

We identified responses from instructors in which opportunities to collaborate and build community were overlooked. As collaboration and sense of community are key aspects of culturally responsive teaching, we saw this as another missed opportunity.

> University "discussions" are NOT casual chats with your classmates, but rather an academic thinking and writing exercise worth significant points toward your final grade. (Participant C)
>
> I never really learned how to post a tweet, nor did I really care. I just did not find it interesting. Why would I want to waste my time reading all of that? (Participant M)
>
> In the future, please answer the discussion in essay format and not in question and answer format. This is covered in the announcement page. As far as your answer In [sic] the future, please do not repost the question. It is redundant. As far as your answer, you [sic] have some weird indentations. Please fix this in your future posts. As far as your answer, In [sic] the future, please always capitalize I when referring to yourself.? (Participant X)

Discrepant Cases for Culturally Nonresponsive Teaching

We identified the following categories as discrepant cases given that they appeared in the responses of three or fewer instructors. Each of these represented comments that contradicted the philosophy of culturally responsive teaching, including stereotyped comments, inaccessible language, and teacher-centered comments.

Stereotyped Comments.

> Thus, evil people will use technology for evil while good people will use technology for good. The problem comes because technology allows evil people to do great damage. (Participant X)
>
> Look at our world years and years ago. It wasn't a "disaster." People talked more; kids played outside, and families ate meals together. Not so "disastrous" in my book. (Participant A)

Use of Language Not Accessible to All.

> Marinating relationship is critical to our existence (Participant B)
>
> could ever replace the warmth and compassion inherent in face-to-face communication let alone in human touch and care and that we also need to be mindful of how much we rely on all these remote technologies before they turn into crutches, avatars, or shields whereby to hide behind and/or escape reality as indicated in your posting as well, and please continue to share (Participant Z)
>
> You not only have the err of caution. (Participant C)

Pushes Personal Opinion.

> She could not do this in virtual reality. She could do this person. Now that she lives next door to me, we can hug every day in person. I do not think you can experience all the senses in virtual reality. (Participant M)

Discussion

The research in online teaching and learning has largely involved the search for a wide net of factors important to student success, satisfaction, and persistence to course completion and degree attainment. This study addresses a gap in research concerning culturally responsive teaching practices in higher education online courses (Kono & Taylor, 2021). As culturally responsive teaching is intended to nurture and support cultural competence while fostering students' academic achievement, the incorporation of characteristics of culturally responsive teaching has the potential to promote success among students who are least likely to succeed or persist in college coursework.

Our findings demonstrate that certain aspects of culturally responsive teaching were implemented by most instructors. At least half of the instructors provided examples from different cultural backgrounds to explain concepts, showed interest in students' cultural backgrounds, encouraged students to make cross-cultural comparisons, incorporated information about international past and current events, encouraged students to develop cultural consciousness, reflected consciousness of personal culture, maintained fluid student-teacher relationships, and encouraged students to engage in collaborative learning. Yet, other aspects of culturally responsive teaching were either implemented sparsely or not implemented at all. These included fostering academic success, supporting language acquisition, using culturally appropriate activities, encouraging students to make cross-cultural comparisons, including issues related to acculturation, and encouraging students to critique cultural norms, values, and institutions.

Our findings also reflected culturally nonresponsive discussion forum posts by instructors. Some of these we characterized as nondifferentiated because they were nonspecific, not responsive to student posts, redundant with previous posts, and expressed general praise without offering feedback. Others in the theme of culturally nonresponsive included missed opportunities for addressing linguistic or cultural differences and provided no encouragement of collaboration or sense of community.

In terms of the practical implications of our findings, we suggest that discussion prompts could be written to incorporate culturally responsive referents that promote the themes of cultural competence, sociopolitical/cultural consciousness, community of learners, and high academic expectations. Findings also suggest that discussions among faculty members about the value of culturally responsive pedagogy and the benefits of culturally responsive teaching could bring the importance of incorporating cultural referents to the forefront during online discussions.

The implications for further research are broad, given how little research has been conducted on culturally responsive teaching in higher education face-to-face and online classes. One direction involves qualitative studies that explore the qualities of culturally responsive teaching in a range of courses at the same or different universities. Along this line of research inquiry, Kono and Taylor (2021) explored the equitable practices used by 19 university faculty members in the abrupt shift from in-person to remote instruction during the pandemic. Their findings showed that instructors who reported student well-being as their top priority experienced strong student engagement, which the authors characterized as a component of culturally sustaining practices. Another direction for further research involves experimental investigations of the effectiveness of professional development in implementing culturally responsive strategies within various disciplines and modes of instruction.

Limitations

This study was limited in scope given that we explored the practices of just 12 instructors in one course within a single online university. As undergraduate students enroll in this course within the first year of matriculation, the demographics of the students in the course would likely reflect the diversity among undergraduates at the university. However, asynchronous discussion forums serve to mask the individuality of students to their instructors except for what the students decide to share. And since the design of the study also masked information about student diversity, it was not possible to identify potential referents to cultural diversity within the discussion forums. The design also masked the identity of course instructors so it was not possible to connect patterns of responses to their diversities.

Conclusion

The study addressed a gap in research on the interactions between instructors and students in online college coursework from the perspective of culturally responsive teaching. We explored the characteristics that reflect culturally responsive teaching, characteristics of culturally responsive teaching that were absent, and characteristics that reflect culturally nonresponsive teaching in the discussion forums of an undergraduate general education course.

Results for answering the first and second research question showed themes of cultural competence, sociopolitical/cultural consciousness, and community of learners, with several subcategories of each, indicating that the participants incorporated some of the a priori categories and subcategories but did not include others. Results for answering the third research question showed themes of nondifferentiated responses, missed opportunities for addressing linguistic or cultural differences, and lack of encouragement for collaboration or sense of community. These findings show that many qualities of culturally responsive teaching that informed our a priori scheme were, indeed, reflected in the discussion forum posts of instructors. However, some qualities were absent, and characteristics of culturally nonresponsive teaching were present in the posts.

As the study involved exploration of culturally responsive teaching in the discussion posts of instructors who had not received training on strategies that reflect the qualities of cultural responsiveness in instruction, the results are both heartening and discouraging. They are heartening in the sense that instructors incorporated culturally responsive practices in the absence of training. Yet, they are discouraging because despite the importance of student engagement in instruction for persistence to college graduation, instructors did not incorporate several qualities of culturally responsive teaching and did use several culturally nonresponsive posts to students that could potentially be inhibiting for full class participation and dissuading to perseverance from course to course.

Declarations

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

The authors assert that approval was obtained from an ethics review board (IRB) at Walden University, USA.

The authors declared that they received no financial support for the research, authorship, and/or publication of this article.

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Advising Sleep Deprived Students to Take Online Classes

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Abstract
Surveys indicate that nearly three-fourths of all college students do not get an adequate amount of sleep on most nights and over half report daytime sleepiness. Sleep deficiency impairs cognitive function, diminishes academic performance, and impedes learning. Asynchronous online education, which provides flexibility to participate in learning exercises and complete assignments at a time and pace that better matches a student's sleep schedule, may offer a solution to this problem. In this study, we examine the impact of reported sleep deprivation on learning outcomes for a group of students who took an asynchronous online class versus a similar group of students who took the same class in a face-to-face (F2F) setting (N = 399). Our results indicate that whereas sleep deprivation, all other factors held constant, significantly negatively affects learning for F2F students, no such influence is observed for online learners. Student counselors and school administrators should therefore consider advising sleep-deprived students to take more online classes to enhance student learning outcomes, which in turn may improve student retention and degree completion.

Keywords: college students, sleep deprivation, face-to-face education, asynchronous online learning, improved learning outcomes, student retention, degree completion

Fendler, R. J., & Ruff, C. (2022). Advising sleep deprived students to take online classes. *Online Learning*, *26*(3), 149-168.

Sleep deprivation is defined as an insufficient duration of sleep or impaired sleep quality over an extended period (Gaultney, 2010). Numerous academic studies document that many college students suffer from some degree of, perhaps even chronic, sleep deprivation (Buysse et al., 1989; Hershner & Chervin, 2014; Breese, 2020; Hirshkowitz et al., 2015). Problems associated with sleepiness include impaired memory, degraded sequential thinking, diminished creativity, risky behavior, increased stress, depression, irritability, and aggression (Kelly et al., 2001; Lowry et al., 2010; Taylor et al., 2013; Schlarb et al, 2017). Sleep deprivation lessens cognitive abilities and can harm academic performance.

Even prior to COVID-19, online student enrollment was steadily growing. Between 2002 and 2018, the average annual growth rate in the number of students taking online courses was seven times greater than the annual growth rate in overall higher education (Seaman et al., 2018; Duffin, 2020). Surveys indicate that, particularly for asynchronous online classes, convenience and flexibility are key reasons why students choose to take their courses remotely (Harris & Martin, 2012). More specifically, in asynchronous online classes, students do not have to "show up" at a specific time for class. They can participate in learning exercises and complete tasks at a pace that most appropriately matches their learning style and at a time that best fits their schedule.

The purpose of this study is to empirically investigate whether, all else equal, the flexible nature of an asynchronous online course helps offset the negative impact of sleep deprivation on learning. More specifically, we examine the major factors (including a sleep deprivation variable) that affect learning outcomes of 399 college students who took a face-to-face (F2F) course relative to students who took the same course, taught by the same instructor, in an asynchronous online setting. All aspects of the course, other than mode of instruction, were designed to be as identical as possible. The impact of sleep deprivation on both course average and score on the common, comprehensive final exam (that all students took in a closely proctored classroom) are examined to determine how sleepiness influences learning in the different settings.

Our study and findings have important implications for students, advisement officers, teachers, and administrators seeking to improve student retention and degree completion. To the extent that the negative consequences of sleep deprivation on student learning are reduced in a virtual format, students who know they have sleep issues should consider taking more online courses, especially asynchronous online classes. Moreover, academic advisors should encourage advisees to complete a sleep quality questionnaire (e.g., the Pittsburgh Sleep Quality Index) and then consider advising students who score poorly to take more of their required course load online. And administrators and teachers should consider increasing asynchronous online offerings at their schools to enhance student learning outcomes, which in turn may improve student retention and degree completion. This final lesson is particularly important for schools with a large percentage of students who also hold part-time or full-time jobs or schools with a significant at-risk student population.

Research Questions

The purpose of this study is to empirically examine whether the combination of convenience and flexibility offered by an asynchronous online class format mitigates the impact of sleep deprivation on student learning outcomes. Our specific research objective is to investigate whether perceived sleep deprivation plays different roles in explaining student performance in F2F vs. asynchronous online courses. In this study, we propose to answer the following research questions:

1. Does the nature of reported sleep deprivation among the college students in our dataset correspond with existing literature?
2. All else constant, are student learning outcomes in a F2F class negatively impacted by a self-reported measure of sleep deprivation?
3. All else constant, is the impact of sleep deprivation on student performance reduced (or perhaps eliminated) by taking the same class in an asynchronous online environment?

Literature Review

Gaultney (2010), using the Pittsburgh Sleep Quality Index, a validated self-rated questionnaire that measures sleep quality and patterns (Buysse et al., 1989), reports that over 60 percent of the 1,845 college students in their survey claim to experience poor sleep quality and as many as 27 percent are at risk of having at least one sleep disorder. Hershner & Chervin (2014) find that over 50 percent of college students report daytime sleepiness and nearly 71 percent allege that they do not get an adequate amount of sleep on most nights, especially during the school week. Breese (2020) notes that in a survey of over 10,000 college students in the United States, the average number of hours that students report sleeping is 6.5 hours per night; the National Sleep Foundation recommends that young adults ages 18 to 25 should get 7 to 9 hours of sleep per night (Hirshkowitz et al., 2015). Obviously, sleep deprivation is a serious problem for many college students.

It is tempting to classify college student sleep problems as merely an immature reaction to newfound independence. Doing so, however, overly simplifies a highly complex issue. There are biological, technological, and societal components to college student sleep deprivation.

Biological Factors

Biology, coupled with questionable high school scheduling and the typical college lifestyle, significantly influences teen and college student sleep issues. All organisms have a biological clock that regulates the cycle of circadian rhythms (National Institute of General Medical Sciences, 2020). In humans, there is an internal clock that controls wakefulness and sleepiness. More specifically, the light-related circadian rhythm tells humans to sleep at night and be awake during the day. The circadian cycle influences hormone production, brain wave patterns, cellular reproduction, and more. Circadian rhythm disorders have been associated with poor concentration, impaired performance, diminished cognitive skills, lack of coordination, and headaches (Barion & Zee, 2007).

According to Hagenauer et al. (2009), researchers have discovered that the typical circadian sleep rhythm differs significantly between youth, teens, and adults. Somewhere in the early teen years, about the time most children begin high school, a biologically driven hormonal change occurs. Scientists identify this change as an internal clock shift that tells teenagers to stay awake for an additional two hours per day compared to what they did as pre-teens. The clock shift reverses itself around age 25.

During this period, teens still need the same number of hours of sleep; they merely want to stay awake later at night and sleep longer each morning. However, most high school classes begin at 8 am or earlier. In fact, in many cities in the U.S., high schoolers start classes before elementary school students. Consequently, high schoolers stay up later (for biological reasons) and wake earlier to go to school (often to accommodate after-school programs such as sports), thus disrupting their natural circadian sleep rhythm. To make matters worse, most young teens stay up even later and sleep longer on weekends and holidays, creating a pattern disruption that further disturbs normal sleep cycles (Richter, 2015; Barnes et al., 2016).

Then, after up to four years of unhealthy sleep throughout high school, teens go to college where they experience being “freed” from having to be in class at 8 every morning. Because they can now sleep in longer, new college students often stay up still later each night. Inevitably, however, a major assignment is due, tomorrow is exam day, or it is finals week, and they pull an all-nighter. Still worse, the typical college lifestyle involves weekend parties that often include drugs and alcohol, further impairing sleep quality (Roehrs & Roth, 2001). Consequently, the college experience, which is supposed to provide young adults an environment where they can develop independence while gaining knowledge and understanding, may instead become the perfect storm for sleep deprivation to thrive (Hershner & Chervin, 2014).

Technological Factors

As the sun sets, the body naturally starts releasing melatonin, a hormone that produces feelings of sleepiness. Electronic devices, such as televisions, cell phones, e-readers, and computer screens emit light within the blue spectrum (called “blue light”) that is similar in color and wavelength to daylight. When these screens are viewed at night, the body stops producing melatonin, which impacts sleep (West et al., 2011).

In a study involving 1,508 participants, aged 13 to 64, Gradisar et al. (2013) report that nine out of ten Americans use a blue-light-emitting technological device in the hour before they go to bed. Of this group, 72 percent of those who are high school and college age use a cell phone just before going to bed. In this same study, cell phones, which are interactive technological devices, are shown to have significantly more negative impacts on sleep quality than televisions, which are passive devices. Robb (2019), in a survey of over 1,000 children and parents, finds that 40 percent of teens use their cellphone within five minutes of going to bed and 36 percent of teens wake up and check their cellphone at least one time every night, the majority of which do so to check social media. Mei et al. (2018) conducted a meta-analysis of 19 peer reviewed sleep research studies, involving over 250,000 adolescents. The authors confirm that research conclusively demonstrates that excessive technology usage significantly prolongs sleep onset and reduces sleep duration.

Societal Factors

Sleep deprivation extends well beyond traditional college students. Cort-Blackson (2018) reports that non-traditional college students with full-time jobs, family responsibilities and other life stressors have a higher prevalence of sleep deprivation compared to the general population. Caceres & Hickey (2020) find that sexual minorities have a significantly more sleep problems than their straight counterparts. Roth (2009) notes a strong relationship between sleep challenges and individuals with multimorbidity. Although causality is difficult to establish, the author reports that as many as ninety percent of patients who report comorbid physical or mental illnesses, such as cardiovascular and respiratory diseases, hypertension, diabetes and mood disorders, also report abnormally high levels of sleep deprivation.

Moreover, sleep deprivation is a worldwide issue affecting all income groups, genders, and age categories (AlDabal & BaHammam, 2011). Sleep issues associated with wealth, stress, active lifestyles, and technology are to be expected, and indeed are well documented, in western countries (Krueger & Friedman, 2009; Groeger et al., 2004). Stranges et al. (2012), who examine sleep problems in Africa and Asia, find that individuals in low-income countries are just as likely to suffer from sleep issues as those in richer countries. In a survey of over 7,000 teens, Amaral et al. (2016) report that females are more likely to experience insomnia than males (24.4% to 15.4%), but high levels of insufficient sleep are reported by both genders at approximately the same rate (females = 29.9%, males = 30.4%). Even the young and the elderly suffer from sleep problems. Fricke-Oerkermann et al. (2007) cite studies indicating that 41 percent of parents report sleep issues in their 2- to-14-year-old children and 31 percent of children aged 6 to 13 claim to have problems initiating and sustaining sleep. Williams et al. (2013) find that a significant percent of older adults also experience insomnia and poor sleep quality.

The World Health Organization (WHO) estimates that nearly two-thirds of adults around the world sleep less than eight hours per night, prompting WHO to refer to sleeplessness as a "global pandemic" (Lyon, 2019). Liu et al. (2016) note that the CDC recently declared that sleep deprivation is a "public health epidemic." Chattu et al. (2018) suggest that insufficient sleep syndrome should be classified on a global level as "one of the major noncommunicable diseases" (p. 61).

With regards to sleep deprivation, COVID-19 has made an already bad situation much worse. Increased stress and anxiety, disrupted routines, diminished activity, increased use of electronic devices, and a lack of stimulation is accentuating the circadian rhythm disorders discussed above. In fact, sleep experts have created a new term for the impact that COVID-19 is having on human sleep: "coronasomnia" (Berg, 2020).

Impact of Sleepiness on Academic Performance

Several studies assert that sleep deprivation negatively impacts student learning outcomes. Kelly et al. (2001) discover that students who sleep six or fewer hours per night (short sleepers) have significantly lower GPAs than those who report sleeping nine or more hours nightly (long sleepers). Lowry, Dean, & Manders (2010) find a significant positive relationship between hours of sleep per night and GPA. They also note that their data indicates a strong negative correlation between sleep quality (i.e., the average number of days a student gets five or fewer hours of sleep) and GPA. Controlling for psychological, demographic, and educational factors, Taylor et al. (2013) find that sleep variables are significant predictors of academic performance in college students; specifically, holding all other variables constant, poor sleep negatively impacts academic performance.

Sleep deprivation in college age students is also associated with mental health problems. Individuals with insomnia report higher levels of chronic fatigue, anxiety, stress, negative thoughts, and a lower quality of life (Schlarb et al., 2017). Sleepiness is correlated with depression, excessive fear of an upcoming stressful life event (e.g., a test or major assignment due), and increased use of stimulants. Unfortunately, these further deteriorate the quality of sleep thus feeding the poor sleep cycle.

Why Students Choose Online Classes

In surveys, students offer many reasons for choosing to take their courses online instead of face-to-face, but chief among these is flexibility/convenience (Harris & Martin, 2012). When students are free to choose between online or F2F instruction at the same school for the same cost, those who choose online, do so because they prefer a learning environment that allows them to fit their classes around work, family, and other commitments instead of figuring out how to arrange those activities around a fixed class schedule (O'Neill et al., 2021).

Some studies find that personal characteristics may influence student performance in online classes and thus students with these characteristics may be more apt to choose an online version of a course instead of a F2F counterpart. Using the Felder and Silverman (1988) learning styles measure, Battalio (2009) finds that reflective learners are more successful than active learners in online classes and sequential learners outperform global learners. In a study of over 1,150 students enrolled in online and F2F courses over a 14-year period, Boghikian-Whitby & Mortagy (2016) investigated the relationship between Myers-Briggs personality types and learning outcomes. They concluded that Sensing, Thinking, and Perceiving personality groups learned significantly more in an online setting than in a face-to-face modality.

More interestingly, Jaggars (2014) finds evidence that students are beginning to actively choose between an online course and a face-to-face course for specific reasons. For example, Jaggars (2014) reports that some students explicitly stated that they learned more effectively in an online course and others touted the lack of distraction from other students in the room. The author also found that students preferred to take "easy" courses online and to take more challenging and "important" courses face-to-face. These findings are particularly relevant for this current study because to the degree that we find that sleep-deprived students perform better in online courses, making these students aware of this finding may help them to choose more effectively which course modality is most appropriate.

Data and Methodology

The data used in this study is comprised of 399 students: 198 students who took an undergraduate course in finance in a traditional F2F setting and 201 students who took the same course online. The F2F and online sections of the course (taught pre-COVID) were purposely designed to be as similar as possible in all ways except setting. All sections of the class (F2F and online) were taught by the same instructor, shared a common syllabus, and followed the same weekly calendar.

The course used in this study is the core finance course in the business curriculum at a large, urban university. All business students, regardless of major, must take this fifteen-week course. The data was collected over two semesters. The online class had an average enrollment of approximately 100 students per semester. The F2F sections of about 50 students per section were taught each semester at various day/time combinations.

In both settings (online and F2F), the course was highly structured. Specific material was covered, and assignments were due each week. After the week ended, any assignments not completed received a score of 0. The major difference between the two courses was that the F2F class had regular classroom meetings during which the instructor lectured, collected completed problem sets, and administered quizzes and exams, and the online class used video lectures (which students could view whenever convenient during the week) and students were able to complete weekly online quizzes or electronically submit completed problem sets anytime during the week up to midnight on the due date.

The data set was formed by combining information on student course performance, student demographic data, and student surveys. Prior approval from the university's IRB was received for this research project. Once the three sets of data were merged into one electronic file, all student-specific identifiers were removed to strictly protect student anonymity.

The independent variables used in this study (except perceived sleep deprivation) have been validated in the finance education literature as being key determinants of student learning outcomes in an introductory finance course (Bredthauer & Fendler, 2016). Student-specific demographic data was provided by the university: GPA (college grade point average to date), gender, major, age, and semester course load (number of course hours taking during semester when taking this finance course). A math assessment variable was based on a short algebra test given at the start of the semester. In an end-of-semester survey, students were asked to indicate if their weekly schedule was highly predictable (4), generally predictable (3), generally unpredictable (2), or highly unpredictable (1). This variable is coded as Predictable Schedule. Students were asked if they "have a job or play a sport." This binary variable is coded as Have Job/Sport (yes = 1). The Hours Job/Sport variable represents the number of hours per week that students indicated that they engaged in either work, sport, or both.

Two questions in the end-of-semester survey regarded sleep. Specifically, students were asked to answer the following:

1. To the nearest half hour (for example, 8.0, 7.5, 7.0, 6.5, etc.), how many hours of sleep per night do you believe you need to function at your optimal level? Put another way, if you had no restrictions whatsoever on how many hours you could sleep per night, what number of hours (to the nearest half hour) would you most likely choose to sleep each night so that whatever you do while you are awake, you are able to do to the best of your ability?
2. To the nearest half hour (for example, 8.0, 7.5, 7.0, 6.5, etc.), what is the average number of hours per night that you actually sleep? Put another way, on average, how many hours of sleep do you actually get each night?

The first variable was coded as "Optimal Sleep Hours" and the second measure was coded as "Actual Sleep Hours." Table 1 provides summary statistics for these two variables for the entire group.

Table 1
Optimal Sleep Hours vs. Actual Sleep Hours for Entire Group

Measure	Min	Max	Mean (SD)
Optimal Sleep Hours	5.0	11.0	7.69 (1.07)
Actual Sleep Hours	2.5	9.0	6.12 (1.27)
Optimal - Actual	0.0	6.0	1.53 (1.21)
Perceived Sleep Deprivation (%)	0.0	70.6	19.3 (14.4)

The means and standard deviations for Optimal Sleep Hours and for Actual Sleep Hours in our dataset correspond with the literature. As noted in the previous section, the National Sleep Foundation recommends that young adults get 7 to 9 hours of sleep per night. The majority (i.e., mean plus or minus one standard deviation) of the students in our data set believe they should get between 6.6 and 8.8 hours of sleep per night. In a survey of over 10,000 college students, Breese (2020) found that the average number of hours that students claim they sleep per night is 6.5 hours. The average student in our dataset claims to sleep 6.1 hours per night.

The range of values for Optimal Sleep Hours is particularly interesting. Whereas some students believe that as few as 5 hours of sleep per night is optimal, others think they need up to 11 hours of sleep per night to perform at their best. This wide range is most likely due to factors such as health and sleep quality. Regardless of the specific reason, these differences are very important for our study because Actual Sleep Hours does not properly measure sleep deprivation. A student who averages 6 hours of sleep per night and believes that 6 hours of sleep is optimal is not sleep deprived. However, a student who gets 6 hours of sleep per night but believes that 10 hours is ideal is highly sleep deprived.

Row three in Table 1 displays summary statistics for Optimal Sleep Hours minus Actual Sleep Hours. For our entire dataset, this value ranges from 0.0 hours to 6.0 hours and has an average of 1.53 hours. Although this measure is interesting, it also does not accurately measure sleep deprivation because it ignores relative scale. For example, a student who believes that 11 hours of sleep per night is optimal but only gets 10.5 hours per night of actual sleep, has an "optimal – actual" amount of 0.5. A student who believes that 3 hours of sleep per night is optimal but only get 2.5 hours per night of actual sleep, also has an "optimal – actual" amount of 0.5. But the first student is getting 10.5/11 = 95.5% of an optimal amount of sleep per night and the second student is only getting 2.5/3 = 83.3% of an optimal amount of sleep per night.

Accordingly, we created a unique variable for our study called "Perceived Sleep Deprivation." This is a measure that relates the actual amount of sleep a student gets to what that student believes is the optimal amount of sleep on a relative basis. Perceived Sleep Deprivation is measured as:

$$\text{Perceived Sleep Deprivation} = 1 - \left(\frac{\text{Actual Sleep Hours}}{\text{Optimal Sleep Hours}}\right) \tag{1}$$

For example, a student whose self-reported optimal amount of sleep is eight hours but only gets seven hours would have a Perceived Sleep Deprivation score of 12.5% (1 - 7/8). Similarly, a student who sleeps six hours per night but believes they need eight, would have a higher perceived sleep deprivation ratio of 25% (1 - 6/8). By asking students to indicate the actual number of hours that they sleep and what they believe would be an optimal number of hours of sleep, our perceived sleep deprivation measure is standardized across all individuals in our dataset. A Chi-Squared Goodness-of-Fit test indicates that the distribution for each of the variables listed in Table 1 is normal.

Finally, our study relies on two dependent variables to measure student performance. The first is course average, which is calculated as follows: 10 percent quiz average, 10 percent problem set average, 20 percent mid-term exam one grade, 20 percent mid-term exam two grade, and 40 percent final exam grade. As this introductory finance course is heavily math oriented, the assessment of all quizzes, problem sets, and exams used to determine the course grade (in both the online and F2F sections) was primarily objective. That is, student answers were either right or wrong, and grading answers required no instructor interpretation. As a result, grading was very similar between course settings.

The second dependent variable used in the study is the student's score on a common, comprehensive final exam. All students (F2F and online) took this common final exam in a physical classroom at the same time on the same day. The final exam was a carefully proctored, strictly timed, closed-book, closed-notes exam.

We examine the possible impact of sleep deprivation on both variables because they measure different aspects of scholarship. Course average is a broader measure of student success. In addition to learning, it is also influenced by persistence and diligence in participating in all activities throughout the entire course. On the other hand, the final exam score is a purer measure of specific student learning outcomes in the course. This comprehensive examination covers every topic in the course in approximately equal weight to how much that topic was stressed in class readings and lectures (whether F2F or video).

Descriptive statistics for all variables used in this study are presented in Table 2. The far-right column in this table indicates whether the differences in mean values between the online group and the F2F group are significant based on t-tests for continuous variables and Chi-square tests for binary variables.

Table 2
Descriptive Statistics for the Online and F2F Group

	Online Group N = 201	**F2F Group** N =198	**Sig.**
Dependent Variables	**Mean (SD)**	**Mean (SD)**	
Course Average (%)	77.91 (10.60)	78.92 (10.39)	*n.s.*
Final Exam Score (%)	68.42 (18.12)	67.14 (15.30)	*n.s.*
Independent Continuous Variables			
GPA	3.25 (0.45)	3.13 (0.43)	$p < 0.01$
Perceived Sleep Deprivation (%)	19.31 (14.72)	20.33 (16.18)	*n.s.*
Age—Years	24.20 (4.61)	23.93 (3.82)	*n.s.*
Course Load—Hours	12.94 (3.62)	13.43 (3.10)	$p < 0.10$
Math Assessment	68.41 (18.61)	65.94 (21.89)	*n.s.*
Predictable Schedule	1.86 (0.69)	1.89 (0.65)	*n.s.*
Hours Job/Sport	23.41 (15.32)	25.62 (15.01)	*n.s.*
Independent Binary Variables	**Percent of Total**	**Percent of Total**	
Female	53.71	51.02	*n.s.*
Have Job/Sport	79.09	88.44	$p < 0.05$
Fin./Acct. Major	29.43	31.31	*n.s.*

As shown in Table 2, students who completed the course in the different settings were very similar. Indeed, GPA is the only variable that is highly significantly different between the online and F2F groups, with the online students having the higher GPA. The F2F students tend to carry a larger course load and are more likely to have a job or play a sport than the online students; however, the course-load difference is only weakly significant. Our university is an urban school which contributes to the generally older age (about 24 years old), many students who work (or play a sport), and a fairly large number of hours per week spent working. It is interesting to note that our perceived sleep deprivation variable is statistically similar between the two groups.

Results

Table 3, which shows the frequency distribution of perceived sleep deprivation overall and for each sub-group, provides an answer to research question 1. As shown in Table 3, only 20 percent of our total sample believe that they are getting an optimal amount of sleep. Thus, 80 percent of the students in our study believe that they have some degree of sleep deprivation. Over 70 percent of our sample believe they have a sleep deprivation of 11 percent or more and nearly 45 percent report having sleep deprivation of 21 percent or greater.

Comparing the different groups, a larger percent of the F2F group gets the optimal amount of sleep (23% vs. 16%). On the other hand, a larger percentage of the F2F group (48% vs. 43%) have a sleep deprivation of 21% or greater.

Table 3
Degree of Perceived Sleep Deprivation—Total and By Group

	ALL		F2F GROUP		ONLINE GROUP	
Perceived Sleep Deprivation	**N**	**% of All**	**N**	**% of F2F**	**N**	**% of Online**
0%	79	20%	46	23%	33	16%
1% to 10%	43	11%	16	8%	27	13%
11% to 20%	98	25%	42	21%	56	28%
21% to 30%	70	17%	33	17%	37	18%
31% to 40%	73	18%	39	20%	34	17%
41% to 50%	27	7%	18	9%	9	5%
51%+	9	2%	4	2%	5	3%
Total	**399**	**100%**	**198**	**100.0%**	**201**	**100.0%**

Research questions 2 and 3 can be answered with regression analysis. One approach is to create a pair of regression equations (one for the online group and one for the F2F group) for each dependent variable and then compare the significant coefficients in each pair. However, this approach has two limitations. First, any comparison of differences in the magnitudes of the coefficients for any independent variable between the F2F and online groups is invalid because a simple regression does not show the significance of that difference. Second, individual simple regressions ignore potential interactions between teaching format and other key variables in our model. For example, it is possible that asynchronous online coursework can have negative effects on students with lower GPAs.

To address these limitations, we instead estimate a single total interaction regression model for each dependent variable, which interacts each independent variable with class format (for the face-to-face group, F2F = 1; for the online group, F2F = 0). The regression coefficient for the variable in the total interaction model equals the regression coefficient for that variable in a simple regression using only online students. The sum of the coefficients of each variable and its interaction with F2F in the total interaction model equals the coefficient of the single variable in a simple regression model using only F2F students. However, the interaction variable indicates whether the coefficient's relationship with the outcome is significantly stronger (or weaker) in the F2F setting in comparison to the online setting. Regarding the variable of interest for this study (i.e., Perceived Sleep Deprivation), the significance of the F2F*SleepDeprivation variable will indicate whether sleep deprivation impacts learning positively, negatively, or not at all, for the F2F students relative to the online students, completely controlling for the interaction effects in the entire model.

Table 4 presents the total interaction model with final exam score as the dependent variable. As noted above, for example, the coefficient for GPA in Table 4 (i.e., 13.40) equals the regression coefficient for GPA in a simple regression using only online students and the sum of the coefficient for GPA and F2F*GPA in Table 4 (i.e., 13.40 – 2.44) equals the coefficient for GPA in the simple regression for the F2F group (i.e., 10.96). Thus, the simple regression models can, in fact, be derived from the total interaction model. However, for the variable GPA, the total interaction model shows that the entire significant impact of GPA on course grade is due to GPA's direct impact on the dependent variable. The interaction impact is effectively zero because the coefficient on F2F*GPA is insignificant. Thus, for our sample, the relationships between GPA and final exams scores, as measured by the slopes of the regression lines, are not statistically different between the two learning environments.

Table 4
Total Interaction Model with Final Exam Score as the Dependent Variable

	Online Group	
Variable	**Coefficient**	**S.E.**
Intercept	13.34	11.81
F2F	9.46	17.65
Gender (female = 1)	-7.95**	2.10
F2F*Gender	6.92*	3.00
GPA	13.40**	2.59
F2F*GPA	-2.44	3.66
Sleep Deprivation	0.05	0.07
F2F*SleepDeprivation	-0.24*	0.10
Age	0.13	0.25
F2F*Age	0.14	0.39
Course Load Hours	0.32	0.32
F2F*CourseLoadHours	-0.35	0.49
Job/Sport Hours	-0.10	0.07
F2F*Job/SportHours	0.14	0.10
Finance/Acct Major (yes=1)	5.39*	2.41
F2F*Finance/AcctMajor	3.65	3.38
Predictable Schedule	-1.15	1.56
F2F*PredictableSchedule	0.27	2.28
Math Assessment	0.15**	0.06
F2F*MathAssessment	-0.06	0.08
Equation Statistics:		
Number of Observations	399	
R-Square	.27	
Adjusted R-Square	.23	

Note. †p < 0.10, *p < 0.05, **p < 0.01

Concerning the focus of this study, the coefficient on Sleep Deprivation is insignificant; however, the coefficient on F2F*SleepDeprivation is highly significant and negative. Thus, sleep deprived students, all else equal, including possible interaction effects, perform significantly worse on the common final exam than online students. More specifically, for the instrument that most appropriately measures overall student learning outcomes in the course, sleep deprived students learned significantly less in the F2F class than they did in the online class. Therefore, our total interaction model suggests that, controlling for all personal factors and controlling for the possible interaction effects, the answers to research questions 2 and 3 are yes.

Figure 1
Final exam score: Interaction between sleep deprivation and course format

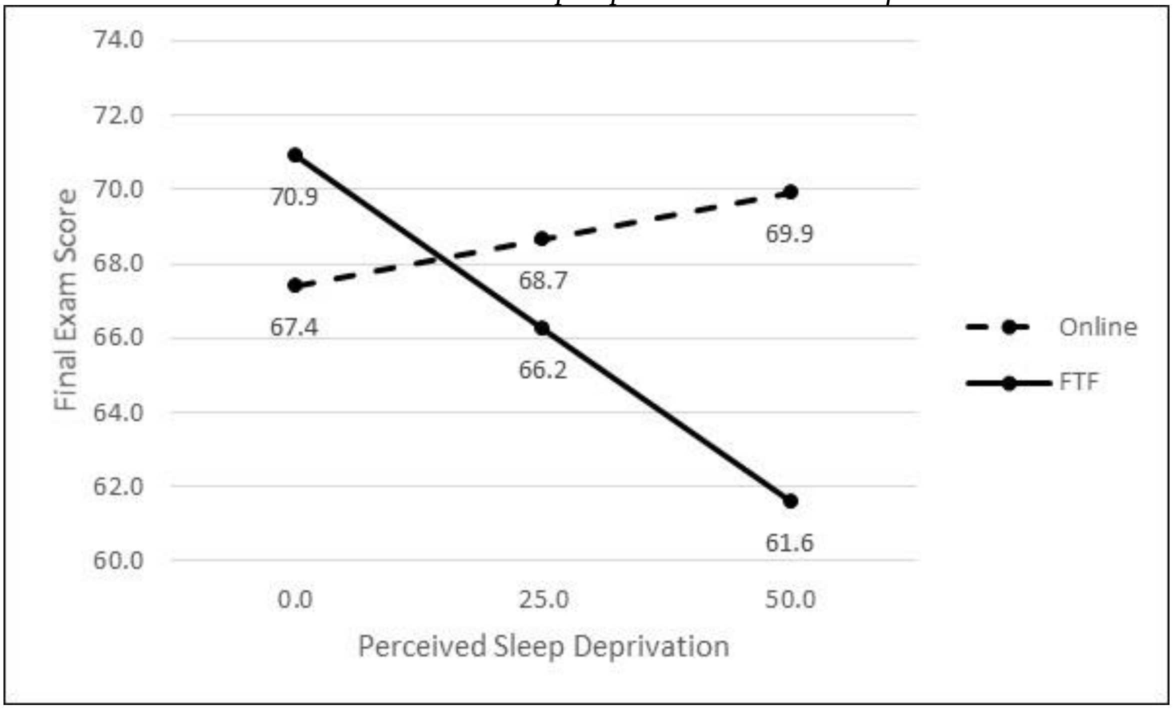

Figure 1 plots the relationship between final exam score and degree of perceived sleep deprivation for both modalities, holding all other factors constant. This graph shows that non-sleep-deprived students appear to perform better on the final exam in F2F courses than they do in online courses, medium-sleep-deprived students perform about the same, and highly-sleep deprived students perform much better in online courses. The breakeven point in this chart is perceived sleep deprivation of 14.8. For our sample, 20 percent of all students have no perceived sleep deprivation, 25.1 percent have perceived sleep deprivation of greater than 0 but less than 14.8, and 55.1 percent have perceived sleep deprivation of greater than 14.8. More than one-quarter of the students in our sample have perceived sleep deprivation of greater than 30.0.

Table 5 presents the total interaction model with course average as the dependent variable. In this regression, the coefficient for F2F*SleepDeprivation is negative, but it is not significant. Thus, whereas a higher degree of perceived sleep deprivation significantly negatively impacted learning in F2F classes, it did not have the same effect on the overall grade earned in the different modalities.

Table 5
Total Interaction Model with Course Average as the Dependent Variable

	Online Group	
Variable	**Coefficient**	**S.E.**
Intercept	35.93**	7.31
F2F	11.46	10.93
Gender (female = 1)	-2.89*	1.30
F2F*Gender	1.91	1.86
GPA	8.90**	1.60
F2F*GPA	0.04	2.27
Sleep Deprivation	-0.03	0.05
F2F*SleepDeprivation	-0.08	0.06
Age	0.13	0.16
F2F*Age	-0.10	0.24
Course Load Hours	0.35†	0.20
F2F*CourseLoadHours	-0.24	0.30
Job/Sport Hours	-0.04	0.04
F2F*Job/SportHours	0.08	0.06
Finance/AcctMajor (yes=1)	2.99*	1.49
F2F*Finance/AcctMajor	2.97	2.10
Predictable Schedule	0.95	0.97
F2F*PredictableSchedule	-1.53	1.41
Math Assessment	0.09*	0.04
F2F*MathAssessment	-0.05	0.05
Equation Statistics:		
Number of Observations	399	
R-Square	.29	
Adjusted R-Square	.25	

Note. †$p < 0.10$, *$p < 0.05$, **$p < 0.01$

One possible explanation for the difference in findings is that although the F2F course and the online course examined in this study were highly similar, there were a few significant differences. In particular, the midterm exams in the F2F class were closed-book, closed-notes proctored exams that were taken in a physical classroom by all students on the same day. Conversely, for the midterm exams in the online class, students were allowed take the online exam during any 150-minute period over the three days that the exam was open. The online exams did not use proctoring software, and although effort was made to reduce cheating on these exams, cheating is a concern for any online, unproctored examination or assignment (Dendir & Maxwell, 2020).

Thus, whereas differences in midterm exam testing procedures as well as academic dishonesty concerns for tests and other assignments completed in a remote setting may impede the purity of course average for the online group (relative to the F2F group), no such differences exist for final exam score since all students in both settings took the same final exam under the same circumstances. Specifically, all students took the exact same final exam in a carefully proctored classroom on the same day at the same time.

Figure 2
Course average: Interaction between sleep deprivation and course format

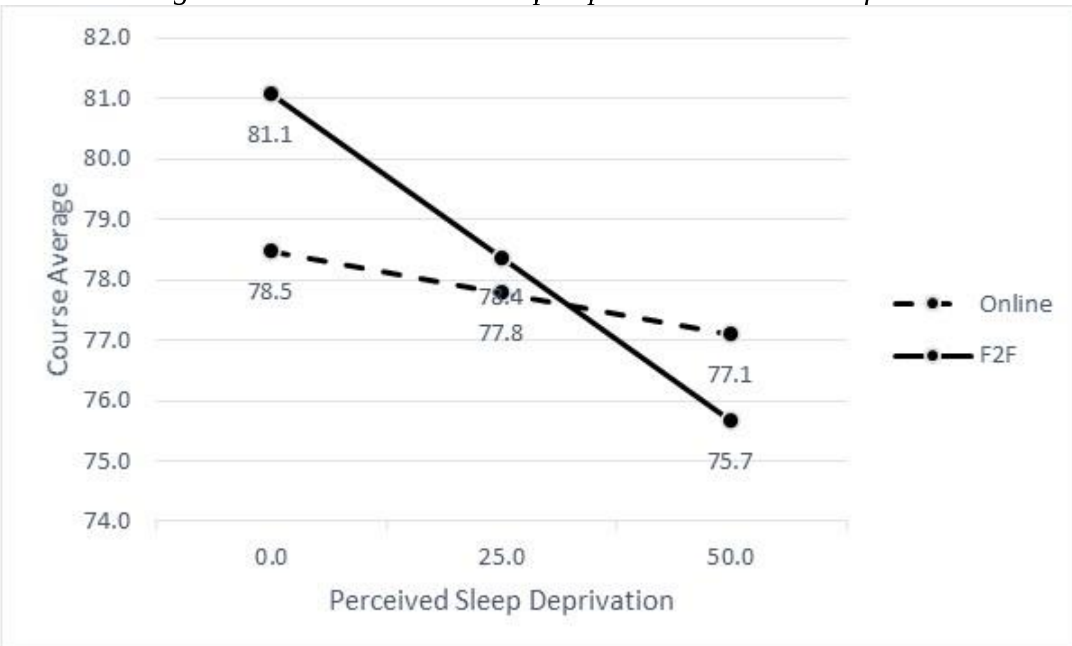

Figure 2 shows the relationship between course average and degree of perceived sleep deprivation for both modalities, holding all other factors constant. As shown in this figure, for perceived sleep deprivation of less than the breakeven point (i.e., 32.2), F2F students have a higher overall course average than online students. But for high levels of sleep deprivation, F2F students perform worse than online students. In our sample, 23 percent of all students had perceived sleep deprivation of greater than 32.3.

Discussion

Sleep deprivation among college students is a national crisis. And there is reason to believe that at-risk college students, who for socio-economic reasons may be more likely to hold a job while going to school and may have poorer sleep-hygiene habits, probably experience more sleep deprivation than other students (Patel et al., 2010; Adenekan et al., 2013). Our study shows that whereas perceived sleep deprivation significantly negatively impacts the learning outcomes of students in a F2F class, this same effect is not observed for students enrolled in an asynchronous online class. Therefore, advising students with sleep deprivation issues, especially at-risk students, to take more of their coursework in an online setting, may allow these students to better maintain the grades necessary to complete their degree programs.

Indeed, college completion rates are a major concern for higher education. Shapiro et al. (2019) report that as of 2019, the six-year completion rate for the fall 2012 four-year public college student cohort was only 65.7 percent. That is, less than two-thirds of all students who started a four-year college program at a public school in 2012 graduated within six years. Even more concerning, this study reveals that Black and Hispanic students are significantly more likely to drop out of college without completing a degree than white and Asian students. Given that overall student debt in the U.S. now tops $1.5 trillion, with a significant portion of this debt held by minority students (Hansen & Shaw, 2020) who all too often borrow money to start college but then do not finish, finding ways to improve graduation rates is imperative.

For over a decade, researchers have questioned whether online education improves or impairs college completion rates (see Wayle & Ozogul [2019]) for an excellent review of this literature). Although most of the early research on this topic suggests a negative relationship between online education and completion, recent studies are more positive. This pattern reflects Moore et al. (2009), who suggest that as students gain experience in taking online courses, and as teachers get better at designing and teaching asynchronous online courses, completion rates will improve. Indeed, in a recent comprehensive study on this topic, James et al. (2016), using the Predictive Analytics Reporting database, examine over 650,000 community college students and conclude that taking some online classes has no negative impact on student retention rates. Wayle & Ozogul (2019), who investigated graduation rates of nearly 13,000 students enrolled in four-year college programs, find that, controlling for student demographic and academic performance variables, taking at least some online classes significantly increases the likelihood of successful degree completion.

Our research supports these more recent studies. In this study, we show that, all else equal, highly sleep deprived students learn significantly less in a F2F setting than in an online version of the same class. As suggested in Jaggars (2014), students are beginning to choose course modality for specific reasons. If students who are aware that they have sleep deprivation issues know that they are likely to learn more in an online version of a course, we would expect that more sleep-deprived students will choose the online class.

Additional study of the relationship between sleep deprivation, retention and degree completion is an interesting area for future research. Research could also explore the trade-offs associated with students who have poorer academic preparation for success in online courses versus the gains to sleep deprived students taking asynchronous online courses. That is, additional research along these lines could shed light on which teaching modality is likely better for, say, a sleep-deprived student who also performs better with the support and structure traditionally associated with a F2F course.

Limitations

As with most empirical research, our study has some limitations. One potential limitation is that, although care was taken to align the online class with the F2F class as much as possible, differences still inevitably exist (in particular, the online class size was about 100 students and the F2F average class size was approximately 50). Another potential limitation of the empirical results is that the studied course is a highly quantitative course with a focus on solving math-oriented problems. Thus, the results of this study may not apply well to a more qualitative course. Put differently, the analysis presented in this paper opens the avenue for similar studies comparing F2F with online settings for purely qualitative courses.

A third potential limitation of this study is that the sample set is based on students at a downtown, urban university who do not generally live on campus and very likely work full- or part-time. Hence, the results of this study may not apply well to, say, a school where the students generally live on, or near, campus and are full-time students. The students at these two different types of schools may have very differing reasons for selecting an online version of a course over a F2F version, or vice versa. Also, online education is relatively new at our university. The average number of previous online courses taken by students in this sample is less than four.

However, this might be a strength of our study because sleep-deprived students are not yet self-selecting into the online offering of the course.

Finally, it must be noted that the online course examined in this study was an asynchronous course in every aspect except for the final exam. A synchronous online course loses some of the flexibility of an asynchronous course, and to the degree that increased flexibility influences the results we report, we would assume that sleep deprivation may play a larger role in a synchronous online course. However, because we cannot determine from our dataset the precise relationship between the flexibility offered by an asynchronous online course and lack of sleep, the question or whether this same effect (i.e., elimination of the negative impact of sleep deprivation on learning) would occur for a synchronous online course is an area for future research.

Conclusions

Sleep deprivation, and its negative impact on academic performance, is a major concern for college students. In this study, we explore the possibility that the flexibility and convenience offered by asynchronous online courses may reduce, or even eliminate, the adverse effect of sleep problems on student learning outcomes. Indeed, for final exam score (a specific measure of student learning), we find that sleep-deprived students perform better in an asynchronous online course environment than they do in a F2F setting.

The results reported in this study should be shared with college students, especially those who struggle with sleep disorders. In addition, academic advisors need to understand that the sleep issues that many students experience in college might be offset by advising these students to take more online courses. And teachers and administrators may need to consider more online course offerings as means of achieving the ultimate goals of higher education, namely, enhanced student learning and improved graduation rates.

Few would argue that coronavirus has been good for education. However, the forced conversion of nearly all F2F classes to an online format in spring 2020 and the continued concentration of online course offerings at traditional colleges and universities in fall 2021, has exposed teachers who never thought of virtual teaching and students who never considered virtual learning to experience something completely new. In an era in which sleeplessness is considered a global pandemic and sleep deprivation is increasingly being recognized as a detriment to student learning, perhaps one day COVID-19 will be thought of as the spark that promoted more online course offerings to the learning benefit, and degree completion progress, of college students who are not getting adequate sleep.

Declarations

The authors declared no conflicts of interests.

The authors declared that they received no funding.

The authors declared that ethical approval was provided by the Institutional Review Board at Georgia State University.

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Transitioning to Online Learning amid COVID-19: Perspectives in a Civil Engineering Program

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Abstract
The transition from face-to-face classes to fully online learning (OL) during the spring semester of 2020 occurred almost globally because of the imposed COVID-19 lockdown. The present study investigated the perception and experiences of undergraduate students and faculty members of the Civil Engineering program at the United Arab Emirates University concerning switching to OL during COVID-19. Quantitative questionnaires were distributed to faculty members and students following the end of the spring semester of 2020. Students and faculty members identified student engagement and online exams as major areas that require improvement. Online exams were challenging for students and difficult to prepare, control, and administer for faculty. Providing technical support is critical for the successful streaming of online courses. Initially, half of the surveyed students began the transition with a positive attitude toward OL, and this percentage increased during the transition. The capacity to continue learning during the COVID-19 crisis and the availability of recorded materials were perceived by the students as the main advantages of OL while challenging online examinations and the lack of social interaction were the main disadvantages.

Keywords: Student perception, faculty perception, COVID-19 pandemic, online learning, civil engineering, emergency remote teaching

Maraqa, M. A., Hamouda, M., El-Hassan, H., El-Dieb, A. S., Aly Hassan, A., (2022). Transitioning to online learning amid COVID-19: Perspectives in a civil engineering program. *Online Learning, 26*(3), 169-201.

The world has yet to recover from the COVID-19 outbreak since the first statement was issued on December 31, 2019, announcing the emergence of cases of "viral pneumonia" in Wuhan, China (WHO, 2020). The virus has spread globally, with more than 274 million cases and the deaths of over 5.3 million people being reported worldwide as of 18 December 2021 (WHO, 2021). The outbreak has set unprecedented limits on social interaction (Murphy, 2020). These restrictions have impacted different sectors and services that rely primarily on social interaction for producing effective outcomes. The health and economic impacts of the pandemic have been the main focus of many recent studies (Nicola et al., 2020; Sohrabi et al., 2020). One sector that has been directly impacted is higher education, particularly as there has been considerable uncertainty concerning the safety guidelines required to limit the spread of the virus (Murphy, 2020; Nicola et al., 2020; Zhang et al., 2020). Higher education institutions (HEIs) were forced to take immediate action, ranging from mild measures, such as campus cleaning and disinfection, to extreme measures, such as campus closure (Bao, 2020; Crawford et al., 2020; Murphy, 2020; Zhang et al., 2020).

The COVID-19 pandemic impacted the learning environment in HEIs drastically. For example, the higher education sector in the USA made the most significant investment jump ever in education technology in 2020 and 2021, mainly by HEIs that had not invested significantly in technologies related to online teaching before the pandemic (Garrett et al., 2021). Some scholars posit that the effects will transform teaching and learning practices worldwide (Crawford et al., 2020; Dhawan, 2020). Transitioning to emergency remote teaching and learning in engineering is difficult because the design and hands-on course delivery requirements are compromised. Accordingly, this study aimed to identify the perceptions of the students and faculty of the Civil Engineering program at the United Arab Emirates (UAE) University regarding the impact of transitioning to online platforms during the pandemic. Quantitative questionnaires were distributed to faculty members and students following the end of the spring semester of 2020 (hereinafter Spring 2020) to identify the challenges faced during the transition and the opportunities for maintaining online pedagogy afterwards. Findings of this study are intended to inform engineering program administrators and university strategists about the factors that influence the effectiveness of the transition from face-to-face (F2F) to fully online learning (OL) pedagogy during a crisis.

Literature Review

Planned Versus Unplanned Online Learning

OL pedagogies have received considerable attention over the past two decades. Most studies have differentiated between planned transitions to OL and emergency remote teaching that took the form of OL but lacked preparation (Gacs et al., 2020; Hodges et al., 2020). The differentiation was intended to ensure a fair judgment of the performance of OL compared to F2F learning (Helms, 2014). In emergencies, the transition to remote teaching is often too rushed to secure the support required for a successful learning experience (Gacs et al., 2020; Hodges et al., 2020; Thompson & Copeland, 2020). Moreover, the focus was on transitioning to an online environment; the pedagogy of virtual education received little attention (Crawford et al., 2020). This haste to implement remote education could create a poor learning experience that would deter faculty members and students from viewing OL as a reliable learning approach (Gacs et al., 2020; Hodges et al., 2020; Thompson & Copeland, 2020). This is particularly true for persons with visual, hearing, or mobility limitations, as the transition to remote teaching could pose new obstacles (Thompson & Copeland, 2020). Nevertheless, emergency remote teaching (i.e., the unplanned version of OL) has been touted as a viable alternative for HEIs during emergencies and as a disaster response (Czerniewicz et al., 2019; Mackey et al., 2012). Blended learning, which combines OL and F2F learning, was proposed as a measure to increase HEIs' academic resilience (Mackey et al., 2012). This "planned" incorporation of OL into HEIs' program delivery has several advantages: the gradual expansion of existing resources and support infrastructure required for the successful adoption of OL; sufficient time and training for faculty members to design OL modules; identifying pitfalls in OL so that technological and pedagogical innovations to improve OL can be implemented; and structural and systemic changes in the organization of the HEI that strengthen its ability to adapt to new challenges (Mackey et al., 2012).

Despite the differences between "planned" OL and emergency response remote teaching, both scenarios share many characteristics that are relevant to the success factors and challenges faced. There is a consensus in the literature that the elements of success in OL comprise securing resources and infrastructure, including access to alternative learning formats; preparing students for the skills needed for independent learning, such as time management and effective communication; training faculty and staff in OL technologies and strategies; and establishing and maintaining a resilient learning community through communication and feedback channels for all stakeholders to foster an inclusive, responsive, and flexible learning environment (Gacs et al., 2020; Mackey et al., 2012; Thompson & Copeland, 2020). Student engagement and the interaction between students and faculty remain key factors in any learning environment yet are particularly difficult to achieve in OL (Paechter & Maier, 2010).

Transitioning to OL During COVID-19

Several studies have emerged over the past two years on the transition to OL during the COVID-19 pandemic. Some assessed imposed policies and proposed strategies to enhance OL. For example, Zhang et al. (2020) assessed the Chinese policy for transitioning to OL during the pandemic, finding vagueness and a lack of consensus regarding the teaching approach, materials, teaching environment, workload, and the consequences on education equity. Potential challenges included weaknesses in the required infrastructure, teachers' lack of experience, and complex home environments. This was echoed by Huang et al. (2020), who called for an expansion of the information technology infrastructure and the provision of relevant technological resources to teachers and students. Rapanta et al. (2020) provided experts opinions on the pedagogical knowledge needed by new online instructors, emphasizing the importance of instructional design and organization, faculty presence, and student assessment. The authors concluded that designing an effective learning environment is not the sole responsibility of faculty but requires management support for faculty development.

In another group of studies, researchers shared their experience or thoughts about existing OL programs (Long, 2020), delivering courses online (García-Alberti et al., 2021), redesigning course content for OL (Reck, 2020; Riley et al., 2021; Streveler & Smith, 2020), improving online delivery of specific courses (Giles & Willerth, 2021; Zapanta et al., 2021), using new approaches for effective online teaching (Alqahtani & Rajkhan, 2020), enhancing student self-study (Balakrishnan & Long, 2020), enhancing student engagement (Mosquera Feijóo et al., 2021; Prince et al., 2020), applying new methods for student assessment (Barra et al., 2020; Teo & Pueh, 2020), and enhancing student motivation (Leung & Chu, 2020; Miller, 2020).

The third group of studies focused on conducting surveys to assess the effectiveness of the OL process during the pandemic. Some of these surveys were conducted for HEIs without consideration of variations in the academic programs. For example, Hayashi et al. (2020) surveyed administrators, faculty, and students at 56 HEIs in Sri Lanka and found that the HEIs had made a remarkable transition to OL, mainly because of free internet access. However, the adoption of OL still varied by discipline, university, and household income. Johnson et al. (2020) surveyed faculty and administrators in 672 HEIs in the USA and found shortfalls in support for students, access to online material, and guidance for working from home. Mishra et al. (2020) conducted a survey of 78 faculty members and 260 students from 26 departments at Mizoram University, India. The main challenges faced by students were an interrupted electricity supply, an unstable internet connection, and a lack of essential resources, whereas the primary concerns raised by the faculty were student engagement and motivation. Lassoued et al. (2020) reported that faculty and students at HEIs in Algeria, Egypt, Palestine, and Iraq faced weak internet connections and a lack of needed devices in transitioning to OL. Students also indicated a lack of motivation to study online and a lack of class interaction; however, faculty members indicated a lack of willingness to implement OL and a lack of professional training. Al-Salman and Haider (2021) surveyed 4,037 undergraduate students in Jordan. They found that economic and psychological stress decreased students' willingness, while instructional and assessment quality improved their attitudes towards OL in the future. Means and Neisler (2021) surveyed 1,008 American undergraduate students and found that they were generally somewhat satisfied with their OL, although their course satisfaction sharply dropped after moving online. Jelińska and Paradowski (2021) surveyed nearly 1,500 school and university instructors from 118 countries. They found that instructors were most engaged and coped best with the transition when they had prior experience with remote instruction.

Other studies conducted surveys focusing on particular programs. Of interest to this study are those that are related to engineering. Liu et al. (2020) surveyed 801 undergraduate engineering students at the University of Toronto, Canada, and found that students experienced decreased motivation for learning and reduced class participation. Naji et al. (2020) also reported a lack of student motivation. The authors further identified self-efficacy beliefs about OL, self-directed learning online, and support as the main factors influencing engineering students' readiness to transition to OL in Qatar. Maraqa et al. (2021) found out that the distance to campus did not play a role in students' perception towards OL during COVID-19 compared to the workload. As the number of courses increased beyond 4, students preferred more F2F settings. Ahmed & Opoku (2021) conducted interviews and surveys to examine the challenges faced by engineering students and faculty members at a HEI in the UAE. They concluded that technology-supported learning tools can enhance students' experiential learning and competencies, but there were several pedagogical, technological, and psychological challenges that faced students and instructors due to the lack of preparedness. Asgari et al. (2021) conducted a survey that involved 110 faculty members and 627 students from six engineering departments at California State University at Long Beach. They identified several challenges encountered by students and faculty members including logistical, technical, pedagogical, privacy/security, and lack of sufficient hands-on training.

The Need for Discipline-Focused Approach

Previous student and faculty survey studies provide insight into the general issues engendered by the emergency transition to OL during the pandemic. The findings also reflect the importance of the preexisting local conditions of the education environment. However, several studies indicated that the challenges faced by students in transitioning to OL during COVID-19 are discipline-dependent (Hassan et al., 2021; Liu et al., 2020; Martha et al., 2021). Thus, a proper diagnosis of the specific challenges encountered by each discipline requires a more focused approach. Further, although there has been considerable development in OL, remote learning for engineering education is still developing (Kocdar et al., 2020). It is challenged by the unique requirements for developing hands-on skills and other practical skills that are necessary for a qualified engineer (Bourne et al., 2005). As perceived by students in some engineering programs, conducting laboratory investigations and designing solutions are merely some of the critical components of engineering education that are difficult to achieve through OL (Vielma & Brey, 2021). However, innovative solutions have emerged in response to such challenges. These solutions often use advanced technology to address specific learning outcomes. One example is the development of virtual laboratories wherein students can conduct an experiment, make observations, and collect and analyze data (Balamuralithara & Woods, 2009; García-Zubía & Rodríguez-Gil, 2021).

This study investigated the sudden transition of classes to a fully online mode during the COVID-19 pandemic in the Civil Engineering program at the UAE University and the challenges thereof. The research questions are as follows:

(1) How did undergraduate civil engineering students perceive the transition to OL during COVID-19 lockdown?

(2) How did faculty members perceive the preparedness for the transition to remote teaching and the opportunities for maintaining OL after the COVID-19 pandemic?

Research Context and Method

Civil and Environmental Engineering (CEE) Department

The CEE Department offers undergraduate and graduate degrees in Civil Engineering in addition to graduate degrees in Water Resources. Currently, the CEE Department has around 250 undergraduate and 70 graduate students in the Civil Engineering and Water Resources programs. Twenty-one faculty members are affiliated with the CEE Department, with two fully released for administrative duties. Two instructors (teaching faculty) are associated with the department.

The undergraduate classes are offered during the day. All courses are scheduled between 8am and 6pm. Prior to the pandemic, the delivery modes included traditional F2F lectures and laboratory sessions utilizing smart boards that are available across campus. All courses were formatted for PC/laptop use and some units have been updated for tablets. The Blackboard learning management system (LMS) is the standard learning environment. All lectures, discussions, homework assignments, and other activities were made available to students through Blackboard, which can be remotely accessed at any time and from any location. Students interacted with faculty members and laboratory engineers through Blackboard, emails, and F2F office hours. For Spring 2020, 15 core courses, three technical electives, and capstone graduation projects were offered for undergraduate students.

Classes in the CEE Department range from 25 to 40 students per section, with multiple sections being offered. It should be noted that before Spring 2020, the undergraduate students at the CEE Department did not take fully online courses.

Readiness of Institution for OL

Over the past few years, the UAE University has formed several committees, communities of practice, and entities to promote smart learning. The Center for Excellence in Teaching and Learning (CETL) is an institution-wide center that aims to enhance and expand faculty teaching pedagogies to improve the student learning experience. This was partly achieved by developing and delivering courses through a blended teaching mode, whereby 25%–75% of the course would be administered online. This teaching pedagogy provides students with the benefits of OL and F2F learning in an integrated modality. The institution has ensured that faculty members have the instructional technologies needed to develop courses in a blended teaching format. In addition to the main LMS, Blackboard, there were several add-ons, including Panopto and Collaborate Ultra. Skype for Business, Microsoft Teams, and Cisco Webex were also made available. This was to facilitate the development of course content using either synchronous or asynchronous modalities. Starting the Spring semester of 2018, the institution began to offer blended teaching for selected courses. Since then and prior to Spring 2020, the institution has offered 53 courses taught in a blended mode, of which 42 were for undergraduate students and 11 were for graduate students. None of the blended taught undergraduate courses was offered by the College of Engineering. However, undergraduate students at the CEE Department could have taken some of these courses as 5 of them belong to the list of the university general requirement courses. During Spring 2020, five Civil Engineering courses (involving six faculty members) were put forward for transformation from F2F learning to a blended delivery mode. Four of these courses were at the graduate level and one was for undergraduate students. Thus, the institution possesses the basics of the required infrastructure and facilities to adopt and implement OL for some courses and faculty members. Nonetheless, none of the undergraduate or graduate level courses at the institution was delivered fully online before the pandemic.

COVID-19 in the Country and Institution

The UAE is keen to provide the technological and human resources required to maintain remote teaching and learning while building a reliable infrastructure to provide the primary services of energy, water, communications (including internet), transportation, healthcare, and education. Additionally, the UAE has established progressive strategies to transition its urban areas into smart cities. In the past two decades, the country has developed its information technology sector and successfully implemented an effective e-government network.

When hit by the COVID-19 pandemic, the UAE's response included flight suspension (excluding repatriation flights), a night curfew, a nationwide sterilization program, a nationwide virus testing program, the shutdown of malls and recreational facilities, and a transition to OL in schools and universities. All HEIs in the UAE switched to fully OL during March 2020. It was decided that all schools and universities would be closed for four weeks starting from March 8. Facilities were deep-cleaned during the closure. OL started on March 22, after the spring break was moved forward to prepare faculty and teachers for the transition. These measures resulted in a reduction in the number of daily cases and a partial reopening of commercial centers in July 2020. Nevertheless, strict measures remained in place for educational facilities, with many HEIs, including the UAE University, continuing to teach fully remotely in Fall 2020 and Spring 2021. In Fall 2021, the restrictions were slightly relieved, allowing 55% occupancy on campus and splitting the students into two groups based on their colleges. The two student groups alternate in attending classes F2F every two weeks (i.e., one group attended classes on campus while the other group received education online). Classes with an enrollment of 33 or more received education online, whereas the final exams for all classes were administered on campus.

Once OL was announced, the CETL developed a series of videos to help faculty members deliver their courses using the available infrastructure. They communicated with students to familiarize them with the new teaching pedagogy. In addition, laboratories were instructed in a virtual format whereby instructors prepared a series of videos for the experiments while they were being conducted. Students were given datasheets with experimental readings to analyze and include in their reports. The Information Technology Unit at the UAE University was available online 24/7 to respond to any inquiry and handle any technical issues. Owing to the abrupt decision to transform to OL and the expected effect on students' performance, the institution decided to provide students with a pass or fail (P/F) option in Spring 2020 rather than retaining the final course grade. This option was provided per course, allowing students to receive P/F for specific courses. Such courses were not included in the students' cumulative or major grade point average (GPA).

Research Participants and Methodology

This study employed an empirical approach to assess the experiences and perceptions of undergraduate students and faculty members for OL versus F2F learning models. Quantitative questionnaires were designed to investigate the perceptions of undergraduate students and faculty regarding the transition from F2F to OL. The questions were tailored to include factors that may have influenced student perceptions, such as gender, academic level, and student seniority.

Student Survey

The undergraduate students in the CEE Department were asked to complete a 15-minute ad-hoc structured survey, which was developed by the authors. According to the Organisation for Economic Co-operation and Development (OECD), an ad hoc survey is defined as "a survey without any plan for repetition" (https://stats.oecd.org/glossary/detail.asp?ID=6276). The survey was designed for a single purpose during an emergency to collect answers to specific research questions. The survey questions were designed by the authors to collect information on students' perception in moving to OL and to gain an understanding of the challenges faced by the students with OL during the pandemic. Before being disseminated to the students, a preliminary form of the survey was distributed to a small group of students to assure the questions are understandable and free of technical jargons. Based on this, the survey form was modified and then circulated online via SurveyMonkey (see Appendix A). The survey was open to all the CEE undergraduates for a period of 10 days; however, students who were conducting their mandatory internship/industrial training in Spring 2020 were asked not to participate. The survey was sent to the students after the semester ended on June 25, 2020, with two follow-up reminders after three and six days, respectively.

The survey was divided into three parts: general information, perception about OL, and facilities and support for OL. The first part was intended to gather information about students' gender, GPA, earned credit hours (CHs) before Spring 2020, enrolled CHs during Spring 2020, and residence location. The second part gathered information about students' preference of teaching modality (F2F versus OL), their feelings about transitioning to OL in Spring 2020 and continuing with OL in the future, and whether OL facilitated learning, enhanced engagement, and enhanced communication skills. The third part collected information about students' access to resources needed for OL including a computer with a webcam, a spare computer, a printer, a reliable internet connection, and a quiet place. Students were also asked if they received support from family members, the university, and the instructors during the transition to OL. The survey questions were in the form of multiple-choice, rating scale, Likert-type scale, or open-ended ones. (An additional part of the survey focused on the assessment and outcome of online examination, but these questions and associated results were not included herein.) The results were collected digitally in a tabular format while ensuring anonymity. Based on the approval obtained by the institution's ethics committee, all the students were told that their participation was voluntary and that they were free to withdraw at any time. Participants were assured that their data would be kept confidential. Within the invitation, the participants were given details about the study and its objectives.

The total undergraduate student population enrolled in the program is 250 students. The target survey participants were 232 as 18 students were enrolled in industrial training and were asked not to respond to the survey. In total, 125 undergraduate students responded. The received responses for the survey represented 54% of the students in the undergraduate program.

Faculty Survey

The faculty survey was designed to gather information concerning the experiences and attitudes of faculty members with online teaching before and after Spring 2020. The survey was also intended to ascertain their overall assessment and possible suggestions for improvement. It comprised 20 questions (see Appendix B). Most questions were developed based on the stated preference approach, where respondents choose responses from a setlist. In some questions, faculty members were asked to choose one answer; in others, all applicable answers had to be selected from the provided list. The last two open-ended questions gave faculty members the option to provide written comments regarding their experiences with online teaching in Spring 2020 and their suggestions for improving the process. Their responses to the open-ended questions were aggregated anonymously, put in order by keywords (training, mode of delivery, and infrastructure), and important quotes were extracted.

The form was sent electronically to 12 faculty members in the CEE Department. The selection of the participating faculty was carried out in consultation with the department to ensure that they had taught courses during Spring 2020. Another selection criterion was to ensure that the faculty members were distributed in proportion to the offered courses in the specialization areas of the CEE Department. Thus, five faculty members were selected from the area of structures and materials, two from environmental engineering, and one from each of the remaining specialization areas—geotechnical engineering, highway and transportation, construction management, surveying and geomatics, and water resources. The surveyed faculty members represented more than half of the teaching staff of the department and taught at least 75% of the undergraduate courses that were offered in Spring 2020. All selected faculty had been affiliated with the department for at least three semesters and so were familiar with the institution's pedagogies, rules, and regulations. The survey response rate was 100%; however, only half the respondents provided additional comments about their experiences and potential suggestions for improving the OL process. Measures were taken to ensure the anonymity of the survey respondents.

Data Analysis

The collected data were analyzed using descriptive statistics. SPSS Statistics was used to perform the regression analysis and calculate correlation coefficients. Microsoft Excel was used to conduct a frequency analysis of the responses provided by students and faculty. On the other hand, the responses collected for open ended questions to the students and the faculty were compiled and discussed.

Results

In the students' survey, male participation accounted for 19% of the students' responses, reflecting the gender ratio across the institution. Most students (62%), who participated in the study, had a GPA between 2.0 and 3.0 (on a 4.0-scale). Approximately, 65% had completed between 60 and 100 credit hours (CHs). The highest participation was observed for students, who had a GPA between 2.0 and 2.5 and had completed 80–100 CHs, representing 17.9% of the total respondents. This group is considerably larger than all the other groups, with the second-highest group at 8% for students who had a GPA between 2.5 and 3.0 and had completed 60–80 CHs. The group percentages could not be controlled owing to the anonymity of the survey. Nevertheless, the disproportionately large group could be explained by the active undergraduate student representatives who likely played a role in encouraging their peers to complete the survey.

For the faculty, the total teaching load in Spring 2020 varied from less than 6 CHs to more than 12 CHs. In addition, 59% of these faculty members taught graduate courses offered by the Civil Engineering or Water Resources programs in Spring 2020. The faculty members' experience in teaching had a range of 3–28 years. However, when asked about their online teaching experience before Spring 2020, 75% indicated they had limited experience or none at all, whereas the rest indicated they were fairly or adequately experienced.

Students' Perception of the COVID-19 Lockdown's Impact on the Transition to OL

A survey question was formulated to evaluate the readiness of students to participate in OL activities. This "Yes/No" survey question was related to students' access to nine basic requirements for OL. A hypothesis test was conducted to decide whether to continue the analysis based on gender or as an aggregate sample. The result of a t-test showed that the responses of male and female students were similar at a 95% confidence level. Accordingly, the following analysis was conducted by aggregating both genders.

The responses show that most of the students have the necessary tools for OL. Only 16 out of 125 students did not have access to a computer equipped with a webcam. However, more than half of the students surveyed (55%) did not have access to a spare computer in case of an emergency. Further, 60% of the students had access to a printer. Most students had a reliable internet connection (76% and 55% for Wi-Fi and cellular network, respectively). Access to a quiet study place was a challenge for almost half the students (42%). Most students received support from family, technical staff, and instructors at 76%, 61%, and 67%, respectively.

Figure 1
Perceptions of Online Learning

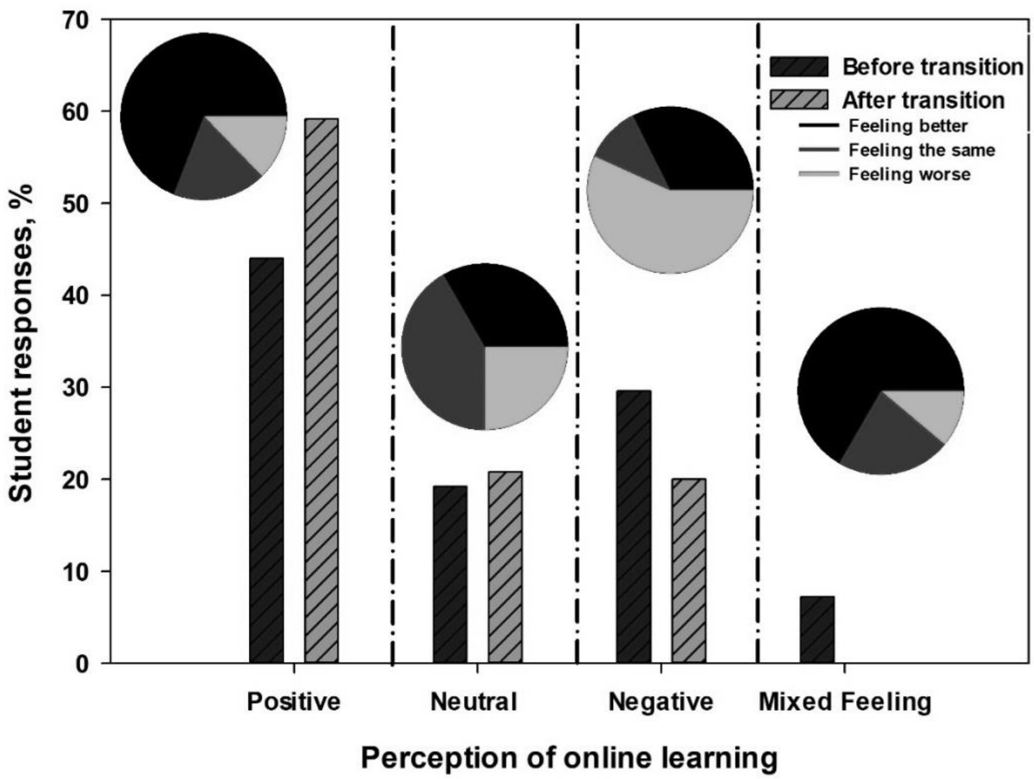


Figure 1 shows student perception towards OL before and after the transition, as summarized from the responses to Questions 7 and 17 (Appendix A), respectively. Responses were classified into the four categories given in Figure 1, e.g., afraid is negative, good is positive, etc. The pie charts indicate how the students' feelings changed throughout the semester. The results in the pie chart are grouped based on their initial perception before the transition, as collected from the responses to Question 8 (Appendix A).

Students were asked about their perception of OL when they first heard about the transition, during the transition, and after the semester. The categories assessed included various feelings ranging from positive (good and interested), neutral, or negative (not good and afraid). Students were allowed to select more than one choice. Subsequently, their responses were categorized into positive, neutral, negative, and mixed feelings. Figure 1 shows the percentage of total student responses concerning their initial feelings toward the change to OL. The majority of the students initially had positive feelings about OL (44%), whereas 30% had negative feelings. Only 13% of the students who initially had positive feelings indicated a change for the negative. Conversely, 68% of the students who had initial negative responses indicated that they felt worse or remained the same during the transition. Thus, the majority of students who started the transition with a certain attitude (whether positive or negative) generally did not change their perception. This fits the trend extracted from the responses after the semester. The fraction with positive attitudes increased; the proportion with negative attitudes dropped. A substantial number of students who had initially indicated a neutral attitude (19%) remained neutral (42%), while

33% became positive. Ultimately, approximately 60% of the students indicated a positive perception after the semester, while those who felt negative dropped to 20%. Two-thirds (67%) of the students who initially had mixed feelings changed to positive. Of the total responses, 64% indicated that OL enhanced students' comfort and engagement in discussions. Moreover, 43% of the total students believed that OL had improved their communication skills, 40.7% believed it did not, and 15.9% could not decide.

To better understand students' perception of OL, a set of questions were posed pertaining to the advantages and disadvantages of OL. Figure 2 shows a heat map of the responses, aggregated by student GPA and completed CHs. Regardless of their GPAs and CHs, the majority of the students indicated that OL allowed them to continue learning during the COVID-19 crisis. The second perceived advantage to OL was the availability of recorded materials that students could revisit at their convenience. More than half the respondents indicated that OL provided flexibility for attending classes outside of designated class time and that not being physically present on campus was an advantage. In general, students with higher GPAs had a more positive response rate for the advantages. The number of completed CHs did not exhibit any significant correlation. A small fraction of the respondents considered that OL made it "easier to concentrate at home," made it "easier to communicate with faculty," was "engaging," and had "easier examinations."

Figure 2

Heat Map Highlighting Students' Preferences Regarding Different Advantages and Disadvantages of Online Learning Classified by GPA and Completed CHs

GPA					Advantages	Completed CHs				
<2	2–2.5	2.5–3	3–3.5	> 3.5		<60	60–80	80–100	100–120	> 120
100%	79%	93%	97%	94%	Continuous learning during pandemic = 88.8%	90%	100%	78%	90%	92%
50%	63%	82%	77%	76%	Availability of recorded material = 72%	77%	77%	47%	90%	92%
0%	52%	75%	80%	76%	Flexibility for attending classes = 66.4%	67%	65%	44%	86%	100%
0%	46%	54%	73%	59%	I don't have to go to campus = 55.2%	60%	50%	39%	81%	58%
50%	31%	32%	43%	6%	Easier to concentrate at home = 31.2%	30%	46%	14%	48%	25%
0%	17%	25%	20%	24%	Easier communication with faculty = 20%	23%	19%	3%	43%	25%
0%	17%	25%	33%	0%	OL to be very engaging = 20%	17%	15%	14%	38%	25%
0%	21%	14%	17%	12%	Online exams are easier = 16.8%	13%	12%	19%	29%	8%

GPA					Disadvantages	Completed CHs				
<2	2–2.5	2.5–3	3–3.5	>3.5		<60	60–80	80–100	100–120	>120
0%	21%	39%	43%	47%	Lack engaging in-class experience = 33.6%	33%	23%	39%	33%	42%
50%	27%	39%	40%	35%	Difficult to study in groups = 34.4%	40%	35%	31%	33%	33%
0%	40%	21%	37%	47%	Lack reliable access to internet = 35.2%	40%	8%	53%	43%	17%
50%	31%	25%	40%	59%	Lack of equipped quiet space = 36%	33%	23%	56%	29%	25%
100%	31%	39%	40%	41%	Staying at home is distracting = 37.6%	50%	35%	36%	33%	25%
50%	29%	46%	50%	35%	Hard to communicate with faculty = 39.2%	47%	19%	42%	38%	58%
50%	44%	29%	40%	47%	Difficult for group projects = 40%	50%	31%	47%	33%	25%
100%	40%	39%	67%	76%	Lack of social experience = 52%	60%	58%	47%	43%	50%
50%	60%	68%	80%	65%	Online exams are more challenging = 67.2%	60%	73%	58%	76%	83%

10	20	30	40	50	60	70	80	90	100

Students also indicated several disadvantages. The respondents ranked "online examinations to be more challenging" as the highest disadvantage, followed by a lack of social interaction. The responses regarding the remaining disadvantages were found to be in a considerably narrow range (34%–40%) without any particular pattern regarding GPA or CHs. Furthermore, all students agreed that staying on campus made them more committed to the learning process, whereas staying at home was distracting.

Students were also asked to rate on a scale from 1 to 10 the extent to which they favor several aspects related to OL during Spring 2020. Synchronous lectures received the highest rate (7.3±2.5), followed by pre-recorded lectures provided before class (7.2±2.5), while the two aspects that received the lowest rating were online laboratory demonstrations (5.8±2.7) and graded quizzes and exams (6.1±2.6).

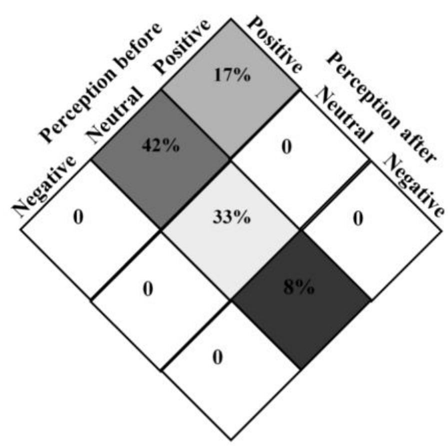
On average, 36% of students believed OL deprived them of access to equipped and quiet study spaces and engaging in-class experience. Approximately 34% of students, on average, believed that OL made it difficult to study in groups, conduct required group projects, and communicate with faculty members. Conversely, the least voted disadvantage of OL was the lack of regular and reliable access to the internet and computing facilities (laptop, iPad, and printer), highlighting the students' readiness for OL. The results were similar when CHs were taken into consideration.

Faculty Perception of OL vs. F2F Learning

Figure 3 presents the faculty members' attitudes toward OL before and after Spring 2020. Half (50%) the faculty members indicated no experience with OL, while the remainder chose "limited" and "acceptable" experience equally. No faculty member indicated extensive experience with OL. Furthermore, many of the faculty members indicated a neutral attitude before the transformation to OL. However, two faculty members with acceptable experience indicated a positive attitude. After their involvement with OL, 50% of the surveyed faculty members did not change their attitude, while 42% switched to positive. Only one faculty member downgraded their perception from neutral to negative.

Figure 2

Heatmap of Faculty Members' Attitude toward Online Teaching Before and After Spring 2020

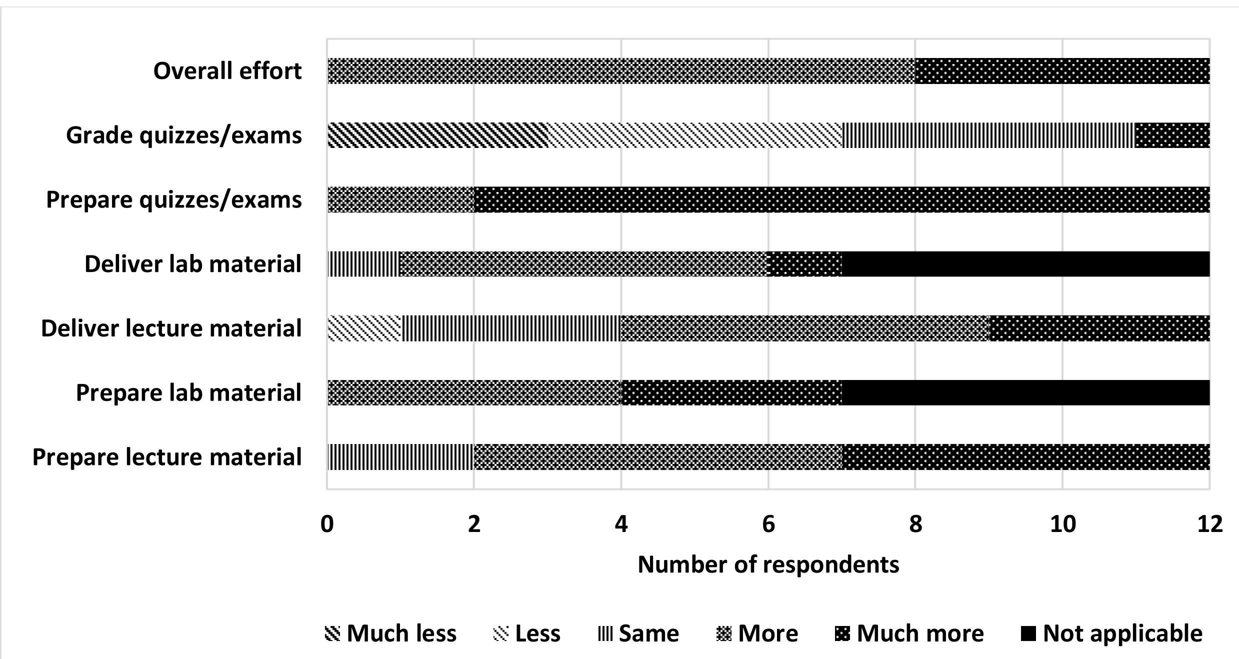


Regarding the transition to OL in Spring 2020, half the faculty considered the transition "acceptable," while the other half regarded it as either "difficult" or "extremely difficult." None, however, believed that the shift was "easy." Notably, the faculty members who described the transition as difficult or very difficult either had no experience with OL or had a heavy teaching load (three or more different courses).

All the faculty members agreed that the overall time and energy allocated to OL during the transition was more than that typically put into F2F learning, as shown in Figure 4. This is unsurprising, as the transition happened in the middle of the semester with a relatively short preparation period. The faculty also indicated that high and very high levels of efforts were required for transforming and delivering the course materials in addition to preparing and administering online quizzes and exams. Conversely, a similar or lesser degree of effort was required to grade online exams as opposed to grading in-class exams. This may be because of the automated online grading system provided by the LMS.

Figure 4

Faculty Members' Opinion of the Effort Allocated to Online Learning during the Transition Compared to F2F



In their teaching pedagogy, the faculty members used different modern tools and techniques to accommodate the sudden transition from F2F learning to OL. The majority (83.3%) used Blackboard to deliver the course material either synchronously or asynchronously (i.e., through recorded videos) because they were familiar with the system. About 67% also used the university conference or chat function to communicate with the students. More than 50% used the LMS to distribute information to students, while about 40% utilized videos from third-party sources to deliver some course material.

To adapt to the OL pedagogy during the COVID-19 pandemic, 11 of the 12 faculty members made changes in the course requirements and assessment tools. Typically, engineering faculty rely on essay or problem-solving questions with an in-class examination; however, the online examination forced them to change the question types to multiple-choice or true/false format, as discussed later. Forty two percent of the faculty lowered their expectations of the students' load, and just over one-half (58%) lowered their expectations of quality. A quarter (25%) dropped some assignments or exams; 17% dropped some of the assigned readings that they had originally given students.

The main challenge faced by all the faculty members was the preparation of online exams, likely owing to the challenge of preparing new sets of questions with a different style than those used for in-class exams, as well as having to edit and post these questions on the institution's LMS. Moreover, 75% of the faculty found it challenging to guarantee the integrity of the process and to prepare the lecture material. All faculty members with a laboratory component associated with their courses found it challenging to prepare material for OL. Becoming familiar with the digital tools of OL was another issue reported by approximately 58% of the faculty. Furthermore, half the faculty (50%) found it difficult to engage students in dialogue and utilize the delivery method. Grading was the least challenging aspect of the OL, as online exams were graded automatically using the LMS. Notably, however, the lack of time to prepare for the sudden transition from F2F learning to OL posed several challenges that, under normal transitioning conditions, could have been circumvented by proper training and preparation.

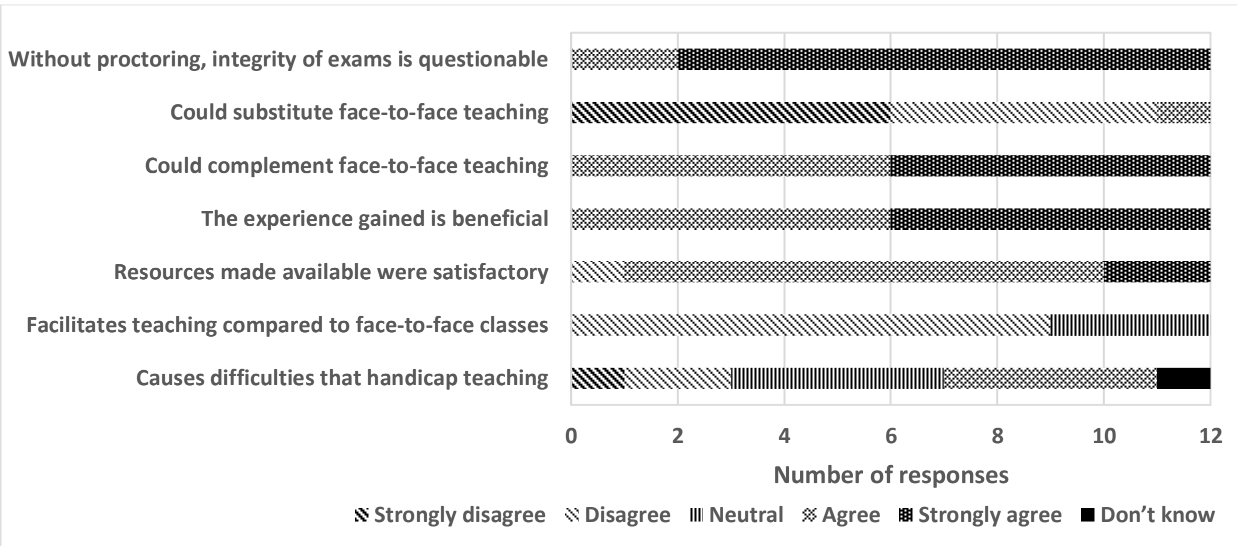
Nevertheless, the instructors did perceive some advantages of the suddenly adopted OL modality. For example, they all agreed that it allowed students to continue learning during the pandemic and that they could use the recorded material in future course offerings. Furthermore, one-third (33%) of the instructors thought that the shift to OL provided flexibility for scheduling class activities and reduced the effort exerted as a faculty member of multiple sections of the same course. However, only two faculty members (17%) found OL to be a relief from the campus commute, with one finding it engaging.

There was an overwhelming agreement among the surveyed faculty members that OL was beneficial and that the process could complement F2F learning going forward (Figure 5). However, given the lack of physical proctoring, the integrity of the online examination was a major concern, even though online proctoring software solutions, such as Respondus Lockdown Browser with webcam integration, were used. By contrast, most faculty members were satisfied with the resources that were made available by the institution to facilitate OL. Nonetheless, they believed that OL did not facilitate teaching and could not solely substitute for the F2F experience. No consensus was observed as to whether or not online classes caused difficulties that hindered their teaching process.

The faculty members were asked to describe the students' performance in Spring 2020 compared to other students who took the same course(s) with F2F instruction. Half the faculty (50%) thought that students' performance was lower; 42% thought that it was the same. The activities selected by all the surveyed faculty members to be most suitable for OL were office hours and group meetings. More than half the respondents (75%, 58%, 50%) agreed that delivering lecture material, supervising graduate students, and conducting tutorial sessions were suitable for OL modality, respectively. The majority, however, believed that OL did not facilitate conducting quizzes, written and oral examinations, and laboratory sessions.

When asked about the assistance needed to conduct OL in the future, 67% requested technical support. Although the institution's IT and CETL staff members responded to requests in a timely fashion, few faculty members were exposed to OL pedagogy prior to the pandemic. Therefore, a sudden surge in technical assistance requests at the early stages of the transition was observed. The second most ranked item (58% of all selected) was the provision of a webcast for students on how to succeed in OL and better access to online digital material. Forty one percent asked for information on best practices for supporting faculty for OL, training material on how to transition courses to an online setting, an online resource hub with links to information, and webinars hosted by OL experts.

Figure 5
Faculty Members' Assessment of Online Learning Based on Their Experience in Spring 2020



Written comments included various remarks on the suitability of the transition process. There was an agreement that the transition to OL experience was interesting but that it involved a steep learning curve. In the future, the prepared, recorded lectures combined with F2F teaching will benefit students and reduce the time needed in class to deliver the entire material. Although preparing the materials for OL was time-consuming, "it saved time when teaching multiple sections". Students found instructional videos explaining how to access the course material useful. OL may be more suitable for graduate courses; delivering undergraduate design courses is challenging. Virtual laboratory experiments were received positively by the majority of students. Some faculty members believed that the students became "careless" during OL. To increase student engagement, faculty members implemented a "reading quiz" at the end of every lecture, which students had to answer to access the following lecture. Consequently, students were more vigilant in completing the required tasks in a timely manner.

Comments received regarding the improvement of OL suggested that students and faculty members be informed about and trained on OL and its benefits. Specialized one-on-one consultation sessions or small group workshops for faculty members were proposed to highlight the different features accessible through the LMS, among other means. One faculty member stated "Inform and train students about online courses and how they can benefit the most. Also, provide specialized one-to-one sessions for instructors". Depending on the nature of the course, blended teaching was recommended to supplement F2F learning at certain percentages. For example, a faculty member wrote "Blended teaching could be great to consider in future with lab sessions and exams are done using the traditional (F2F) methods". Comments on improving the OL infrastructure included the use of pen tablets (or touch screen laptops) instead of iPads, the use of platforms that focused on soft skills for engineers to complement technical programs (e.g., https://www.edx.org/learn/soft-skills), and investment in virtual labs, through which students can conduct experiments online (e.g., https://www.labster.com/). One of the surveyed faculty members noted "A policy should be available to address online legal issues… particularly when students request to have makeup exams due to experiencing technical problems during exams." The same faculty member added "A third-party exam proctoring system should be available."

Discussion

A few studies surveyed undergraduate students and faculty members in civil engineering programs to assess their perception regarding the transition to OL during COVID-19. Ayadat et al. (2021) conducted a student survey at Prince Mohammad Bin Fahd University, Saudi Arabia. They reported that the shift to OL generally met the individual learning needs of students, but it was not as convenient as F2F learning. Wenceslao & Felisa (2021) conducted a survey for students and faculty members at four HEIs in Philippines, with the majority (90%) of the students were from civil engineering programs. More than 90% of the respondents (students and faculty) believed that the quality of education declined because of the shift to OL and 64% thought it is not as effective as F2F learning. Wardhono et al. (2020) surveyed students in Indonesia who were enrolled in basic engineering and structure courses and found that the implementation of OL was not quite effective.

Initially, half of the surveyed students in this study began the transition to OL during the COVID-19 pandemic with a positive attitude towards OL, and this percentage increased during the transition. This is consistent with the findings of Ahmed & Opoku (2021) who reported that 52% of the surveyed engineering students were initially excited about the transition to OL during the pandemic. Meanwhile, most of the surveyed faculty members in this study either retained the same attitude about OL as before the transition or switched to a positive one. One of the aspects that could have caused this behavior is the readiness of the institute and the technical and administrative support received during the pandemic. Indeed, the readiness of the institution and its ability to mobilize resources play a critical role in its response to offer broader services and support to online transition (Bensaid & Brahimi, 2021; Hart et al., 2021), which could positively affect the quality of teaching (Nuere & de Miguel, 2020), and ultimately, results in higher satisfaction of the stakeholders.

The interaction between students and faculty members is considered a critical factor for a successful OL experience (McCaslin & Brown, 2015). Increasing student engagement requires a refinement of the delivery method. Following the transition, faculty members delivered their classes in absolute asynchronous, absolute synchronous, or a combination of both modes. In absolute asynchronous instructions, students watched pre-recorded videos and did not have to attend class at scheduled times. By contrast, the absolute synchronous mode mimicked F2F instruction by limiting learning to the designated class time. All combined models included pre-recorded videos that could be watched during or before class time. However, these models varied in the duration of engagement during designated class times. Synchronous lectures could be more engaging than asynchronous ones (Jelińska & Paradowski, 2021); however, the former could be problematic depending on one's internet access and/or a lack of quiet space at home during lecture time. Having recorded synchronous or asynchronous lectures appears to be more favorable to students engaged in OL than having non-recorded synchronous sessions (Liu et al., 2020). Therefore, a combined mode involving a pre-recorded lecture followed by a recorded live discussion could be more effective for OL. This is in line with the findings of others (Alqahtani & Rajkhan, 2020; Ramo et al., 2021; Rapanta et al., 2020).

Students also seemed to miss the engagement and interaction with faculty members. Student engagement is considered one of the main challenges reported for civil engineering programs (Ayadat et al. 2021; Wenceslao & Felisa, 2021; Wardhono et al., 2020) and for other engineering programs (Asgari et al., 2021; Ahmed & Opoku, 2021). Several researchers have suggested different approaches to enhance student engagement in OL. Wilson and Allen (2011) suggested that increasing student engagement requires additional contact between faculty members and students through progress updates or discussion boards and forums. Asynchronous lectures were more convenient for accommodating different time zones. In the asynchronous mode assessment questions could be used to split the class to several parts and act as a prerequisite to access the following part. Bao (2020) has suggested several instructional strategies to improve the effectiveness of the delivery method of online classes, such as dividing the teaching content into smaller units to help students maintain focus.

McCaslin & Brown (2015) proposed some steps that faculty members could take to enhance students' interaction, including providing detailed instructions, being proactive in contacting students regularly, and developing self-assessment tools to help students decide early on if they need assistance. Mahmood (2020) recommended sharing resources before the class to help create interactive online classes. Pacansky-Brock et al. (2020) suggested that instructors facilitate interpersonal interaction and foster social presence in OL. Professional training may help instructors promote interaction and enhance engagement in online courses (Shepherd et al., 2016). This is emphasized by Rutherford et al. (2021), who noticed that generally, instructors who were highly supportive of implementing interaction-oriented practices during F2F teaching tended to be less supportive of these practices during the COVID-19 transition to OL. The extent of success in implementing OL could be discipline- and subject-related (Bourne et al., 2005). For example, courses with laboratory or heavy design components should be treated differently than theory-based ones. This is likely why engineering programs generally lag when it comes to adopting OL. The engineering faculty members surveyed overwhelmingly believed that OL could not replace—only complement—F2F teaching. Thus, a blended approach could be adopted to create a more meaningful learning environment wherein 25%–75% of the course would be administered online, as offered in some engineering programs (El-Zein et al., 2009; Ozer et al., 2003). Blended teaching and learning, if designed properly, could resolve some of the concerns raised by the surveyed students and faculty. Faculty members should determine the course activities to be delivered in the F2F or online modality. Students chose exams (with quizzes at the highest rank), followed by lectures, as the most suitable course parts for OL. The lowest ranks were for laboratories and group work. A blended course remedies the lack of social interaction, which was indicated as a major disadvantage of OL by the students.

There was an overwhelming agreement among the faculty members in this study concerning the increased time needed for converting courses to the OL delivery mode, mainly owing to the preparation of lecture materials and online exams. The transition from F2F teaching to OL is "considerably time-consuming and changes faculty's role and teaching responsibilities" even under normal conditions (Lichoro, 2015). The effort could have been amplified during the

COVID-19 pandemic, given the urgency of the transition with the limited time provided to faculty members to prepare and adapt. Adhikari et al. (2021) indicated that the transition to OL during COVID-19 had greatly affected construction educators, with more time spent in developing, communicating, and delivering the course content. A similar concern was made by engineering faculty members as reported by Ahmed & Opoku (2021). As for the students, no consensus existed among them on how OL affected the amount of time required for studying. The results showed a three-way tie between an increase, a decrease, and no difference between OL and F2F.

The faculty members perceived that students' performance in OL as either similar or lower than in traditionally taught F2F courses. Such qualitative assessment is important but needs to be verified through either direct or indirect quantitative means. Nonetheless, it appears to be in line with the findings of Supernak et al. (2021), who quantitatively assessed the learning outcomes of the same civil engineering students at San Diego State University before (with F2F instructions) and after (with OL) the lockdown. They found that the coverage of student learning outcomes with OL was quite high, but slightly lower than the pre-pandemic counterparts. They also found no significant difference for almost 80% of the compared student's scores performed for sixteen student outcomes. However, courses that rely on lab experiments or those involved assigned student teamwork during the pandemic were negatively affected by the lockdown. Apparently, achievement of students' learning outcomes cannot be generalized for all civil engineering courses, and possibly not for the same course at different civil engineering programs. Conflicting results regarding achievement of student learning outcomes between F2F and OL modalities were reported in studies conducted prior to the pandemic. For instance, some studies have indicated no significant differences between the two modalities (Aktas & Omurtag, 2013; Chirikov et al., 2020; McFarland & Hamilton, 2005; Mollenkopf et al., 2017; Silcox, 2004); others have found OL to be more (Dutton et al., 2001; Holbert, 2020; Ladyshewsky, 2004; Nguyen & Paschal, 2002) or less effective (Alpert et al., 2016; Bettinger et al., 2017). Similar conflicting trends were observed with blended courses wherein students' performance either improved (El-Zein et al., 2009; Reynolds & Paulus, 2009), remained the same (Alpert et al., 2016; Bowen et al., 2014), or decreased (Wellington et al., 2005) compared to F2F equivalents. These variations could result from other factors, such as the experience of the faculty members, the nature of the course, and student interest in the subject (Aktas & Omurtag, 2013). As this study evinces, access to a fast internet connection, a quiet study place, proper hardware, etc., can also be determining factors in the success of OL.

In the last two decades, there has been a rapid growth in fully online or blended courses (Allen & Seaman, 2013). The experience gained regarding OL during COVID-19 should lay the foundation for HEIs to expand their OL delivery methods in the future. Such measures are inevitable, given the uncertainties related to the spread of COVID-19. Positive OL experiences in undergraduate engineering programs, as found herein, are expected to reshape the delivery mode of undergraduate education. Learning pedagogies will never return to their pre-pandemic pattern, and a substantial transformation from traditional to a blended or fully OL approach seems almost inevitable. In fact, 77% of the chief online officers at HEIs in the USA predicted some or significant acceleration in future online undergraduate enrollment (Garrett et al., 2021). Therefore, it is essential to continuously assess the students' learning experience and their learning outcomes (Bourne et al., 2005; Francis & Shannon, 2013). The assessment of learning outcomes is already established as part of the enhancement process in many engineering programs (Schachterle, 1999). However, evaluating the effectiveness of blended learning or OL entails more than merely relying on outcome assessment. Fortunately, most institutions transitioning to OL have a benchmark to assess the effectiveness of the transition by comparing the pedagogical features of online course delivery to those of the F2F counterpart. Many studies have compared student perception and performance in an OL course against those in a F2F equivalent (Girard et al., 2016; Kelly et al., 2007; Paechter & Maier, 2010; Paul & Jefferson, 2019). These studies focused on aspects of student engagement through course design, social presence, interaction with peers and faculty, and the attainment of learning outcomes. Nevertheless, continuous investigation and more studies are required to establish tailored OL requirements that would guarantee a successful learning environment given technical, cultural, and social factors.

Conclusion

This study investigated, through a quantitative survey, the perception of undergraduate students and faculty members in a Civil Engineering program concerning transitioning to OL during COVID-19. Results revealed that student engagement and online exams are major areas that need improvement. Moreover, provision of technical support is critical for the successful delivery of online courses. From a student perspective, the capacity to continue learning during COVID-19 and the availability of recorded materials are the main advantages of OL; challenging online examinations and the lack of social interaction are the main disadvantages. Although transitioning to emergency remote teaching and learning in civil engineering is difficult, results have shown that half of the students preferred OL. Results also show that the measures applied to engage students in learning activities designed to enhance hands-on skills were adequate given the emergency situation. OL course delivery in civil engineering will never match F2F because the nature of civil engineering demonstrations requires more than simple visual aids.

The results and interpretations presented herein cannot be generalized for other programs within the college nor the institution. Moreover, only two types of surveys were utilized, namely, the faculty and student surveys. The opinions and feedback from administrators were not addressed. In terms of readiness and preparedness to undertake OL, most faculty members and students were new to online courses, and some participants had no prior experience with OL. This may have had a direct influence on the results obtained. Another limitation of the study is that it only discussed the perception of students and faculty members with respect to an emergency OL delivery mode. Other than the two weeks that the institution made available prior to restarting Spring 2020, the faculty and students did not have sufficient time to plan the transformation. Thus, the findings cannot be generalized to other forms of remote or distant learning, including planned online, blended, or televised learning. Additionally, students' performance may have been affected by the short preparation time, which may have impacted their opinion of OL; however, their performance was not categorized based on ethnicity, family background, or country of origin.

Future research may investigate how the perception of students and faculty members in the same program changed after practicing OL for multiple semesters during the COVID-19 pandemic. Meanwhile, it will be interesting to explore how students perceive their performance under emergency OL. Research could also be undertaken to compare students' and faculty members' perceptions across different engineering programs within the same institution. Students from other programs may have different challenges with OL (Liu et al., 2020). By doing so, engineering departments will be able to identify the challenges faced by their students to develop appropriate mitigation measures specific to their programs. Showcases from HEIs worldwide could form the basis for comparative studies that are needed to elucidate how higher education is influenced by program type, socio-cultural aspects, economic status, institutional readiness, and faculty members' and students' experience with OL. As we learn more about the impact of COVID-19 on higher education, research will be needed to understand how HEIs should reshape their teaching and learning provisions while considering all the aspects that lead to the successful delivery of online courses, including institutional support, technical support for course development and delivery, course structure, teaching/learning process, social and student engagement, faculty support, student support, and process assessment. Indeed, assessment, by itself could form another line of research that could be carried out using well-established frameworks (Pedro & Kumar, 2020) that are intended to evaluate the quality of OL programs and suggest actions for improvement. This will not only help in identifying the challenges that need to be overcome to improve the delivery of OL in future crises, but also helps if a decision is to be taken to continue OL or blended teaching in the aftermath of COVID-19.

Acknowledgments

The authors would like to thank the students and faculty members who participated in the surveys.

Declarations

The authors declared no conflicts of interests.
The authors declared that they received no funding.
The authors declared that ethical approval for this work was granted by the United Arab Emirates University.

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Appendix A

Student Survey Form

We would like to know your views on the online learning of civil engineering courses during Spring 2020. Please note that this survey is solely intended for educational and research purposes. Participants' name or any form of identification is not required to participate.

A. General information

1.	What is your gender? ☐ Male ☐ Female
2.	What is your GPA? ☐ <2 ☐ 2–2.5 ☐ 2.5–3 ☐ 3–3.5 ☐ >3.5
3.	How many credit hours did you complete before Spring 2020? ☐ <60 ☐ 60–80 ☐ 80–100 ☐ 100–120 ☐ >120
4.	How many credit hours were you enrolled in during Spring 2020? ☐ <12 ☐ 12–14 ☐ 15–18 ☐ >18
5.	Where do you currently reside? -------------------------------------

B. Perception about online learning

6.	Do you prefer online classes to a face-to-face classroom setting? ☐ Yes ☐ No
7.	How did you feel about online learning when you first heard about the transition owing to COVID-19? ☐ Good ☐ Interested ☐ Neutral ☐ Not Good ☐ Afraid
8.	During online classes, did your initial feelings change? ☐ I started to feel better about it ☐ It turned out to be the worst ☐ My feelings remained the same.
9.	If online classes are optional in the coming semester, would you enroll in online classes? ☐ Yes ☐ No ☐ I don't know
10.	Did you enroll in online classes for the summer of 2020? ☐ Yes ☐ No
11.	Do you think having online classes can cause difficulties or problems that may handicap your learning process? ☐ Yes ☐ No ☐ I don't know
12.	Do online classes facilitate learning in the same manner as face-to-face classes? ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
13.	Online classes enhance comfort and engagement in discussion. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
14.	Do online classes play a significant role in enhancing communication skills? ☐ Yes ☐ No ☐ I don't know
15.	In your opinion, what are the advantages of online classes? (Select all that apply.) ☐ It allowed students to continue learning during the COVID-19 crisis. ☐ It provided flexibility for studying and attending classes outside designated class time. ☐ Availability of recorded material that I can revisit at any time ☐ It was easier to concentrate at home compared to the classroom.

	☐ Online exams are easier. ☐ Communication with faculty is easier, and responsiveness is faster. ☐ I find online learning to be very engaging. ☐ I can stay at home, and I don't have to commute to campus or stay in the dorms.
16.	In your opinion, what are the disadvantages of online classes? (Select all that apply.) ☐ I miss the social experience with other fellow students. ☐ It is difficult to study in groups with other classmates. ☐ It is difficult to conduct required group projects. ☐ Communication with faculty is more difficult. ☐ Lack of access to equipped and quiet study spaces ☐ I find online exams to be more difficult. ☐ Lack regular/reliable access to the Internet and computing facilities (laptop, iPad, etc.) ☐ Lack of an engaging in-class experience ☐ Staying on campus provides more dedication to the learning process, while staying home is distracting.
17.	How did you feel about online learning after you completed your online learning experience in Spring 2020? ☐ Good ☐ Satisfied ☐ Neutral ☐ Unsatisfied ☐ Not good
18.	According to your experience in Spring 2020, rate the following from 1 to 10, where 1 means not favored at all and 10 means strongly favored. ☐ Pre-recorded videos provided before class ☐ Synchronous live lectures ☐ Faculty meetings (office hours) ☐ Online laboratory demonstrations ☐ In-class learning quizzes (provided within each learning module) ☐ Trial quizzes not contributing to grades ☐ Graded assessment tools (quizzes, midterm, and final exam)

C. Facilities and support for online learning

19.	Did you have access to the following?		
	Computer with webcam	☐ Yes	☐ No
	Spare computer for emergency	☐ Yes	☐ No
	Printer	☐ Yes	☐ No
	Reliable Wi-Fi internet connection	☐ Yes	☐ No
	Reliable cellular internet connection (4g)	☐ Yes	☐ No
	A quiet dedicated place to study and take exams	☐ Yes	☐ No
	Emotional support from family members	☐ Yes	☐ No
	Technical support from the university	☐ Yes	☐ No
	Support from the course instructor	☐ Yes	☐ No

D. Comments

20.	Please add any comment that describes your experience of online learning and/or how to improve the process.

Appendix B

Instructor Survey Form

We would like to know your views on the online teaching of civil engineering courses during Spring 2020. Please note that this survey is solely intended for educational and research purposes. Participants' private information will not be revealed or shared, and no name or any form of identification is required to participate.

1.	What experience did you have with online teaching before Spring 2020? □ Extensive □ Acceptable □ Limited □ None
2.	What attitude did you have toward online teaching before Spring 2020? □ Positive attitude □ Neutral □ Negative attitude
3.	What was your overall teaching and administrative load in Spring 2020? □ <6 □ 6–9 □ 10–12 □ >12
4.	What was your undergraduate teaching load in Spring 2020? □ <6 □ 6–9 □ 10–12 □ >12
5.	What was your graduate teaching load (other than thesis supervision) in Spring 2020? □ 0 □ 1 □ 2 □ 3 □ >3
6.	How many different courses did you teach online in Spring 2020? *Please do not count multiple sections of the same course or thesis supervision.* □ 0 □ 1 □ 2 □ 3 □ >3
7.	How would you describe the transition to online teaching in Spring 2020? □ Very difficult □ Difficult □ Acceptable □ Easy □ Very easy
8.	Compared to face-to-face teaching, how would you describe the effort you allocated to online teaching in Spring 2020 in the following aspects?

Aspect	Much less	Less	Same	More	Much more	Not applicable
A. Preparing lecture material						
B. Preparing lab material						
C. Delivering lecture material						
D. Delivering lab material						
E. Preparing quizzes and exams						
F. Grading quizzes and exam						
G. Overall effort						

9.	What technique did you use to transition courses to online settings in Spring 2020? *Select all that apply.* □ Institution's LMS □ Utilized synchronous video technology □ Used other forms of video to record lectures □ Used videos from third-party sources □ Distributed information using the LMS □ Used institution's conference or chat function to communicate with students
10.	How did you change the requirements for or expectations of students in the shift to online teaching in Spring 2020? *Select all that apply.* □ I changed the kinds of assignments or exams that I give to students. □ I lowered my expectations of the amount of work students would be able to do.

<table>
<tr><td></td><td>☐ I dropped some assignments or exams.
☐ I dropped some of the readings that I originally asked students to do.
☐ I lowered my expectations about the quality of work that my students will be able to do.</td></tr>
<tr><td>11.</td><td>What are the challenges you faced in delivering online courses in Spring 2020? Select all that apply.
☐ Managing my own time
☐ Becoming familiar with the technology
☐ Preparing lecture material
☐ Preparing laboratory material
☐ Delivery method
☐ Preparing online exams
☐ Grading online exams
☐ Assessing students
☐ Student engagement in dialogue
☐ Assurance of process integrity
☐ Coping with the adverse climate caused by the pandemic</td></tr>
<tr><td>12.</td><td>What are the advantages of online classes in Spring 2020? Select all that apply.
☐ It allowed students to continue learning during the COVID-19 crisis.
☐ It provided flexibility for scheduling class activities.
☐ Availability of recorded material that I can use later
☐ I find online learning to be very engaging.
☐ I can stay at home, and I don’t have to commute to campus.
☐ It reduces the effort in case of multiple sections of the same course.</td></tr>
<tr><td>13.</td><td>What methods did you use to examine students during online teaching in Spring 2020? Select all that apply.
☐ True/False questions
☐ Multiple-choice questions
☐ Final answer (in numbers) questions
☐ Quantitative solving questions
☐ Theory testing questions
☐ Submission of a scanned copy of the solution
☐ Backtracking is not allowed
☐ Single attempt
☐ Respondus monitoring with webcam
☐ Oral examination
☐ Questions appear one at a time</td></tr>
<tr><td>14.</td><td>What kind of attitude do you have toward online teaching now?
☐ Positive attitude ☐ Neutral ☐ Negative attitude</td></tr>
<tr><td>15.</td><td>To what extent do you agree or disagree with the following statements based on your experience with online teaching in Spring 2020?
<table>
<tr><th>Statement</th><th>Strongly disagree</th><th>Disagree</th><th>Neutral</th><th>Agree</th><th>Strongly agree</th><th>I don’t know</th></tr>
<tr><td>Online classes cause difficulties that handicap your teaching process.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Online classes facilitate teaching compared to face-to-face classes.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Resources that were made available to facilitate online teaching were satisfactory.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
</table>

	The experience that you gained with online teaching was beneficial.							
	Online teaching could complement face-to-face teaching.							
	Online teaching could substitute face-to-face teaching.							
	Without proctoring, the integrity of online examination is questionable.							

16.	How would you describe the overall students' performance in Spring 2020 as compared to students who took with you the same course(s) with face-to-face instructions? ☐ Far below ☐ Below ☐ Same ☐ Above ☐ Far above
17.	Which of the followings is suitable to be delivered through online teaching? *Select all that apply.* ☐ Lecture materials ☐ Oral examination ☐ Tutorial sessions ☐ Quizzes ☐ Laboratory sessions ☐ Office hours ☐ Exams ☐ Group meetings ☐ Thesis supervision
18.	What assistance would you require for online teaching to ensure a better delivery of a quality educational experience to your students? *Select all that apply.* ☐ Information on how best to support students ☐ A webcast for students on how to succeed in online classes ☐ Greater access to online digital materials ☐ Best practices on how to support faculty for online teaching ☐ Advice on how to adhere to accessibility requirements when moving online ☐ Training material for faculty on how to move courses to online ☐ An online resource hub with links to information about how to quickly transition to online learning ☐ Webinars hosted by online learning experts for faculty on how to move courses online ☐ Support for managing organizational change ☐ Technical support ☐ One-to-one consultation with online learning experts
19.	Please add any comment that describes your experience of online teaching.
20.	Please add any comment on how to improve online teaching.

Creating a Social Presence Measure: Self-Rated Behaviors that Indicate Mediated Presence

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Abstract
This study involved the creation and validation of a self-rated social presence measure. Study 1 utilized focus groups to create items. The focus group participants were presented with a set of items based upon past literature; through discussion of these items, a preliminary measure was created. Study 2 involved an exploratory factor analysis on the preliminary measure to eliminate items that did not work well with each other. This reduced the measure from 54 to 23 items. Study 3 validated a 21-item self-rated measure of creating a social presence (PSP), which can be used to determine if people have difficulty projecting themselves as real individuals willing to interact with other online communicators.

Keywords: computer-mediated communication (CMC), instrument development, focus groups, exploratory factor analysis (EFA), confirmatory factor analysis (CFA)

Christen, S., Violanti, M.T., and Morrow, J. (2022). Creating a social presence measure: Self-rated behaviors that indicate mediated presence. *Online Learning*, *26*(3), 202-220.

Online education continues to rise—more than 6.9 million students enrolled in online courses that comprised about thirty-five percent of all degree-granting postsecondary institutions' offerings prior to the COVID-19 pandemic (Ruiz & Sun, 2021). Online education has been reported to increase access for all students. For those with minority identities, data show online education can potentially have a negative effect on completion rates (Garret, 2018). To counter this negative effect, instructors must critically examine their pedagogical strategies and student-instructor communication choices in online classes (Driscoll et al., 2012; Garrison et al., 2003). When students do not perceive the instructor and other students as real, exhibiting social presence, they have lower motivation (Cole et al., 2017; Richardson & Swan, 2003), feel more isolated (Phirangee, 2016) and may avoid learning class material (Titsworth et al., 2010). Online educators who utilize affective communication demonstrate that they are real individuals, which encourages reciprocity by students (Swan & Shih, 2005) and promotes cohesion (Fall et al., 2010).

Online educators need to understand social presence and pedagogical strategies that promote social presence in the online class because the perception of social presence increases students' satisfaction and perceived learning (Collins et al., 2019; Richardson et al., 2017; Song et al., 2019), which have been linked to student persistence, retention, motivation, and success (Richardson et al., 2017). Social presence also has a central role in online teaching because it affects the student's ability to think, understand, and discuss course material (Armellini & De Stefani, 2015, Kucuk & Richardson, 2019). Instructors in both workplace training and educational environments need to use pedagogical strategies that promote social presence to help learners feel connected to each other if they are going to discuss ideas and work together (Armellini & De Stefani, 2016; Kear et al., 2014; Kozan, 2016). When instructors create a social presence within the class, students want to connect with their instructor more than their peers (Lowenthal & Dunlap, 2018). Making connections is at the heart of social presence theory. The purpose of this study is to depict the theoretically grounded process of creating and validating a self-assessment social presence measure for instructors and students.

Social Presence Theory

Social presence was first conceptualized as the perceptions, feelings, and reactions that are established in a computer-mediated communication (CMC) interaction, such as online education (Biocca et al., 2003; Garrison et al., 2000; Lowenthal & Snelson, 2017; Tu & McIsaac, 2002). To initiate/maintain a true interpersonal connection, online educators need to establish a social presence (Harms & Biocca, 2004; Kehrwald, 2008). More recently, Lowenthal and Snelson (2017) have questioned the veracity of including affect in such a definition as this would be more of an indicator of immediacy or connection than social presence. For this investigation, social presence is the degree of interpersonal connection established when communicators are using CMC, which is at the heart of what it means to be a social being. Creating connection in the online learning environment has been linked to successful outcomes for students, especially the connection between student and instructor (Collins et al., 2019; Richardson et al., 2017; Song et al., 2019). To create this connection, CMC users must project a persona of being open and willing to communicate with other CMC communicators (Biocca et al., 2003; Biocca, Harms, et al.., 2001; Kehrwald, 2008; Swan & Shih, 2005). The social presence connection intensity can vary (Biocca et al., 2003), and is based upon the CMC users' communication skills (Kehrwald, 2008).

Social presence goes beyond perceptions and involves the actions performed to project a social presence (Paquette, 2016). Communicators establish social presence by using affective, interactive, and cohesive communication (Caples, 2006; Rourke et al., 1999). Affective communication includes messages that share emotions, disclose personal information, and/or display computer-mediated paralinguistics (Caples, 2006; Garrison et al., 2000; Garrison & Akyol, 2012; Rourke et al., 1999). Interactive Communication refers to indications the communicator is open to receiving and attending to others' messages (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). The third way users create social presence by adapting to CMC is cohesive communication, which enhances feelings of being connected to another individual through vocatives and phatics.

Research has defined social presence and found it enhances online learning, but what has not been researched is how to identify or train people who lack the ability to project a social presence. Previous social presence instruments only measure people's perception of social presence (Bangert, 2009; Biocca & Harms, 2002; Biocca, Burgoon et al., 2001), not the participant behaviors that create social presence. Because they do not measure an individual's behaviors, we cannot determine whether a single person, small group of people, or everyone created this feeling of being connected. While measuring perceptions of social presence is important, it limits our understanding of how social presence is created and who is responsible for creating it. Additionally, there are questions about the validity of the social presence measure used in the community of inquiry, which also highlights the need to be able to identify people who have issues with projecting a social presence (Dempsey & Zhang, 2019). To address this gap, we need to develop and validate a theoretically grounded social presence behaviors self-rating measure to identify individuals with issues projecting a social presence.

Study 1: Measurement Development Focus Groups

Focus groups operate in the initial stage of instrument development for several reasons. They allow participants to review and ensure items represent the domain of interest, can be comprehended easily, provide face validity and potentially improve a measure's reliability (Morgan, 1997; Ritchie & Lewis, 2005; Stewart et al., 2007). Focus groups help a researcher discover the domains to measure, the potential indicators of the domains, and proper wording of items (Morgan, 1997). According to previous research, the domains of social presence are *affective*, *cohesive*, and *interactive* communication (Garrison et al., 2000; Garrison et al., 2003; Rourke et al., 1999). Because three domains and several indicators of those domains have been defined previously, the focus groups enhanced the wording of items within each domain and developed additional items as needed.

Participants

Focus group size affects the quality and depth of discussion (Morgan, 1997; Ritchie & Lewis, 2005; Stewart et al., 2007). Although there is no standard, experts recommend that a focus group should consist of at least 5 and no more than 12 participants to be manageable and ensure everyone can participate fully (Morgan, 1997; Ritchie & Lewis, 2005; Stewart et al., 2007). Ten participants were recruited for each focus group session. The number of recommended focus groups is three to five to allow the researcher to find redundancy while maintaining control (Morgan, 1997). Redundancy occurs when new sources of information do not bring forth new categories of information (Patton, 2002). There were seven focus groups with 62 total participants. Groups had participants ranging in age from 19 to 33 years old (M = 20.82, SD = 2.73) and 42% of participants were female. Focus group members self-selected into the seven available time slots that ranged over three days with times in the morning and afternoon for maximum flexibility.

The participants, who received extra credit, were recruited from general education communication classes to obtain a cross section of the student population. The participants were recruited for ease of access and purposive sampling with the goal of ensuring that all had experience with the phenomenon central to the research investigation (Patton, 2002). Because college students tend to be early adopters of CMC and use it more than the general population (Jones et al., 2002), recruiting college students increased the likelihood they were frequent CMC users. Just over 62 percent rated themselves as somewhat frequent to frequent CMC users.

Procedures

Focus groups met in a vacant classroom and were seated in a circle to enhance conversational style. The focus group meetings consisted of five sections. The first section (welcoming) included explaining the purpose and obtaining signed consent. The second through fourth sections were discussions concerning the three indicators of social presence (affective, interactive, and cohesive). During these three sections, participants were given a document containing the indicator's definition and a list of potential items for that indicator. Order bias, where topic or item sequencing affects the participants' responses (Easton et al., 2003), was minimized by rotating the three sections (Onwuegbuzie & Leech, 2007). The moderator then asked the participants to provide input on the item wording. The moderator and a research assistant took notes of the items discussed; after review, the notes were used to adjust the items' wording and add items participants suggested. The fifth section (closing) involved answering participants' questions and ensuring extra credit was recorded correctly.

The preliminary 30 items were developed from a review of literature concerning social presence (Biocca et al., 2003; Biocca, Harms et al., 2001; Caples, 2006; Garrison et al., 2000, 2003; Kehrwald, 2008; Swan & Shih, 2005). Previous research identified three domains of social presence and the researcher provided the participants with short definitions prior to discussing each section. The definitions served as a reference point so participants could review the proposed measure's preliminary items.

Participants were asked to read through the items individually and given highlighters and pens to make notes on their individual copies of any item(s) that they had difficulty comprehending. After the participants had lowered their pen and highlighters, the moderator asked which items, if any, were confusing or needed to be adjusted. Individual participants would then discuss the issues they had with the items, which would lead other participants to include their thoughts. All 7 focus groups evaluated the original 30 items, of which several items consistently emerged as problematic. The moderator asked each focus group member to provide suggestions that would clarify the item for future participants. Once the discussion stagnated in a focus group, the moderator brought up suggestions made by earlier focus groups.

Focus Group Results

Affective Items. For the affective section, participants reviewed 10 initial items. Affective communication refers to emotions, experiences, and the use of paralinguistics to share emotion (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). Issues emerged around items that involved paralinguistics, the use of abbreviations, and nonstandard grammar to transfer nonverbal communication.

All seven focus groups identified the term “text speak” as being confusing. Several participants in multiple focus groups asked for clarification of the phrase. The term “lol” (laugh out loud) was provided as an example of text speak to help clarify the issue. Students were asked if they could provide another term and “text slang” was offered, but this term could not be agreed upon by subsequent focus groups. After the focus groups had discussed the issue in-depth, all remaining focus groups agreed that this term was not suitable. Since the example “lol” helped the participants to understand the term “text speak,” “lol” was added as an example.

The second issue involved the term “icon.” A participant asked if the question was referring to the term “emoticon.” When this issue was brought up in subsequent groups, the moderator asked if the term “emoticon” would be a better fit and they agreed it improved the clarity. All items containing the term “icon” were reworded with the term “emoticons.” The remaining affective items were discussed by the focus groups, but none of the participants identified any other clarity or relevance issues.

Interactive Items. Interactive communication, which refers to indications that the communicator is open to receiving and attending to messages, garnered only one confusing item. Participants in all focus groups had issues with the term “quote.” Through discussion with the participants, the word “quote” was determined to be too strong of a term. Several participants stated that they would never quote someone specifically. After the discussion seemed to stall, the moderator asked all focus groups about the phrase “referencing past conversations” because this phrase was created to capture the same information as the term “quote.” All participants agreed that the phrase “referencing past conversations” increased clarity. Thus, the phrase “referencing past conversations” replaced “quote.” All focus groups reviewed the remaining items, but the participants did not identify any other issues with clarity or the concept.

Cohesion Items. Social presence theory predicts that cohesion is established by using first names, personal pronouns, and the use of small talk (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). Only one issue arose, and it concerned the use of first names. Participants in all seven focus groups had issues with the items that discussed the use of first names in CMC. Participants stated they rarely use names when they communicate with others via CMC because the name of the person with whom they are communicating usually appears on the phone or computer screen. Upon reflection, items concerning first names were retained since previous literature has suggested it is an important aspect of presence (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). The focus groups reviewed all other cohesive items but did not find any issue with the items relating to cohesive communication.

Modified Version of Scale. After the initial items were updated to reflect the focus group findings, additional items that were consistent with the same content and wording suggested by the focus groups were created for each section of the proposed measure. Originally, the focus group participants were given 30 items (available from the first author), 10 from each subsection. Because the goal was to create a new measure, additional items were created to ensure the construct was captured (Pett, Lackey, & Sullivan, 2003). There are an infinite number of items that represent any abstract construct; it is the goal of measurement theory to identify items that best capture the construct of interest (Nunnally & Bernstein, 1994). Focus groups were used to identify symbols that best represent constructs and synonyms for those symbols were used to create new items. Using the 30 items agreed upon by the focus groups as templates, an additional 23 items were created to reflect original items. For example, the original item “I encourage others to send me computer-mediated messages” was used to create “I let people know that they can send me computer-mediated messages.”

After the focus groups, to better capture the affective communication domain of social presence, an additional 12 items were added. Six of the items concerned the idea of sharing emotions and/or experiences. The next six items that were added involved the concept of paralinguistics. An additional eight items were added to the interactive communication subsection. These items revolved around the concepts of initiating or responding to messages. Due to the discussion by the participants in several of the focus groups, four items were added that involved the use of pictures and informal language. These items were not added to the original hypothesized areas of affective, cohesive, or interactive communication because it could not be determined where the items should fit. This process brought the initial social presence behavior conceptualization to 53 items.

Study 2: Exploratory Factor Analysis (Construct Validity)

Exploratory factor analysis (EFA) is used when the total number of factors needed to fully explain the relationships among items is unknown and the researcher needs to examine the fundamental structure of the construct (Pett et al., 2003). EFA compares the items in terms of best fit to account for the most variance (Nunnally & Bernstein, 1994). Thus, an EFA identifies items that work well together and items that need to be eliminated from a measure. The EFA procedure was chosen over a Confirmatory Factor Analysis (CFA) because there have been issues concerning the definition of social presence (Armellini & Stefani, 2016). Although a CFA is a more rigorous test of a measure (Allen, Titsworth, & Hunt, 2009), there must be a supported definition and theoretical factor structure to run a CFA (Byrne, 2016). The EFA was chosen to ensure that the items did work well with one another.

Participants

Participants were recruited via general education courses and were offered either research credit or extra credit to participate in the study. The number of participants needed for an EFA is currently open for debate (Pett et al., 2003); however, 300 participants has been suggested as a good rule of thumb (Tabachnick & Fidell, 2000). Because the study constitutes an investigation of CMC, high CMC users were needed as study participants. College students tend to use CMC more than the general population (Jones et al., 2002). Therefore, recruitment of high CMC users took place on college campuses. A total of 400 participants completed the survey and were used in the study. Over 82 percent of the participants identified themselves as moderate to frequent CMC users. When asked about their experience with CMC, 78 percent of the participants ranked themselves as experienced or very experienced. Additionally, 54 percent rated themselves as experts or near experts with CMC. The sample comprised 48 percent females and 52 percent males, and they ranged in age from 19 to 63 years-old (M = 23; SD = 6.24).

Procedures

Participants were provided a hyperlink to an online questionnaire containing a description of the study, a consent form, and 116 survey questions with 53 being directly related to the EFA. Other items were included as part of a larger study and not analyzed with these data.

The survey included the social presence self-assessment items and demographic questions concerning CMC use. The questionnaire took approximately 20 minutes to complete.

EFA Results

Social presence's three overarching domains of affective, interactive, and cohesive communication in online discussions (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999; Swan & Shih, 2005) led to this measure's creation to determine whether all aspects of social presence were being captured. An exploratory factor analysis using Principal Axis Factoring with Direct Oblimin rotation was used. This method was appropriate because the underlying factors should theoretically be correlated (Allen et al., 2009; Pett et al., 2003). To ensure that the items in the identified matrix have a relationship, Bartlett's test of sphericity was conducted. The test was statistically significant, $X^2(253) = 3,244.19$, $p < .001$ The Kaiser-Meyer-Olkin measure of sampling adequacy result was .94, which is considered an excellent sample size (Pett et al., 2003). Items that did not load >.32 on any of the components were deleted (Tabachnick & Fidell, 2000), and any items that loaded on multiple factors without a difference greater than .2 were also deleted (Hair, 2010). This reduced the measure to 24 items. ($\alpha = .93$). An examination of the Scree Plot showed there was a distinctive difference between the three-factor and the five-factor solutions. To determine which solution to use, the measure was forced into three-factor and five-factor solutions. An examination of the three-factor and five-factor solutions showed that the five-factor solution aligned with previous theoretical assumptions more than the three-factor solution. That is, the three-factor solution placed affective items on the same factor as cohesive items, while the five-factor solution separated affective, cohesive, and interactive items on different factors. Thus, the theoretically consistent, five-factor solution was chosen (see Table 1 for descriptive statistics).

Table 1
Factor Correlations and Reliability

	Sharing	**Paralinguistics**	**First Names**	**Small Talk**	**Alpha**
Sharing					.88
Paralinguistics	.440				.71
First Names	.413	.280			.83
Small Talk	.649	.380	.306		.75
Interacting	.756	.303	.508	.539	.83

Note. All correlations are statistically significant ($p < .001$) and include 400 participants.

Since the use of paralinguistics involves informal language and non-alphabetic symbols to display emotions, theoretically it should factor with sharing of emotions and/or experiences. After the EFA, the results showed that Affective communication contained two separate factors, which strongly suggest that the CMC users view the sharing of emotion through text as something different from showing it via paralinguistics. This varies greatly from past research and needs further investigation.

The use of inclusive pronouns was predicted to indicate cohesive communication. Cohesive communication involved the feelings of being connected to another individual, and it consisted of vocative and phatic communication (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). Vocatives was defined as the use of personal pronouns (we, us, our) and the use of first names; however, this study eliminated the use of inclusive pronouns. The act of looking for signs of connection in CMC discussion transcripts may have led the original researchers to become biased. Another option could be that personal pronouns may be a little too subtle for the users of CMC to identify. To determine if personal pronouns is in fact a component of social presence theory, additional research is needed.

The other aspect identified as vocatives was the use of first names, which factored out separately from the use of small talk or phatic communication. This created two separate factors for cohesive communication, which differs from previous research (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). Items concerning use of first names were almost eliminated due to discussion with the focus groups. Several participants stated they did not use first names in CMC because the technology tends to include the name of the interactants on the screen, eliminating the need to include first names when using CMC. When asked about other CMC channels, such as email, the focus groups stated they used first names when they knew the other interactants' first names. However, several examples brought up by the focus group participants referenced situations in which the use of first names would be inappropriate, such as contacting a professor. Since there were conflicting ideas concerning the decision to retain the items, the researcher based the decision upon the weight given to the topic in prior research. Considering the results of the measure, the decision to retain the cohesion items concerning first names was justified.

The third area, interactive communication, involved using indicators that demonstrated to other CMC users the sender was open to receiving and attending to messages (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999). CMC users demonstrate interactive communication by asking/answering questions and referencing past conversation, thus showing other communicators they are open to interacting. This area contained one factor that corresponds with previous research.

The EFA identified five factors and reduced the measure from 53 to 23 items. The five factors identified by the EFA are open to interacting, use of paralinguistics, use of first names, use of small talk, and the sharing of emotion and experience. This five-component solution accounted for 62 percent of the variance.

Study 3: Confirmatory Factor Analysis

Participants

A total of 331 participants completed the survey using the same recruiting and data cleaning techniques and procedures as study 2. Any sample size over 200 participants for a CFA is considered large (Kline, 2005). The sample of participants was comprised of 55 percent females and 45 percent males, and they ranged in age from 19 to 62 years-old (M = 23; SD = 6.77). Specifically, for the CFA, over 85 percent of the participants identified themselves as moderate to frequent users of CMC. When asked about their experience with CMC, 71 percent of the participants ranked themselves as experienced or very experienced. Additionally, 55 percent consider themselves expert or near experts with CMC.

Procedures

Participants were provided a hyperlink to an online questionnaire containing a description of the study, a consent form, and 80 survey questions. The preliminary self-assessment social presence behavior measure (23 items): the Harms & Biocca (2004) job satisfaction scale (8 items), the M.I.N.D. the labs social presence measure (36 items), the Watson (2007) CMC anxiety measure (8 items); and demographic questions concerning age, sex, and CMC knowledge (5 items). The questionnaire was randomized to prevent order bias and took approximately 20 minutes to complete. Because students were offered extra/research credit for participation, the participants entered a code that allowed list-wise data deletion, to minimize skewed results and address participants' technical difficulties (e.g., power or internet outages), if someone participated more than once.

Instruments and Measures

CMC apprehension (CMCA) refers to anxiety concerning sending and receiving messages via a computer-mediated system (Brown et al., 2004; Scott & Timmerman, 2005). The scale (Scott & Timmerman, 2005) had 10 items and was considered reliable (α =.79). Watson (2007) dropped 2 of the original 10 items to improve reliability (α =.81). For this study, the Watson (2007) version of the CMCA scale was used. The CMCA measure has been found to predict the use of new communication technologies in organizational settings (Scott & Timmerman, 2005), visits to social networking sites, and updates to the user's profiles (Watson, 2007). There is a negative relationship between CMC apprehension and social presence (Wrench & Punyanunt-Carter, 2007), which indicates construct validity.

The Abridged Job in General Scale (AJIG) measures global job satisfaction (Russell et al., 2004) and correlates with a person's identification and commitment to the company (Russell et al., 2004). With eight items, the measure has achieved acceptable reliability (α = .85) and shown construct validity (Russell et al., 2004). Theoretically, no relationship between a person's job satisfaction and ability to project oneself as a socially present individual should exist, which allows for discriminant validity testing.

The M.I.N.D. lab social presence measure is based upon the definitions and reviews of other measures of social presence (Biocca, Burgoon et al., 2001) and is being used to establish concurrent validty. The researchers created an initial pool of 80 items narrowed down to 69 items to improve content and face validity (Harms & Biocca, 2004). A pilot test and factor analysis eliminated items that did not factor together eliminated 33 items and retained 36 items (Harms & Biocca, 2004) with acceptable reliability (α = .81). The confirmatory factor analysis provided support for the six factors: co-presence (sense of being in an online environment with another person), attention allocation, perceived message understanding, perceived emotional interdependence, and perceived behavioral interdependence (Harms & Biocca, 2004). The measure has criterion validity to the extent that it can tell the difference in social presence between face-to-face interactions and mediated interactions (Harms & Biocca, 2004). It failed, however, to find a difference in different forms of mediation, specifically video- and text-based mediation (Harms & Biocca, 2004).

CFA Results

CFA involves a test of internal consistency followed by a test of parallelism. Each of the five factors identified in the EFA was tested with the AMOS maximum likelihood parameter estimation algorithm. An examination of the standardized residual covariances was conducted if the model fit did not meet the standards of a close to approximate fit established by Kline (2005). This was done to determine if any items were greater than 2.58 (Byrne, 2016), which is a sign of internal consistency issues within the measure.

The item “I use punctuation like capitalization to communicate my feelings” from affective communication was removed due to internal consistency issues. All 22 remaining items were retained.

To determine if the model was second-order unidimensional or multidimensional, a CFA tested both models and indicated they were a close to approximate fit (Kline, 2005), but the multidimensional model was a better fit [$\chi^2(220, N = 331) = 345.82$, $p = .01$. RMSEA =. 053 (90% CI: .045–.062), GFI = .91] than the second order unidimensional model [$\chi^2(184, N = 331) = 376.240$, $p = .01$ RMSEA =. 056 (90% CI: .048–.064), GFI= .90]. The multidimensional model had lower chi square and RMSEA values and the GFI was higher than the unidimensional model; however, the differences between the fit of the unidimensional and multidimensional models were very small. To help determine which model was preferred, an examination of the reliability of the entire measure (unidimensional) and the subsections (multidimensional) were examined. The unidimensional model (α = .92) had subsections between .71 and .88. Since the subsections of the multidimensional model have acceptable reliability, lower chi-square and RMSEA values, and the GFI was higher than the unidimensional model, the multidimensional model was chosen. See Tables 2 and 3 for descriptive statistics and correlations.

Table 2
Descriptive Statistics

Measure	**Mean**	**S.D.**	**Min.–Max.**	**Skew**	**Kurtosis**	**Cronbach's α**
Social Presence Measure	4.56	.97	1.70-7.00	-.059	.049	.92
M.I.N.D. Labs Social Presence	4.57	.83	1.00-7.00	-.159	2.00	.95
AJIG	2.53	.47	1.00-7.00	-1.13	-.754	.83
CMC Anxiety	4.40	.86	2.00-7.00	.183	-.206	.77
CMC Experience	5.82	1.03	2.33-7.00	-.789	-.009	.78

Table 3
Correlations

Correlations: Observed

Factor	Correlations			
	Social Presence	Job Sat	MIND	CMCA
Job Satisfaction	.09			
M.I.N.D. Labs Social Presence	.51*	.08		
CMC Anxiety	.40*	-.10	-.11	
CMC Experience	.32*	.21*	.22*	.36*

Note. * $p < .01$, N = 400

Table 3, Cont. Correlations: Corrected for Attenuation due to Measurement Error

Factor	Correlations			
	Social Presence	Job Sat	MIND	CMCA
Job Satisfaction	.10			
M.I.N.D. Labs Social Presence	.55*	.09		
CMC Anxiety	.52*	-.13	-.14	
CMC Experience	.38*	.26*	.25*	.50*

Note. * $p < .01$, N = 400

A test of parallelism, using CFA, was conducted on all four measures to establish concurrent and discriminant validity. The model fit did not meet the standards of a close to approximate fit (Kline, 2005); an examination of the standardized residual covariances from all the measures was conducted and any item causing an internal consistency issue was removed. One item was removed from the preliminary measure, reducing the measure to 21 items. The finalized version of the measure showed a close to approximate fit according to Kline (2005) [$\chi^2(161, N = 331) = 283$, $p < .05$. RMSEA =. 046 (90% CI: .036–.055), GFI = .92].

The CMC anxiety measure was used to establish convergent validity because of its negative relationship with social presence (Wrench & Punyanunt-Carter, 2007). Logically, as social presence increases, anxiety due to the use of CMC should decrease. The CMC anxiety measure is calculated differently than other anxiety measures. Specifically, scores on the measure will be higher as anxiety lowers. This negative relationship between CMC apprehension and the social presence behavior measure was confirmed [$r(331) = .40$, $p < .001$; corrected for attenuation due to measurement error ($\acute{r}$) $\acute{r} = .52$, $p < .001$], with 25 percent of the variance in social presence being explained by CMC anxiety.

Discriminant validity was tested using AJIG; there should not be a relationship between job satisfaction and ability to project oneself as a social individual. As predicted, there was not a statistically significant correlation between AJIG identified after the test of parallelism and the social presence measure [$r(331) = .09$, $p > .05$. ; $\acute{r} = .10$, $p > .05$].

To establish concurrent validity, CMC usage demographics and the relationship between the M.I.N.D. Labs social presence measure and the preliminary self-assessment social presence behavior measure were examined. Participants were asked three questions concerning their experience, use, and knowledge concerning CMC. The three questions were combined to create the participants' CMC Experience score ($\alpha = .78$; $M = 17.45$; $SD = 3.096$). As experience with CMC increases, so should the participants' social presence [$r(331) = .323$, $p < .001$; $\acute{r} = .38$, $p = .000$] with CMC experience scores explaining 10.4 percent of the variance in social presence scores. Additionally, theory predicts that the M.I.N.D. Labs Social Presence Measure should be positively correlated with the preliminary social presence behavior measure [$r(331) = .55$, $p < .001$; $\acute{r} = .55$, $p < .001$]; social presence perceptions explained 30 percent of the variance in social presence behaviors.

Discussion

This series of studies creates and provides validity testing of a self-rated measure assessing an individual's ability to project a social presence. This measure's intended purpose is to identify individuals who have trouble initiating social presence, and the areas of social presence with which they have difficulty. This measure can be used as a tool in online education to screen and provide additional training to students and professors. In fact, it may be more important to identify the professors who have issues because instructor involvement has been found to be a key component to creating social presence within online classes (Whiteside, 2015).

In Study 1, focus groups provided face validity by restructuring or borrowing items and using them outside the context in which they were intended (Morgan, 1997; Ritchie & Lewis, 2005; Stewart, et al., 2007). Participants clarified terminology and wording issues and provided guidance for study two. During the exploratory factor analysis, the preferred five-factor solution expanded social presence theory's three factors of affective, cohesive, and interactive communication. Interactive communication remained untouched. Affective communication split into sharing of emotions/feelings and paralinguistics. Focus group participants had difficulty with the terms associated with paralinguistics ("text speak" and "icon"). Since the purpose of paralinguistics is to replace nonverbal messages not transmitted via CMC, participants may have viewed text as a verbal component as in "sending a text" and paralinguistics as the nonverbal component. Cohesive communication split into small talk and first names while eliminating inclusive pronouns.

The original researchers (Caples, 2006; Garrison et al., 2000; Rourke et al., 1999) identified personal pronouns by analyzing CMC discussion transcripts to find telltale signs of connection, which may have been a specific context in which they were more prevalent than general CMC. The first-name items were almost eliminated during the focus groups because current technology makes them unnecessary by including them on the phone screen. When asked about other CMC channels, the participants did indicate that they use first names when they knew them and also indicated they are inappropriate in situations such as contacting a professor. The conflicting perspectives and theoretical justification led the researchers to keep the items, which may explain why the cohesive factor was severed.

The remaining 23 items were used in study three. In the confirmatory factor analysis and validity study, the CFA reduced the scale by two items due to internal consistency issues. The finalized scale showed concurrent validity with the CMC Users Experience survey and M.I.N.D. Labs Social Presence Measure (all three were strongly correlated with each other), discriminant validity with the AJIG job satisfaction measure (nonsignificant correlation), and convergent validity with the CMC Apprehension measure (strong correlation).

Future Research and Limitations

The first limitation is the use of the purposive sample to recruit CMC users who are very experienced with CMC. The lack of participants with little CMC experience prevents us from investigating whether those with little CMC experience adapt the same way that experienced CMC users do. Future research needs to determine if the measure would be as helpful with individuals who refrain from interacting via CMC channels. Additionally, the sample should include both students and faculty who have experience with CMC and online education. Further research should be conducted concerning the five areas of social presence verified in this study. CMC scenarios could be created with varied levels of the five social presence areas identified. For example, a series of CMC scenarios using paralinguistics and textual references to emotion could be created. One scenario using both paralinguistics and textual references equally, two scenarios using either paralinguistics or textual reference to emotion, and two scenarios using both. The scenarios would then be ranked according to the level of social presence that the participants perceived. This would let us determine if paralinguistics or textual references varies with the level of social presence CMC users experience.

The relationship between social presence and CMC apprehension should be investigated as well. The two measures correlated according to theory but does CMC apprehension lower due to social presence? Users with high levels of apprehension who score low on social presence behaviors should be recruited. A series of trainings could be designed to lower CMC apprehension or increase social presence behaviors. An experimental design would allow researchers to assess the exact relationship between CMC apprehension and social presence.

The final limitation is due to the COVID-19 pandemic. This research was conducted before the pandemic forced most of higher education online. It would be prudent to include more demographic information asking about both the students' and faculty's experience with CMC and online education given the worldwide move to online emergency remote teaching.

Contributions and Implications

The measure can be used as a tool in online education to screen and provide additional training to students and faculty. In addition, the individual's scores on the subsections of the instrument can indicate area(s) of social presence needing improvement. Instructors could use the measure to assess the ability of their classes and assign groups based on communication ability, thus pairing students with social presence behaviors deficiencies with proficient students. In addition, online educators who have issues with social presence behaviors can be identified, which allows educational institutions to pick instructors who adapt well to the online environment as role models and trainers of others who do not have the same social presence behavior proficiencies. Research has shown that instructors training in social presence increase not only their use of social presence cues, but also their students' use of presence cues (Paquette, 2016). Since the role of the online instructor is critical in creating a positive classroom climate (Kaufmann et al.,2016), instructors must help the students feel they are more than a name on a roster (Cunningham, 2015; Jiang & Koo, 2020).

Declarations

The authors declare no conflicts of interest.

The authors declare no funding support for this work.

Ethics approval was granted for the study by the University of Tennessee, USA Institutional Review Board.

Note

Author Scott Christen changed institutions to Tennessee Technological University, USA since this article was originally submitted.

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Appendix A
Projecting a Social Presence Measure

<u>Directions</u>: The following scale concerns your behaviors when using computer-mediated communication. Computer mediated communication is the use of communication channels such as email, text messaging, social networks, chat, etc. Please respond to the following statements as they apply to your use of computer-mediated communication using the following scale:

1	**2**	**3**	**4**	**5**	**6**	**7**
Strongly Disagree	**Disagree**	**Slightly Disagree**	**Neither Agree nor Disagree**	**Slightly Agree**	**Agree**	**Strongly Agree**

1. I tend to share my feelings with others via computer-mediated communication *(asp)*
2. I tend to disclose my past experiences and opinions with other online communicators. *(asp)*
3. When other online communicators share personal information, it improves the communication. *(asp)*
4. I initiate conversations concerning how others think/feel via computer-mediated communication. *(asp)*
5. I ask other people their opinion via computer-mediated communication. *(asp)*
6. I share my opinions via computer-mediated communication. *(asp)*
7. I discuss my thoughts and feelings when appropriate with others via computer-mediated communication *(asp)*
8. I over-use punctuations (!!!, ???, etc…) to convey my feelings. *(asp)*
9. I like it when others over use punctuation (!!!, ???, etc…) to convey feelings. *(asp)*
10. I use capitalization to stress certain points when using computer-mediated communication channels. *(asp)*
11. I like it when people refer to me by first name in computer-mediated communication if the communication channel does not automatically include my name. *(csp)*
12. I use small talk to make my computer-mediated messages more personal. *(csp)*
13. I usually include small talk in computer-mediated communication. *(csp)*.
14. I enjoy it when people use small talk in computer-mediated communication. *(csp)*
15. If I know the other person's first name, I use that in my computer-mediated messages with them if the communication channel does not include it automatically. *(csp)*
16. I encourage others to use my first name in computer-mediated communication if the communication channel does not provide it automatically. *(csp)*
17. I like to send others computer-mediated messages. *(isp)*
18. I like to receive messages from others via computer-mediated communication. *(isp)*
19. I send messages to let others know that I received their computer-mediated message. *(isp)*
20. I ask others for their contact information so I can use computer-mediated communication to contact them later. *(isp)*
21. I let people know that they can send me computer-mediated messages. *(isp)*

Note. ASP = affective social presence; CSP = cohesive social presence; ISP = Interactive social presence

Using Online Tools to Develop Higher Order Learning Among Tertiary Students

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Abstract
It is widely recognised that the development of higher order thinking skills is a fundamental goal of higher education. There are a variety of online tools that assist the development of student higher order thinking. In this paper, a process of scaffolding for the writing of higher-order questions enabled through peer learning activities is explored. Data collected over two years across five cohorts shows that there was an overall statistically significant improvement in the number of higher-order questions produced by students at the end of each unit. The findings reveal a viable peer teaching tool that can easily be embedded into existing programmes to develop the necessary critical thinking skills for higher education students.

Keywords: Higher order thinking, online, taxonomy, scaffolding, higher education

Page, A. (2022). Using online tools to develop higher order learning among tertiary students. *Online Learning*, *26*(3), 221-235.

This article discusses the use of an online software platform that enables the student development of the multiple-choice questions in an initial teacher education course delivered at an online university in Australia. Specifically, the article investigates the importance of teacher scaffolding. The ongoing participation in the student-teacher relationship enabled the development of quality questions that students subsequently authored. Additionally, the importance of peer explanations associated with their questions provided continued student progress in their ability to write high quality questions. While there are investigations into the quality of student-produced questions reported in the literature, the current analysis addresses gaps in studies relating to initial teacher education literature as well as the student-teacher partnership required to develop higher-order thinking skills and production of quality questions.

There are many online tools to assist students in their online learning and examples such as self-quizzing facilitate the development of higher-order thinking skills as it has been shown that these specific skills positively correlate with academic success (Kenney, 2020). This study presents one online software platform that teacher education providers can easily use to expedite this process. The publicly available software requires students to author multiple choice questions from course content that encourages students to engage in the course content in greater depth. Multiple choice questions are then shared and discussed among peers. This approach encourages collaboration, co-constructivism of learning, and a rich engagement in the course material (Denny et al., 2011). While it has been noted that the potential challenges to multiple-choice writing are that creating good items can be confusing to the novice, this article provides an outline of the efficacy of the online platform as a useful learning tool that included a scaffold for learners to overcome this potential issue. To maximise student learning, scaffolding for students about how to take ownership of the course content by writing a good multiple-choice question, as well as higher-order questions, will be shown to be fundamentally important. It will also show how socially constructed learning to produce quality outcomes can be developed. Therefore, instead of lecturers transmitting information and content, students are engaged in the learning process to meet their learning outcomes (Rivers et al., 2017). The role of learning communities to support the development of student initial learning in writing multiple-choice questions in the online space will be discussed. Data show that online tools assisted the development of writing higher-order questions across five cohorts of students in an initial teacher education course. The findings will outline that the benefits of using online tools to encourage the process of active learning—shifting students from passive receivers to active learners—is a worthwhile addition in higher education.

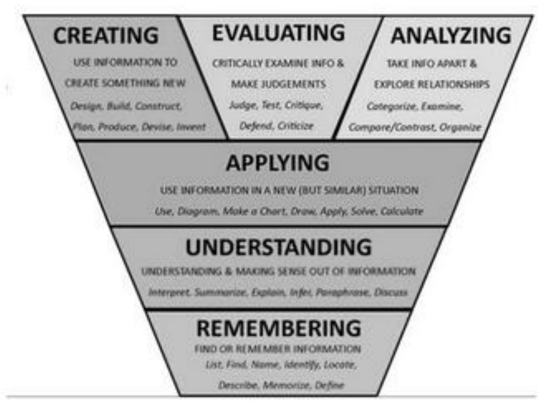
Foundational Ideas about Higher Order Thinking

Higher order thinking skills are considered an essential component in our ever-changing world for our future citizens. Higher-order thinking skills are necessary to facilitate the transition of students' knowledge and skills into responsible action and to meet this challenge, the development of critical thinking is required (Choi et al., 2017). The significance of developing higher order thinking skills in students is well documented. Research has shown significant differences in average student performance when higher-order instruction is used (Caulfield-Sloan & Ruzicka, 2005; Jones, 2015) and Nevid et al., (2017) have shown that writing-to-learn assignments applying the concepts of higher-order thinking improved subsequent examination performance. The critical thinking necessary to respond to higher-order instruction is one of the main components in encouraging students to take responsibility for their decisions, think logically and problem-solve (Liu et al., 2014). There is also evidence to support the view that critical thinking skills can further assist in career development and promotion (Casner-Lotto & Barrington, 2006). Moreover, the significance of developing the skill of higher-order questioning in students is that it both provides a platform for critical thinking and provokes student interest and deeper thinking (McCollister & Sayler, 2010).

Scaffolding (Wood et al., 1976) allows for the preparation for students of higher-order questioning, as students move from a lower level of understanding to a higher level of questioning and knowledge. It involves a focus on the moment-by-moment exchanges between the teacher and students in a teaching and learning sequence, or as Parkin and Harper (2018) articulate, “scaffolding is like teaching someone to ride a bike” (p.36). In the online environment, scaffolding has been found to have a large and statistically significant effect on learning outcomes (Doo et al., 2020). Scaffolding nurtures students understanding and helps students feel more comfortable learning new material, which is likened to the lecturer modelling what is needed or providing expectations of what is required (Robinson et al., 2017).

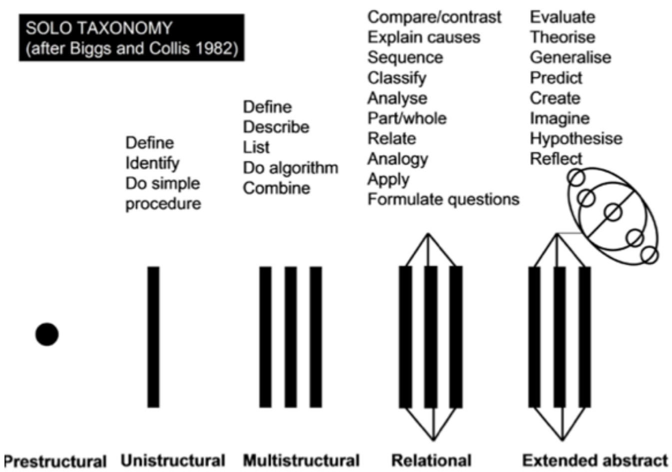
Scaffolding is often used to transition student learning towards greater cognitive complexity, as described in Bloom’s taxonomy (Bloom, 1956). The taxonomy describes how a student should move in a step-by-step process (McNeil, 2011). The revised Bloom’s taxonomy pyramid (Anderson et al., 2001), adapted to reflect 21st-century learning, moves students from the development of basic recall and memory to the understanding of knowledge and the application of that knowledge. Analysis of their learning is then able to be achieved at the next step in the hierarchy. Evaluation and finally creation, where students put together the elements of their knowledge and understanding of the material, can then be performed by moving through the more cognitively challenging phases of the taxonomy.

Figure 1
Revised Bloom’s Taxonomy: Cognitive Domain (Anderson et al., 2001) cited in Douglas, Wilson, and Ennis (2012).



Support for, and expectations of, student learning through the provision of a feedback rubric using this taxonomy has proven to be successful. Feedback is given in partnership and requires reciprocal engagement by the student and in this model, lecturers and students have as much responsibility as the other (Rivers, et al., 2017). Other research provides evidence that feedback promotes academic success. Giacumo et al. (2013), for example have shown that students given a writing assignment without a rubric did not perform as well in the production of higher-order thinking than did the students who were given a rubric where higher-order thinking categories were listed as prompts. To assist in the quantitative rigour of such an approach, Omar et al. (2012) had developed a classification system to facilitate the measurement of higher-order questions in exam essays using Bloom's taxonomy. However, the usefulness of Bloom's taxonomy to give feedback has also been called into question, especially concerning its limited evaluation of the criteria levels (Biggs & Collis, 2014). The Structure of Observed Learning Outcomes (SOLO) taxonomy was developed is an instrument that allows for the evaluation of the quality of a student's work retrospectively in a systematic way, thus addressing the limitations of accurate measurement in Bloom's framework (Biggs & Collis, 1982). The taxonomy is also known to support students to reflect on their thinking while providing feedback and feedforward concerning learning (Chan et al., 2002). The structure of the SOLO taxonomy is outlined below.

Figure 2
SOLO Taxonomy (Biggs & Collis, 1982) http://www.johnbiggs.com.au/academic/solo-taxonomy/



The teaching of higher-order thinking according to the taxonomies is designed to develop student learning. Moreover, the educational benefits from engaging students in the creation of question development from course content themselves have been deemed successful regarding learning outcomes (Bates et al., 2014). One method of engaging students in the course material has been in the production of multiple-choice question development. Multiple-choice formats, however, have long been criticised for their inability to tap into higher-order thinking because traditionally, the questions themselves have only been developed at knowledge-level thinking (Hancock, 1994). Multiple-choice questions have also been criticised for their overuse in online learning as a "traditional" assessment tool (Dumford et al, 2018) although by "traditional" the authors refer to the use of a summative approach to determining students' knowledge of the course content (Rambe, 2020). They remain, however, arguably the most popular type of assessment in education and have been reported as an activity that promotes learning and can be used in formative assessment allowing immediate feedback (Butler, 2018). Further, Butler (2018) stipulates multiple-choice questions that demand high levels of student critical thinking as vital, and research has shown that multiple-choice questions as an assessment assist in providing higher mastery and retention of course content (Mingo et al., 2018).

The synthesis level of "creation" in Bloom's taxonomy can only be assessed using multiple-choice questions, for example, by the production of new questions. Additionally, evaluation can only occur in the description of the answer by the author. The limitations of traditional multiple-choice development can be overcome by introducing platforms to assist student partnerships in learning, teaching, and assessment.

Online Tools for the Development of Higher Order Thinking

While there are many online tools to assist students in their development of higher order thinking (Kenney, 2020), this study was particularly interested in PeerWise as a tool to facilitate peer-to-peer interactions and collaboration with course material. PeerWise is an online software tool that requires students to engage in the creation, sharing, responding and discussion process with other students. It requires students to use these skills in the development of multiple-choice questions, written from course content. PeerWise was designed by Denny et al., in 2008, offering an innovative approach to teaching and learning by encouraging students to engage with the course material in a novel way. The system was specifically designed to promote higher order thinking by providing a cost-free platform that allowed students to specify an explanation of their multiple-choice answer and critically evaluate others' answers. The inclusion of the comments area allows students to give feedback about other peers' questions, ask questions for clarification and for the author to respond, which allows for the clarification and further development of the initial model answer (Galloway & Burns, 2015). This element of peer assessment and feedback takes students from being recipients of their educational process to being working partners, creating, assessing and making critical judgements. PeerWise uses a pedagogical methodology of *constructive evaluation* that allows students themselves to develop higher order questions that are driven by their own learning rather than teacher-led learning (Luxton-Reilly & Denny, 2010). Constructive evaluation shifts the learner from being a passive consumer of course content to participants in knowledge sharing and production.

Research conducted into the efficacy of online multiple-choice tools has produced two consistent results. The first key finding is that students are inclined to contribute more questions, answers. and give comments to peers than is asked of them as a minimum requirement, suggesting high levels of interest and engagement in the course material. Alongside these outcomes, a further finding has indicated that there is a correlation with higher summative assessment scores and students with higher levels of scores (Bates et al., 2012; Casey et al., 2014; Denny et al., 2009; Denny et al., 2010; Feeley & Parris, 2012).

There are, however, fewer studies that address the quality of student-generated contributions in multiple-choice online tools. In one study, Denny et al. (2009) investigated the quality of student-generated questions Specifically, they examined the errors detected and subsequently corrected by peers. The definition of quality was whether the questions were an effective and efficient tool to help peers learn. Ratings were given from 0 to 5. While subjective, it was found that students write and use high-quality questions more often than low-quality questions.

Furthermore, Bates et al. (2014) found that 75% of chemistry student-generated questions were developed at a standard beyond simple recall using a revised Bloom's taxonomy (Anderson et al., 2001) to map question quality. Anderson et al. (2001) suggested a simplification of

Bloom's taxonomy which groups the upper three levels into a single level. In Bates' et al. (2014) study, academic staff interaction was passive after introducing students to the assignment with scaffolding activities. Again, using the revised Bloom's taxonomy by Anderson et al. to map question quality, Galloway and Burns (2015) investigated the quality of physics student-generated content. Comparably, the findings indicated 86% of the participants provided examples of high-quality questions (defined as more than simple factual recall). Scaffolding was provided for students before the task only.

An additional outcome of Bates and Galloway's work was the evidence of a strong link between the scaffolding resources that both supported and guided students and the writing of high-quality questions and explanations. This is supported by other work such as Preus (2012), who concluded that with adequate support strategies and teaching resources, all students including those with learning difficulties could achieve improved levels on Bloom's taxonomy. This research contributed to the study in using online multiple-choice tools and the application of scaffolding students to write higher-order questions according to Bloom's taxonomy. It achieves this aim by investigating the use of ongoing scaffolding throughout the unit of teaching as well as providing feedback for improvement, rather than providing students with an understanding of scaffolding as a single event. Further, scaffolding the writing process towards higher-order questions in this way has been applied in an online context (Preus, 2012).

It becomes increasingly apparent, given the research outlined above, that the efficacy of scaffolding and feedback appears to require strong and ongoing relationships between students and their lecturers. Regular and specific feedback encourages active engagement and is required to move student learning towards becoming "partners in the learning journey through learning to ask questions and evaluate conclusions and answers" (Rivers, et al., 2017, p. 4).

Theoretical Framework

The model is underpinned by the theoretical framework of social constructivism (Vygotsky, 1978), which purports that knowledge is assembled through social interplay. The construction of meaning is developed in the interaction with others and is critical to the learning process. Discussion and social interaction enable students to arrive at a level of deeper understanding of their shared meanings of the material. While support systems for online learners have long been a concern for the online teaching space and the development of essential skills (McLoughlin & Marshall, 2000) as traditional platforms of social interaction occur face-to-face (Luxton-Reilly & Denny, 2010), social learning opportunities can occur online when students come together in virtual learning environments (Richardson et al., 2017). Thus, in alignment with social constructivist theory, scaffolding, or to be more precise using Vygotsky's terminology—operating within the zone of proximal development (Obukhova & Korepanova, 2009)—is used as a mechanism to provide students with the capabilities from a teacher or other peer to help them perform a task that would not typically be accomplished independently.

The current article describes the use of student-generated content within the context of multiple-choice higher-order assessment questions where scaffolding is consistently provided for students and interaction encouraged between peers. In the online teaching course, students were invited to participate in learning communities in which they were able to share ideas, ask questions, and respond to peer comments. The communities included the participation by the lecturer. Reciprocal feedback was enabled accepting students as partners in the content to explore. Details of the method that was used for the study are described below.

Method

The current research explored the role of scaffolding to assist in the authoring higher-order questions. The research questions were:

1. How can students be encouraged to interact with the teaching material presented in an online higher education programme?
2. How can students develop higher order thinking skills in an online higher education programme?
3. How successful was the online tool used in the study in developing higher order thinking skills?

Participants

Participants were pre-service teacher education students enrolled in an online university course that used an online software tool, across four cohorts over two years. These students lived in a variety of locations around Australia as well as overseas. Students were between 21 and 52 years of age. Seventy percent of the participants were women and 30% were male. All were enrolled in a post-graduate pre-service teaching degree and 44% were enrolled as primary school pre-service teaching students and 66% were enrolled as secondary school pre-service teaching students. Ethics approval was obtained to use students' data from the university's Human Ethics Committee. Students gave consent to participate in the collection of the summary of results. For the purposes of the research focus, results were analysed across each cohort, allowing the participants to be anonymous.

Procedures

The delivery of the classroom management course consisted of eight weeks in total. Students were enrolled in communities of practice and each community received weekly resources to scaffold the writing of questions, explanations, and evaluations/comments. Bloom's taxonomy (revised) (Anderson et al., 2001) provided a framework to guide higher-order question writing while the SOLO taxonomy (Biggs & Collis, 1982, 2014) provided a framework to help assess and describe the growing complexity in question writing and understanding of the unit content. Each week, an updated scaffold was posted to include examples of questions, explanation, and critical evaluation and comments—all mapped to the frameworks. Students also participated in weekly community forum discussions where they were encouraged by the lecturer to ask and respond to questions from each other relating to the course content. The lecturer participated in the forums to confirm the accuracy of the content when required.

The multiple-choice activity formed 30% of the overall unit grade, and over the eight-week unit, and student submissions were required to be submitted every two weeks, making a total of four submissions per student. For each submission, students were required to:

1. Design two higher-order multiple-choice questions based on the related readings, resources, and materials
2. Write a detailed explanation for each of the two questions to justify the correct answer and to explain and/or justify each distractor option, using the related readings, resources, and materials to support their explanations.
3. Answer at least four multiple-choice questions created by peers. Students were encouraged to answer as many questions as possible beyond the required four to help deepen their understanding of the content and to improve their multiple-choice question writing and answering skills.

4. Critically evaluate two questions created by their peers.

Student evaluations and analyses informed by any relevant literature from the unit and beyond with in-text referencing were completed. The primary focus of the evaluation/analysis was concentrated on the content of the question – as indicated in the marking rubric. As a secondary focus, students were encouraged to evaluate the structure and/or quality of peers' question/s. Students were also required to support each evaluation with multiple sources (i.e., at least two references) derived from the unit materials and beyond to be eligible for full marks under the criterion. Students were given marks for the correct submission of each section. The higher the score indicated more higher-level thinking questions authored by students. A score of 30 showed students writing questions that were all higher order.

The dataset comprised six cohorts of students (N = 625), with a wide range of student numbers in each cohort ($N_{cohort\ 1} = 189, N_{cohort\ 2} = 29, N_{cohort\ 3} = 88, N_{cohort\ 4} = 181, N_{cohort\ 5} = 36, N_{cohort\ 6} = 102$). This made comparisons between all cohorts to assess the consistency of performance within a given assessment task difficult, particularly for cohort 2 due to its small number of members. It would be expected that marking would be consistent within cohorts 1, 3, 4 and 6 as these contain a sufficient data sample.

An examination of the data distributions for all assessment tasks showed a ceiling effect for all tasks, with a substantial number of students achieving full marks for the task from all cohorts. For this reason, all data analysis will use non-parametric methods, using IBM SPSS Statistics V22.0. In order to determine changes between the assignment scores for each student across the cohorts, a Kruskal-Wallis test was first employed to establish if there were any significant differences in the marking between the cohorts. A Friedman's test was then conducted to identify a difference between the four assignments on the whole dataset, and a Wilcoxon Signed Ranks Test was used as a post-hoc test to identify changes in performance between successive assignments.

Results

An assessment of the marking on each individual assessment task for cohorts 1, 3, 4 and 6 was completed to determine if the marking of the tasks were consistent across these cohorts. A Kruskal-Wallis test was employed to establish if there were any significant differences in the marking between the cohorts, with the results shown in Table 1.

Table 1

Kruskal-Wallis Tests for Assignments 1 to 4 for Cohorts 1, 3, 4 and 6

	Assign 1	Assign 2	Assign 3	Assign 4
Kruskal-Wallis H	16.48	16.23	26.06	26.53
df	3	3	3	3
Asymp. Sig.	.001	.001	.000	.000

a. Kruskal Wallis Test
b. Grouping Variable: Cohort

The results in Table 1 indicate however, significant variations in the marking indicated for all assessment tasks and suggests that there is some lack of consistency in marking within tasks that might need to be addressed. Table 2 shows the mean rank comparisons reported in the Kruskal-Wallis tests for each of the assessment tasks.

Table 2
Mean Rank Comparisons for Assignments 1 to 4 for Cohorts 1, 3, 4 and 6

	Cohort	N	Mean Rank
Assign 1	1	188	299.67
	3	87	284.32
	4	181	287.50
	6	102	224.02
	Total	558	
Assign 2	1	187	299.45
	3	88	316.69
	4	181	258.86
	6	102	247.48
	Total	558	
Assign 3	1	187	298.41
	3	85	319.40
	4	174	235.24
	6	101	257.37
	Total	547	
Assign 4	1	185	286.65
	3	85	305.47
	4	170	224.54
	6	99	286.51
	Total	539	

An examination of student data from Table 2 showed that while there appears to be some variation in the consistency of grading within the cohorts, there was an overall statistically significant improvement in student results, where an increase in higher-order questions across their respective trimester can be observed. From Week 3 onwards, high quality questions, explanations and critical evaluations and comments were evident. Questions reflected a combination of thinking levels with growing complexity in understanding and linking of evidence-based research to future practice. There appears to be substantial variation in the mean rankings in the various assessment tasks, shown in Tables 3, and indicated in an analysis of the Wilcoxon Signed ranks Test (Table 4) and summary of rank changes (Table 5). For example, cohort 3 has the highest mean rank for assignments 2, 3 and 4, suggesting that cohort 3 may have been marked more liberally. Due to the variation identified in the cohorts for each of the assignments, an analysis at the cohort level does not appear to be justifiable.

Table 3
Mean Ranks for Assignments 1 to 4 for Dataset

	Mean Rank
Assign 1	2.14
Assign 2	2.56
Assign 3	2.57
Assign 4	2.73

Table 4
Wilcoxon Signed Ranks Tests for Improvements Between Successive Assignments

	Assign2 – Assign1	Assign3 – Assign2	Assign4 – Assign3
Z	-7.273	-.712	-2.826
Asymp. Sig. (2-tailed)	.000	.476	.005

Table 5
Summary of Rank Changes Between Successive Assessment Tasks

		N	Mean Rank	Sum of Ranks
Assign2 – Assign1	Negative Ranks	130	181.30	23569.00
	Positive Ranks	271	210.45	57032.00
	Ties	217		
	Total	618		
Assign3 – Assign2	Negative Ranks	170	187.42	31861.50
	Positive Ranks	179	163.20	29213.50
	Ties	251		
	Total	600		
Assign4 – Assign3	Negative Ranks	127	153.14	19449.00
	Positive Ranks	181	155.45	28137.00
	Ties	283		
	Total	591		

Discussion

The preservice teacher education course in classroom management began in Trimester 1, with the scaffolded teaching of higher order thinking skills for students using the platform of an online multiple-choice tool until Trimester 3 two years later, when the unit was restructured. In this article, student construction of higher-order multiple choice questions and the thinking that underpinned the authoring of those questions is examined. The purpose of comparing assessment marks for each student as they progress through the unit was to verify the usefulness of an online tool as valuable in enabling the scaffolding of higher order thinking and for students to take greater responsibility for their learning. The results, in response to the research questions, indicated that the online software tool, assisted students to interact with course material and enable them to produce quality multi-choice questions. Secondly, the results also indicated that student cohorts produced a larger number of higher order questions across the unit. From these results, it can also be concluded that online tools to facilitate the development of higher order thinking are successful, although scaffolding was also provided to assist students in the development of these skills.

The multiple-choice tool is a web-based system that supports student learning in a variety of ways in part because students are asked to actively engage in the course content (Denny et al., 2008). Traditional, transmission-style methods of online teaching practices are often limited to recorded lectures and the reading and revision of texts, causing higher education pedagogy to come under scrutiny (Gilboy et al., 2015). Scaffolding relies on learner-centred instruction and encourages students to take responsibility for engaging in the lesson, challenge their thinking, and enable problem-solving (Bergmann & Sams, 2012). Scaffolding also aligned with the framework of social constructivism, used as a pedagogical approach in the unit. For these reasons, an online multiple-choice tool, alongside learning communities of practice, is considered an excellent online approach to learning.

Limitations and Future Research

As previously noted, there were variations in the consistency of grading within the cohorts. This discrepancy can be addressed by introducing robust moderation practices that provide quality assurance across assessments (Crimmins et al., 2016). The inconsistencies were however somewhat surprising, given the use of the SOLO taxonomy to provide a rubric to guide the marking, proposed as a solution to a similar problem by Hardy et al. (2014). A further limitation of the study was that while conclusive outcomes were evident in the quantitative analysis, it would be valuable to investigate student perceptions of the specific nature of the benefits of peer interactions in order to provide for a richer assessment of the usefulness of the approach described in this paper. Understanding the nuances of what best works in the learning process would also benefit future research directions.

Recommendations for future teaching practices include the continued application of online tools, the addition of ongoing scaffolding, and the support of peer community forums to encourage the development of higher order thinking skills for pre-service teacher education students. Replication of the study comparing the quantity and quality of various applications of scaffolding and across a comparison group would be useful to provide a more comprehensive understanding of the role that teachers play in the online learning platform.

Conclusion

This study provides evidence to support the use of software tools that can serve to assist in the planning and delivery of online teaching. Tools such as the platform used in this study are cost-free applications that can be embedded within higher education prgrams to faciliate students' interaction with the course material. Additionally, online multiple-choice tools served as an interesting means by which to include multiple-choice quizzes into a unit. Morevover, this study showed that students did improve in their ability to produce higher order questions over the teaching period. This result provides support for such platforms to be used in higher education teaching programmes.

Declarations

The author declares no conflicts of interest.

Ethics approval for the study was granted by the University of New English, Australia Institutional Review Board.

The author declares no funding for this work.

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Enhancing College Students' Online Group Work Perceptions and Skills Using a Utility-Value Intervention

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Abstract
College students' perceptions of online group work can be negative, which creates challenges for implementing group work in online courses. Additionally, little research has examined group work skill development, despite calls for better preparing students for working effectively in groups. The purpose of the current study was to test the effectiveness of a utility-value intervention designed to enhance students' perceptions of online group work and their group work skill use. Students (N = 68) were randomly assigned to view a video and answer an essay question on the usefulness and benefits (utility value) of online group work and group work skills (intervention) or on how online group projects were graded (control). Students in the intervention condition indicated online group work to be more useful and reported greater post-intervention group work skill use compared to students in the control condition. Students further reported their perceptions of the usefulness and costs of online group work, as well as their group work skills and insights, in open-ended items. Overall, the current study provides an effective and easy to implement intervention for improving college students' perceptions of online group work and their group work skill use.

Keywords: Online group work, active learning, motivation, student attitudes, group work skills, online pedagogy

Kelly, A. E., Clinton-Lisell, V., & Klein, K. A. (2022). Enhancing college students' online group work perceptions and skills using a utility-value intervention. *Online Learning*, *26*(3), 236-258.

Distance education and online course enrollment trends have steadily increased, with enrollment growing at a higher rate than that of traditional face-to-face courses (Allen & Seaman, 2015; EDUCAUSE, 2021). Specifically, the percentage of students enrolled in distance education courses has risen from 25.5% to 34.7% since 2012, and 2.3 million students (or 14% of the total undergraduate enrollment) exclusively enroll in distance education courses (U. S. Department of Education, 2020). In the wake of the COVID-19 pandemic, remote and online instruction have increased dramatically. While many higher education institutions are planning to resume in-person instruction at pre-pandemic levels, some are continuing to limit in-person classes due to health and safety concerns. Others are choosing to retain a higher number of hybrid or online courses post-pandemic due to student preferences (Burke, 2021). Indeed, a recent survey of students enrolled in U.S. higher education institutions found that a majority would like to take either fully online courses or hybrid courses (a combination of in-person and online instruction) in the future (McKenzie, 2021). As a result, the post-pandemic demand for distance education is expected to remain steady.

Review of Literature

The Importance of Group Work in Online Courses

With online and distance education continuing to grow, more instructors may be looking for ways to effectively use active learning strategies in their online courses. One particularly effective but often underutilized technique (Cherney et al., 2018) is online group work. Online collaborative learning or group work is a pedagogical tool that allows students to work together to accomplish a common learning task. Group work has been identified as a best practice in online education (Bailey & Card, 2009) and is associated with a number of benefits. Specifically, research consistently shows student learning outcomes are enhanced with collaborative learning compared to individual learning (Chapman et al., 2005; Stahl et al., 2014). Group learning provides students with the opportunity to clarify their knowledge, resulting in a deeper understanding of course material (Johnson & Johnson, 2005). Further, online collaborative work helps students better manage their course workload and allows them to learn from the strengths and unique perspectives of their peers (Chang & Kang, 2016).

Additionally, student engagement is a critical aspect of successful learning, but online students tend to be less engaged in active or collaborative learning compared to face-to-face students (Chen et al., 2008). Further, small group activities in online courses provide opportunities for learner-to-learner interaction which, in turn, helps foster a sense of community (Rovai, 2002; Moore et al., 2016). Indeed, students often feel isolated in online courses due to a lack of peer-to-peer interaction or reduced instructor presence. Researchers have suggested that isolation and lack of connection contribute to the higher attrition rates in online courses (Bowers & Kumar, 2015), so engaging students in collaborative work may be a part of improving online student retention.

In addition to learning outcome benefits, online group work allows students to develop competencies that will better prepare them for the workforce. These include building positive relationships, learning how to effectively manage tasks, engaging in complex problem solving, and resolving conflict. In fact, research consistently indicates the ability to work well in teams—especially with those from diverse backgrounds—is one of the top skills employers look for in college graduates (Hart Research & Associates, 2018). Further, learning to work effectively in groups is arguably one of the most important interpersonal skills students can develop, as it influences employability, productivity, and career success (Johnson & Johnson, 1989; Chapman & Van Auken, 2001).

Challenges Associated with Online Group Work

Despite the benefits associated with online collaborative learning and group work, several challenges make it difficult for instructors to implement it effectively. Asynchronized communication between students creates unique challenges for facilitating online group work. These include time zone differences, lack of communication initiation, lack of response timeliness, and delayed peer feedback (Koh & Hill, 2009; Chang & Kang, 2016). Students also report logistical difficulties being harder to resolve in online classes compared to face-to-face classes (Smith et al., 2011) and view online collaborative work as more time consuming and resource intensive (MacNeill et al., 2014).

The most frequently reported group work challenge is the unequal distribution of effort—or the workload not being equitable among group members (Burdett & Hastie, 2009). “Free riders” are group members that do not contribute equally but still benefit from the work of other group members (Hall & Buzwell, 2012). Uneven contributions among group members can be more problematic for online group work settings, as it is easier for students to be less engaged and responsive compared to face-to-face group work settings (Chang & Kang, 2016). Unfortunately, it can be difficult to eliminate all instances of “free riding” but using peer evaluation improves individual accountability within groups (Maiden & Perry, 2011).

Student attitudes toward group work may pose further challenges when attempting to facilitate online group work. Overall findings related to students’ perceptions of online group work are mixed. Some research indicates that students hold more negative perceptions of online group work than face-to-face group work (Smith et al., 2011; Rezaei, 2017), and some students feel that online courses should not require students to work in groups (Lee et al., 2016). Additionally, group work assessments were found to be a key source of online course dissatisfaction (Garratt-Reed et al., 2016) and a majority (77%) of adult online learners disagreed that group projects were helpful in their courses (Stevens, 2014). On the other hand, Martin and Bolliger (2018) found that the most important strategies for online engagement, as rated by students, were relevant to peer interaction and collaborative learning. Additionally, positive perceptions of online group work are reported more often when instructors provide structure and guidance with online collaborative activities (Faja, 2013) and when they implement strategies for increasing the effectiveness of online collaboration (Falls et al., 2014). Thus, instructors appear to play an important role in enhancing students’ perceptions of online group work. These findings mirror student perceptions of face-to-face group work as well. Evidence suggests that active facilitation and support from instructors are integral to managing negative perceptions of group work (Chapman & Van Auken, 2001; Bailey et al., 2015).

Improving Student Perceptions of Online Group Work

Given that attitudes are often a key determinant of behavior (Ajzen & Fishbein, 1980), attempting to improve student attitudes toward online group work is an important endeavor. Students with positive attitudes toward group work should be more willing to work collaboratively, both in the classroom and in the workplace (Walker, 2001; Chapman & Van Auken, 2001). One recommendation for improving students’ attitudes toward group work is to explain the rationale behind collaborative learning (Bailey et al., 2015). Indeed, faculty members who conveyed information about working in groups—including telling students about the value and benefits of group work and providing them with information about group logistics and interpersonal dynamics—were more likely to have students who reported favorable experiences with group work (Chapman & Van Auken, 2001). These findings were correlational in nature, however, and the authors pointed to the need to empirically examine the potential effects of providing this information to students using experimental and control groups. The current study addresses this need by comparing perceptions of online group work between students who received information about the value and benefits associated with online group work to students who did not receive this information.

This approach to improving student attitudes toward online group work is rooted in the expectancy-value theory of motivation. According to this model, the perceived value of a task is the major driver of motivation to engage in the task—with task value including both *utility value* and *intrinsic value* (Wigfield & Eccles, 2002). Utility value refers to the perceived usefulness or relevance of the task to one's life (Hulleman et al., 2008), whereas intrinsic value refers to the enjoyment or inherent interest in a task (Eccles & Wigfield, 2002). Utility-value interventions have been used to improve students' attitudes toward their courses (e.g., high school mathematics and science) by informing them about the benefits of engaging in a task or having them write about the personal relevance and applicability of course material to their life goals (Rozek et al., 2015; Harackiewicz et al., 2016). These course-based interventions typically focus on utility value since it is more malleable by external factors than intrinsic value (Harackiewicz et al., 2012).

More recently, utility-value interventions have been used to effectively improve students' attitudes toward active learning strategies, including both face-to-face group discussion and online discussion boards. In both cases, interventions involved informing students about the benefits and importance of group discussion or online discussion board experience for learning outcomes, course performance, and career skill development. Compared to students in the control conditions who did not receive utility-value information, those in the intervention conditions reported greater perceived value and usefulness of group discussions and online discussion boards (Clinton & Kelly, 2020a; Clinton & Kelly, 2020b). Given that a utility-value intervention improved students' attitudes toward these active learning strategies, it seems plausible that it could also be used to improve students' attitudes toward online group work. The current study addressed this possibility by testing the effectiveness of a utility-value intervention designed to enhance students' perceptions of online group work.

The Impact of Group Work Skills Training

As previously discussed, opportunities for collaborative work in educational settings allow students to develop key workplace competencies (Dunne & Prince, 1997). However, some evidence suggests that students do not feel adequately prepared for the collaborative work their future careers will require (Landrum et al., 2010). Similarly, national surveys report an incongruity between students' perceived level of preparedness for various workplace competencies (including team-based learning) and their actual level of preparedness as rated by employers (Hart Research & Associates, 2018). The lack of preparation may be, in part, because faculty members infrequently utilize group work in their courses. Indeed, recent data from the National Survey of Student Engagement indicates that only 31.5% of senior-level students and 32.4% of first-year students reported collaborative learning experiences in their courses (NSSE, 2019).

Lack of preparedness for workplace collaboration may also stem from students failing to develop effective group work skills despite having experience with collaborative work in their courses. Placing students in group learning environments does not guarantee they will develop the skills necessary to work effectively in groups, and the assumption that most students already possess these skills has not received much support (Michaelson & Black, 1994; Prichard et al., 2006). As a result, researchers have called for improved student preparation to engage in collaborative work by teaching them how to do so effectively (Hillyard et al., 2010; Maiden & Perry, 2011). However, only two known studies have examined the effectiveness of receiving teamwork skills training. Both studies found that skills training significantly improved students' knowledge and proficiency of teamwork competencies (Ellis et al., 2005), as well as their use of team skills and individual test performance (Prichard et al., 2006). While these studies show the benefits of team skills training, the training did not happen within the context of a course nor were the skills used within the context of a course-based project or assignment. Therefore, it remains unclear whether group work skills training impacts students' group work skill use within the context of a course.

Further, researchers have only recently identified a measurable set of group work skills within an academic context, which has limited opportunities for meaningfully assessing student group work skill development. Cumming et al. (2015) developed and validated the Group Work Skills Questionnaire (GSQ), which assesses two types of group work skills: task management skills and interpersonal skills. The authors further recommended the GSQ be used as a tool to evaluate the effectiveness of group work skill interventions. Therefore, the current study contributed to this significant gap in research by comparing group work skill use between students who received direct instruction on group work skills and how to effectively work in groups (intervention condition) and students who did not receive this instruction (control condition).

The Current Study

The purpose of the current study was to evaluate the effectiveness of a utility-value intervention designed to improve students' perceptions of online group work, as well as their use of group work skills. The current study builds on previous work showing that perceptions of active learning strategies (face-to-face discussions; Clinton & Kelly, 2020a; and online discussions; Clinton & Kelly, 2020b) were more positive after engaging in a utility-value intervention. Since students tend to have negative attitudes toward online group work, specifically examining whether a utility-value intervention could improve students' attitudes toward online group work is particularly important. The current study also builds on prior research highlighting the benefits of teamwork skills training on students' knowledge, proficiency, and use of team skills (Ellis et al., 2005; Prichard et al., 2006). Given that instructors have been encouraged to help students better develop group work skills (Cumming et al., 2015), examining interventions targeting group work skill use is also critical. Furthermore, including group work skills education in the intervention should reinforce the utility value (perceived usefulness) of online group work, as knowledge and use of group work skills is relevant for students' career goals.

The following research questions were examined in the current study:

A) **Would the utility-value intervention lead to greater perceptions of the usefulness (i.e., perceived utility value) of online group work?**
Based on prior research, it was expected that students receiving the utility-value intervention would report higher levels of perceived usefulness compared to the control condition. Additionally, even though the intervention was not designed to increase students' inherent interest and enjoyment of online group work, it was possible that students receiving the utility-value intervention would also report enhanced intrinsic value of online group work (Hulleman et al., 2017).

B) **Would the utility-value intervention lead to greater group work skill use?**
Based on prior research indicating that perceived utility value promotes active task engagement and helps students acquire activity-related skills and knowledge (Hulleman & Harackiewicz, 2020), it was expected that students engaging in the utility-value intervention would report greater post-intervention group work skill use compared to the control condition.

C) **What would students in both the utility-value intervention and control condition report with respect to the usefulness (perceived utility value), interest and enjoyment (perceived intrinsic value), and costs of online group work?**
This question was examined through open-ended questions assessing how student responses varied based on whether they received the utility-value information. Further, examining these open-ended responses allowed for greater understanding of student attitudes toward online group work.

D) **Were student attitudes toward online group work and group work skill use related to course performance?**
Based on prior research showing utility value interventions sometimes lead to better course performance (Fritea & Opre, 2015), it was possible that greater perceived value of online group work would be associated with better performance in the course, in terms of students' group project grades and final course performance. Further, based on prior research showing individual test performance benefits for team-skills trained participants (Prichard et al., 2006), it was possible that greater group work skill use would lead to better performance on the group project for students in the intervention condition.

Method

Context

The current study involved two sections (Fall 2020 and Spring 2021) of an asynchronous online undergraduate History and Systems of Psychology course (PSYC 405) at a midsized, Midwestern public university. The same instructor taught both sections of the course and all course materials and assessments were identical between the course sections. Students in both sections of the course were required to complete a group project during the first half of the semester. The project involved creating and presenting a research poster on a classic study in the history of psychology. Specifically, each group was assigned a study and worked together to create a draft and a final copy of a research poster. The poster draft was submitted during the fourth week of the course and students received feedback from either the instructor or course graduate teaching assistant.

During the eighth week of the course, the final copy of the poster was due, and a virtual poster presentation session took place. For the poster session, groups recorded a 5–7-minute video presentation of their poster, with all group members being required to present. To share and discuss the poster presentations, groups were required to post their video presentations to the discussion board on their course Learning Management System (Blackboard). To facilitate poster discussion, each student was required to watch video presentations for five other groups and ask a follow-up question for each presentation. Further, each group was responsible for replying to all questions asked about their poster. Students received credit for all components of the project (group contract, poster draft, final poster, video presentation, and poster discussion) and the project counted toward 13% of students' final grade in the course. Finally, given that technology tool difficulties are a roadblock to effective online collaborative work (Robinson et al., 2017), the instructor familiarized students with tools for file sharing, group member discussion, and video presentation recording.

This study used a quantitative experimental design in which most analyses were numerically examined through descriptive and inferential statistics (Creswell, 2019). Because random assignment was used, causal inference can be made about the effect of the intervention on post-intervention measures (Creswell, 2019). However, open-ended responses on the post-intervention measures were examined in a more qualitative, open manner in order to hear student voices.

Participants

All 106 students in both course sections were eligible to participate, but a total of 68 students completed the activities related to this study (pre-intervention questionnaire, post-video quiz, and post-intervention questionnaire; see Materials and Measures for details). Of these 68 students, 9 were male, 58 were female, and one reported a non-binary gender identity. Students ranged in age from 20–58 years (M = 23.35, SD = 6.21). With respect to class level, all participants were senior-level students, as the course was an undergraduate capstone course. Racial and ethnic identity data were not collected, but the public university where the study was conducted is a predominantly White institution. Further, 14 students (20.6%) reported first-generation student status and most (77.9%) were on-campus students taking the course online. Finally, 42 students (61.8%) reported having prior experience with online groupwork in their courses, with an average of 24.66% of their online courses including some type of groupwork component (SD = 23.33%). Prior to data collection, the authors obtained approval from the institutional review board and an exempt protocol was granted.

Materials and Measures

Pre-intervention Measures. To assess students' pre-intervention attitudes toward group work, the Feelings Toward Group Work questionnaire (Cantwell & Adams, 2002) was adapted. Participants indicated their level of agreement with items measuring preference for group work on a 5-point scale ranging from *never true of me* to *always true of me*. The questionnaire included three scales: preference for individual work (seven items; α = .70), preference for working in groups (six items; α = .60), and discomfort with group work (four items; α = .76). Additionally, the Groupwork Skills Questionnaire (GSQ; Cumming et al., 2015) was used to assess students' pre-intervention group work skills. Participants indicated the frequency with which they employed specific skills on a 5-point scale ranging from *never* to *always*. Two subscales are included on the measure: task management skills (5 items; α = .72), which includes factors such as establishing goals, monitoring, and evaluating progress, and planning the sequence of activities to be completed, and interpersonal skills (5 items; α = .81), which includes factors such as resolving conflict, enhancing communication, and providing social support for group members.

Intervention and Control Materials. For the intervention condition, a video lecture designed to enhance the utility value of online group work and provide information about group work skills was created. Specifically, the video presented evidence regarding the importance of group work for career skill development and workplace readiness, course performance, and building a sense of community in an online course environment. The video also described effective contributions to groups and teams, including discussion of important group work skills like setting ground rules and expectations, communicating effectively, evaluating group work progress, being responsive to group members, and dealing with "free riders." Each of the benefits of online group work presented in the video related to utility value in that they were either relevant for goals of doing well in the course or developing career skills. The video for the control condition only included information about the requirements for the course group project and how it would be graded.

After viewing the intervention or control video, students in both conditions took a required quiz on the video. In both conditions, the quiz had the same 8 multiple-choice items based on the syllabus, and the last item was an essay that varied by condition. The purpose of this essay was to have students engage in the intervention. For the intervention condition, students answered the question, "Based on the video you saw on online group work in this course, write 2 paragraphs about how online group work may be useful for learning course material or relevant to your life goals. Give at least two examples." For the control condition, students answered the question, "Based on the video you saw on the group project requirements for this course, write 2 paragraphs about how the group project will be structured and graded."

Post-intervention Questionnaire. The post-intervention questionnaire included a scale adapted from Hulleman et al. (2008) to report perceptions related to the intrinsic value (six items; α = .91) and the utility value of online group work (nine items; α = .91). Participants indicated their level of agreement on a 5-point scale ranging from *disagree strongly* to *agree strongly*. Three open-ended items were also included regarding the perceived intrinsic value ("What is inherently interesting or enjoyable about online group work?"), perceived utility value ("How is online group work useful for you, now or in the future?"), and potential costs of online group work ("What are the costs or downsides of online group work?"). The themes for items were coded through a content analysis in an inductive manner (Barry, Murphy, & Drew, 2015). A research assistant further coded a subset of the responses, and inter-rater agreement between the author's coding and the research assistant's coding was good (k = .90). An additional open-ended item asked students to indicate the skills or insights they developed because of participating in online group work in the course. Inter-rater agreement for this item was also good (k = .89). Finally, participants completed the Groupwork Skills Questionnaire (Cumming et al., 2015) to measure post-intervention skill use, and demographic items were included at the end of the post-intervention questionnaire. The study was not pre-registered, but materials and measures are available at the project page on the Open Science Framework (https://osf.io/4rfn8/?view_only=bfe396c398334953bcf6137ab9615a31).

Procedure

At the beginning of the Fall 2020 and Spring 2021 semesters, students were invited to complete the pre-intervention questionnaire for bonus points. An alternative assignment was available for students that chose not to complete the pre-intervention questionnaire. At the end of the first week of the semester, students were randomly assigned to the intervention or control condition through their course Learning Management System (Blackboard). The instructor also randomly assigned students to groups within the intervention (n = 36) and control conditions (n = 32). In other words, groups were composed of either all intervention condition students or all control condition students, not a mixture of students from both conditions. Following the recommendations for facilitating online group work (Hesterman, 2016), each group completed and signed a group contract before beginning work on the project. The purpose of the contract was to have students discuss and agree to work and establish performance expectations in advance of working together. At the end of the first week of the course, students viewed a video on either the benefits of online group work (intervention) or the requirements for the group work project and how it would be graded (control). Following the video, students completed the post-video quiz and responded to the essay prompt.

During the ninth week of the semester, after the group project had been completed, students were invited to complete the post-intervention questionnaire for bonus points. An alternative assignment was available for bonus points for the students that chose not to complete the post-intervention questionnaire. Additionally, following the recommendations for facilitating group work (Chapman & Van Auken, 2001; Burdett, 2003), students completed a self-evaluation of their own performance and peer evaluations of their group members' performance through their course Learning Management System. The purpose of these evaluations was to ensure the individual contributions of all group members were acknowledged and to encourage individual accountability within groups (Burdett, 2003).

Results

Pre-Intervention Groupwork Attitudes and Skills

To determine whether initial differences in feelings toward group work existed between conditions, a series of one-way ANOVAs were run, with condition (control or intervention) as the independent variable and preference for individual work, preference for group work, and discomfort with group work as the dependent variables. There were no significant differences in preference for individual work (F (1, 66) = .077, p = .782) or preference for group work (F (1, 66) = .071, p = .790). However, the intervention condition reported significantly more discomfort with group work than the control condition (F (1,66) = 8.110, p = .006, η^2 = .109). To control for this pre-intervention attitude difference, "discomfort with group work" was included as a covariate in post-intervention analyses. See Table 1 for means and standard deviations by condition.

Table 1
Pre-Intervention Measure Means and Standard Deviations by Condition

Construct	Control (n = 32) *M (SD)*	Intervention (n = 36) *M (SD)*
Preference for Individual Work	22.19 (6.47)	22.61 (6.10)
Preference for Group Work	24.47 (4.01)	24.72 (3.82)
Discomfort with Group Work	8.97 (2.79)	11.14* (3.42)
Task Skills	17.00 (3.04)	16.86 (3.63)
Interpersonal Skills	19.09 (3.38)	19.50 (3.44)

Note. $^{*}p < .05$.

To determine whether initial differences in experience with online group work existed between conditions, an independent sample's t-test was run with prior online groupwork experience (percentage of online courses with groupwork) included as the dependent variable, and condition (control or intervention) as the independent variable. There were no significant differences in online groupwork experience between the conditions (t (66) = -1.106, p = .273).

To determine whether initial differences in group work skills existed between the conditions, two one-way ANOVAs were run, with condition as the independent variable, and task skills and interpersonal skills as the dependent variables. There were no initial differences in task skill use (F (1, 66) = .029, p = .886) and interpersonal skill use (F (1, 66) = .240, p = .626) between the conditions. See Table 1 for means and standard deviations by condition.

Post-Intervention Group Work Attitudes

To test for post-intervention utility value and intrinsic value effects, two one-way ANCOVAs were conducted, with "discomfort with group work" included as a covariate. There were no significant differences in the intrinsic value of online groupwork between conditions (F (1, 66) = 2.150, p = .147), but the intervention condition reported significantly greater utility value for online group work (F (1,66) = 6.567, p = .013, η^2 = .092) than the control condition. See Table 2 for means and standard deviations by condition.

Table 2
Post-Intervention Measure Means and Standard Deviations by Condition

Construct	Control (n = 32) *M (SD)*	Intervention (n = 36) *M (SD)*
Intrinsic Value	2.89 (.92)	3.11 (.93)
Utility Value	3.51 (.69)	3.84* (.66)
Task Skills	17.59 (3.64)	18.81* (2.94)
Interpersonal Skills	18.59 (3.64)	19.67* (4.12)

Note. $^{*}p < .05$.

Further, Tables 3, 4, and 5 include the frequencies of the codes for intrinsic value, utility value, and cost, respectively, with some students giving multiple answers. These frequencies represent the number of students who made a statement coded as a particular theme. In terms of intrinsic value, students most frequently reported that hearing or discussing others' ideas, meeting new people, and socializing were inherently interesting or enjoyable aspects of online group work. Fewer students reported working collaboratively and working with those having different opinions or backgrounds to be interesting or enjoyable about online group work. Teaching others and learning from others were additional intrinsic value themes.

Table 3

Examples and Frequency of Themes by Condition for the Intrinsic Value of Online Group Work

Theme	Example	Intervention	Control	Total
Hearing or discussing others' ideas	"Seeing other peoples' ideas about the subject being discussed in the group."	13	12	25
Meeting new people and socializing with others	"I enjoy getting to know more students on a better personal level and that is due to group work."	8	12	20
Working collaboratively	"Sometimes it's nice to be able to break up a project among other people rather than doing everything yourself."	5	9	14
Working with people that are different from you	"Being able to see things in a different perspective based on how other people learn and think."	7	5	12
Teaching others and learning from others	"You get to learn information that you may not know if working alone."	8	1	9
Nothing inherently interesting or enjoyable	"I do not find any particular thing about group work interesting or enjoyable."	1	2	3

Note: N = 68 (n = 32 for Control, n = 36 for Intervention)

In terms of utility value, students most frequently reported that online group work was useful for their future career endeavors (especially the intervention condition) and for helping build teamwork and communication skills. Less frequently mentioned themes were teaching and learning from others, exposure to different perspectives, and time management.

Table 4

Examples and Frequency of Themes by Condition for the Utility Value of Online Group Work.

Theme	Example	Intervention	Control	Total
Teamwork and communication skills	"Group work teaches me how to have better communication and teamwork skills."	15	14	29
Future career benefits	"In the profession I want to go into, there is always going to be some form of group work."	18	8	26
Teaching others and learning from others	"Teaching students with less experience."	3	3	6

Exposure to viewpoints and perspectives of others	"It helps to have multiple perspectives to better understand topics."	0	5	5
Time management	"Keeps me on track to finish my portion in a timely manner."	4	0	4
Working with people who are different from you	"Working with different personalities is a learned skill."	2	2	4
Not useful	"I do not find group work to be a useful addition to my academic studies now, nor do I perceive it will benefit me in any way for the future."	0	1	1

Note: N = 68 (n = 32 for Control, n = 36 for Intervention)

For the costs or downsides of online group work, students most frequently reported unequal workload distribution and having to pick up the slack from non-contributing group members (slightly more so for the control than the intervention condition). Students also reported coordinating schedules, having to trust and rely on others, and having different standards of work as costs or downsides of online group work. Less frequently reported themes included online group work being too time consuming and experiencing difficult group dynamics.

Table 5

Examples and Frequency of Themes by Condition for the Costs of Online Group Work.

Theme	Example	Intervention	Control	Total
Unequal workload distribution or picking up other group members' slack	"Sometimes some members of groups do not contribute the same amount of effort as others and that can be frustrating."	17	20	27
Having to rely on others	"Relying on others to get their work done."	7	7	14
Difficulties coordinating schedules	"My schedule or when I am available makes it hard to coordinate times with other group members."	6	4	10
Different expectations or standards of work between group members	"Others doing the work in ways you did not visualize it being done."	4	6	10
More time consuming than individual work	"Often times group work takes more time than individual activities."	4	2	6
Group member dynamic difficulties	"When others do not acknowledge your ideas or presence, it lessens confidence."	3	1	4
Other members getting credit despite not doing work	"I am doing all the work while they do little and still get a good grade."	2	1	3

Note: N = 68 (n = 32 for Control, n = 36 for Intervention)

Post-Intervention Group Work Skills

To determine whether there were post-intervention differences in group work skill use based on condition (control or intervention), a series of one-way ANCOVAs were run with "discomfort with group work" included as a covariate. Both task skill use (F (1, 66) = 4.339, p =

.041, η^2 = .045) and interpersonal skill use (F (1,66) = 5.566, p = .021, η^2 = .079) were significantly higher in the intervention condition than the control condition. See Table 2 for means and standard deviations by condition.

Further, Table 6 includes the frequencies of the codes for the skills and insights developed as a result of participating in online group work, with some students giving multiple answers. These frequencies represent the number of students who made a statement coded with a particular theme. In terms of skills and insights, students in both conditions frequently reported communication skills to be the key skill developed through their online group work experience. Additional frequently reported skills included patience, compromise, listening, and working with others. Less frequently reported skills and insights were learning how to complete a project online, leadership skills, and planning, strategizing, and delegating work.

Table 6

Examples and Frequency of Themes by Condition for Skills and Insights Developed Through Online Group Work.

Theme	Example	Intervention	Control	Total
Communication skills	"Being able to communicate with others."	10	9	19
Patience, compromise, and listening to others	"I've learned to be patient and let others do their work on their own time."	6	12	18
Working with others	"Learning how to work as a team."	7	5	12
Time management and working efficiently	"More hands make less work."	7	4	11
Leadership skills	"I learned to take the lead instead of waiting for something to be assigned to me."	3	4	7
Collaborating online	"Working effectively with others in an online environment."	3	2	5
Planning, strategizing, and delegating	"Coming up with ideas and strategies for the project."	4	1	5

Note: N = 68 (n = 32 for Control, n = 36 for Intervention)

Utility Value, Group Work Skills, and Course Performance

To determine whether students' attitudes toward online group work and post-intervention group work skill use were associated with course performance, a series of analyses were conducted. First, a one-way ANCOVA was run with project grade as the dependent variable, condition as the independent variable, and "discomfort with group work" included as a covariate. There were no differences in group project grades between the control (M = 96.40, SD = 2.76) and intervention (M = 96.55, SD = 1.70) conditions (F (1, 66) = .210, p = .649), indicating that the intervention did not reliably impact final group project grades. Additionally, to examine whether perceived utility value of online groupwork was associated with group project grades, a Pearson product correlation was run. A small, nonsignificant positive correlation was found (r (68) = .095, p = .441), revealing that the perceived utility value of online groupwork was not related to final group project grades.

Further, a Pearson product correlation was conducted to examine whether students' post-intervention groupwork skill use correlated with their group project grade. A small, nonsignificant positive correlation was found (r (68) = .069, p = .577), indicating that students' post-intervention groupwork skill use was not associated with their final group project grade.

Finally, a one-way ANCOVA was run with final course grade as the dependent variable, condition as the independent variable, and "discomfort with group work" included as a covariate. There were no differences in final course grades between the control (M = 90.60, SD = 4.29) and intervention (M = 90.11, SD = 5.63) conditions (F (1, 66) = .050, p = .825), indicating that the intervention did not reliably impact final group course grades. Further, a Pearson product correlation was run to examine whether perceived utility value of online groupwork was associated with students' final course grades. A small, nonsignificant positive correlation was found (r (68) = .159, p = .376), revealing that the perceived utility value of online groupwork was not related to final course grades.

Discussion

The purpose of the current study was to test the effectiveness of a utility-value intervention on students' perceptions of online group work and their use of group work skills. Overall, the utility-value intervention was effective, as students in the intervention condition reported greater perceived usefulness (utility value) of online group work than students in the control condition. This did not extend to intrinsic value, however, which differs from prior research showing that enhanced utility value also benefitted intrinsic value (Hulleman et al., 2010). Since intrinsic value comes from within an individual, it may be less malleable than utility value and a stronger intervention may have been needed to show intrinsic value effects (Harackiewicz et al., 2016). The current study also supports the application of utility-value interventions to active learning strategies and extends prior work showing the interventions can be used to effectively improve students' perceptions of these strategies (Clinton & Kelly, 2020a; Clinton & Kelly, 2020b). This is important given that students may resist active learning despite the benefits for student engagement and course performance (Finelli et al., 2018).

Even though the intervention did not show a benefit for intrinsic value, students did report finding aspects of online group work to be inherently interesting and enjoyable. Responses to the open-ended intrinsic value item most frequently indicated that meeting and interacting with other students were the most enjoyable aspects of online group work. This points to the importance of opportunities for social interaction in online courses and underscores the finding that online group work can build a sense of community in online courses (Ouzts, 2006).

The utility-value intervention did not impact course performance as assessed by group project scores and final course grades. This was not surprising given little evidence exists that utility-value interventions improve course performance, particularly in psychology courses (Soicher & Becker-Blease, 2020). Students' final course grades were likely affected by other moderating variables not related to motivation. Further, utility-value interventions typically lead to greater course performance benefits for male students (Hulleman et al., 2017). Given the sample in the current study included mostly female students, finding course performance benefits would have been unexpected.

Additionally, group work skill use was not associated with better performance on the group project. It was tentatively hypothesized that greater group work skill use might lead to better group project performance based on prior research indicating that team-skills training led to better individual test performance (Prichard et al., 2006). Instead, group project performance in the current study was equivalent between the control and intervention conditions. This was likely because groups submitted a project draft and received feedback, thereby giving groups in both conditions an equal opportunity to submit a high-quality final project.

Consistent with prior research indicating benefits associated with team-skills training (Ellis et al., 2005; Prichard et al., 2006), the utility-value intervention in the current study effectively improved students' group work skill use. Students reported greater post-intervention use of both task skills and interpersonal skills. These findings support the notion that informing students about specific group work skills and how to effectively work in groups is enough to promote greater skill use (Chapman & Van Auken, 2001). This is important given that students may not possess effective group work skills, nor will they necessarily develop these skills as a result of being placed in collaborative learning situations (Oakley et al., 2004; Prichard et al., 2006). Future research should examine the impact of group work skill interventions on introductory college students, as the current study utilized an upper-level student sample. Introductory students have had fewer opportunities for group work and would particularly benefit from instruction on group work skills, given collaborative learning is often used by instructors of introductory-level courses (Thompson & Lamanna, 2019).

Several limitations in the current study should also be mentioned. The context for this study included a psychology capstone course at just one institution. Therefore, generalizability is somewhat limited, and students may have been more inherently motivated to engage in the course. Future research should test the effectiveness of this intervention with students from other disciplinary backgrounds, as well as with different forms of online collaborative work. In addition, while a number of factors influence the effectiveness of group work, successes in the current study were limited to attitudinal readiness and group work skill use. Further, we did not collect demographic information about students' racial or ethnic identities, nor whether they were domestic or international students. Given that cultural backgrounds may influence students' comfort with interacting with other students (Hofstede, 1986; Mittelmeier et al., 2017), an interesting avenue for future research would be how identities relate to group work experiences.

It is also important to acknowledge that the use of a group contract and peer evaluations may have impacted the study's outcomes. Both practices improve group functioning and perceptions of group work (Aggarwal & O'Brien, 2008) and were not controlled for in the current study. However, despite this, students in the intervention condition still experienced improved perceptions and group work skill use relative to students in the control condition. Finally, data collection took place during the COVID-19 pandemic, which has significantly disrupted college students' lives and adversely impacted both their physical and mental health (Copeland et al., 2021). This undoubtedly created additional challenges for completing online group work. Despite these challenges, online group work provided students with the opportunity to engage with their peers and likely created a greater sense of community in the course, both of which have been central to students' learning and motivation during the pandemic (Conklin & Garrett Dikkers, 2021).

Conclusions

Overall, the current study provides a brief, easy-to-use, and empirically supported intervention for improving college students' perceptions of online group work and their group work skill use. Given the growth prediction for online and distance education (Burke, 2021; McKenzie, 2021), finding ways to implement active learning strategies more effectively in online courses is critical. Students' negative perceptions of online group work can make it more challenging to facilitate (Chang & Kang, 2016), but the current study offers a feasible way to mitigate this challenge and potentially improve students' experiences with online group work. Findings from the current study further point to the benefits of utilizing group work in online courses. Students reported gaining experience with a variety of skills as a result of their online group work and recognized the usefulness of online group work for career skill development and future career endeavors. Given that employers seek to hire college graduates with collaborative work experience and teamwork skills (Hart Research & Associates, 2018), students should be given ample opportunities to develop these skills by participating in group work in their online courses.

Declarations
The authors declare no conflicts of interest.
IRB approval was granted for the study by the University of North Dakota, USA.
The authors declare no funding support for this work.

Acknowledgement
The authors wish to acknowledge Courtney N. Tindell for her invaluable assistance with evaluating the group projects during both semesters of data collection.

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Towards Professionalism in Higher Education: An Exploratory Case Study of Struggles and Needs of Online Adjunct Professors

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Abstract
The purpose of this research was to gain an understanding of the unique professional development needs related to the struggles of online adjunct professors. Twenty-one participants from within a purposefully selected group of online adjunct professors in the United States participated in this qualitative investigation. Data were gathered in two phases: the first phase consisted of a six open-ended-question Qualtrics questionnaire completed by the 21 respondents, and the second phase was follow-up interviews with six of the 21 participants along with the collection of pertinent documents related to professional development. Results indicate that online adjunct professors receive varied and limited professional development, and therefore need more training in the following major categories: course preparation and technology awareness, access to course materials and online resources, and improved communication interaction and engagement. The participating online adjunct professors confirmed that training within these professional development areas would be most beneficial for all stakeholders and should be provided by their employing institution or attained through self-initiated methods.

Keywords: adjunct, faculty, online education, professional development

Butters, D & Gann, C. (2022). Towards professionalism in higher education: An exploratory case study of struggles and needs of online adjunct professors. *Online Learning*, *26*(3), 259-273.

During the past decade, institutions of higher education have significantly increased their use of online modalities to deliver education services to meet society demands (Seaman et al., 2018). More people are realizing and acknowledging the fact that a college degree, especially postsecondary education, is becoming increasingly important, enabling them to become marketable and successful in today's workplace (Gehrke et al., 2015). The changes in student population demographics, such as the growth of non-traditional and distance learning students, are a primary reason that online courses continue to emerge and grow, thereby creating a need for more qualified educators. The rapid growth of online education demands careful attention be placed on the preparedness of the academic force in these online settings. Academic leadership must ensure that non-traditional and traditional learning quality remains consistent by addressing pedagogical needs of professors (Nash, 2015).

Online adjunct instructors' pedagogical decision-making regarding their instructional approach has a significant impact on whether the student's online course experience and outcome are positive or negative. Although many online professors have extensive teaching experience within a classroom environment, they may not possess the specific skills needed to teach online with the same level of confidence (Bennett, 2019; Mandernach et al., 2015). Research indicates that professional development efforts for online adjunct professors directly correlate to improved student outcomes, as well as greater faculty satisfaction, engagement, and sense of belonging (Nash, 2015; Nica, 2018; Rich, 2017). However, despite the correlation between faculty and student outcomes, the majority of online adjunct faculty receive little, if any, formal preparation, or professional development in effective teaching practices (Eagan et al., 2014). Since the use of technology for on-campus and online education has become widespread, more than half of new faculty appointed are part-time or other non-tenure attaining, fixed-contract personnel, and the number of full-time positions has declined (Magda et al., 2015; Rich, 2017). These changes within the traditional academic faculty setting could potentially have a negative impact on teaching efficacy, student learning outcomes, higher degree completion, and institutional financial solvency (Gehrke et al., 2016). With these changes and their potential impact on the educational community comes a need to examine current research in the field related to adjunct faculty and their professional development opportunities as the use of adjuncts continues to grow across institutions (Nash, 2015; Nica, 2018; Rich, 2017). The following research questions guided this case study:

RQ1. How do online adjunct faculty describe pedagogical struggles that affect their teaching skills?

RQ2: What professional development opportunities do online faculty describe as needed to mitigate these struggles?

Review of Literature

The definition of online education has evolved over time due to changing aspects regarding the nature of technology and institutional organizations. In a broad sense, online education is described as planned instruction that normally occurs through different technologies and usually a specific organizational structure (Bolitzer, 2019). Online education reaches a very large number of students, and it continues to gain in popularity. This phenomenon has led to new programs being developed at a wide range of colleges and universities, which is creating a competitive environment related to the recruitment, marketing, and retention of students and faculty alike (Allen & Seaman, 2017).

As the student population becomes more diverse, higher education institutions are providing more online education options to meet the needs of the growing population of students whose lifestyle are not best met by the traditional classroom (Nordin & Anthony, 2014). Most students who seek online higher education are adults who are holding full-time jobs; some have additional constraints that come with having children or a family. Higher education students who fit within these demographics may be drawn to the benefits of online education, which include accessibility, less commuting time, ease in management of school/work conflicts, and lower cost and need for childcare (Stack, 2015).

Due to the expanding number of online courses being offered at colleges and universities, and an increased reliance on the adjunct faculty supporting such growth, more research must be conducted to ensure that adjunct online professors are better prepared to meet the challenges associated with this evolving academic environment (Rich, 2017). This review of literature will specifically focus on adjunct faculty, their role and challenges, as well as professional development literature related to higher education and adjunct faculty. This literature review is meant to demonstrate the importance of these topics that led to the need for further research, as conducted in this study.

Adjunct Faculty: Their Role and Challenges

Adjunct professors can be described as non-tenured faculty who teach on a part-time or limited basis. Adjuncts can be employed to teach one or more courses during a semester or academic year, and they may instruct at multiple colleges simultaneously (Nica, 2016). Adjunct faculty typically perform multiple duties under the direction of the educational institution's academic department chair. Adjunct professors are usually motivated to teach for a variety of personal and professional reasons, including the emotional and intellectual rewards of teaching, the freedom associated with a flexible work schedule, and financial compensation (Bolitzer, 2019).

In general, online adjunct faculty are required to have a minimum of a master's degree and additional hours of work experience in education to be considered for employment at a college or university. Educational institutions tend to hire online adjunct faculty because of their flexibility and cost-effectiveness (Magda et al., 2015). Adjunct faculty bring some distinct and positive attributes to the classroom, such as special competencies, more diverse experiences, and innovative approaches. However, due to the special challenges that adjunct online professors and faculty face, valid concern exists that the quality of higher education will be negatively impacted (Nash, 2015; Nica, 2018).

Efforts to improve adjunct faculty teaching and development face certain challenges, in part because the majority of adjunct professors are temporary faculty working outside the tenure track (Finkelstein et al., 2016; Kezar & Maxey, 2016). The scholarly literature suggests that adjunct faculty receive limited institutional resources, services, and instructional development opportunities (Bojarcyk, 2008; Eagan et al., 2015; Gehrke & Kezar, 2015; Keehn & Martinez, 2007; Meixner et al., 2010). Additionally, many online adjunct professors have unique monetary and time management obstacles. This is due, in part, to their part-time status that may entail a lack of full-time benefits, such as healthcare, and lower wages, creating the need to be employed by multiple institutions (Nica, 2018). Many adjunct faculty are now seeking part-time or contingent positions with multiple institutions as a way to maximize compensation potential. The disparity of salaries and benefits among online adjunct faculty and tenured professors creates additional stress on the individuals and educational institutions alike, which can impact the performance of the organization (Eagan et al., 2015).

Online adjunct faculty have further obstacles as they usually have a lack of support for beneficial professional development opportunities, limited contact and guidance from their employing higher education institution and limited or nonexistent support for research prospects (Burns et al., 2015; Nica, 2018; Terosky & Heasley, 2015). In the past, adjunct professors may have had full-time jobs and benefits outside the university or were retired and were not reliant on the adjunct wages as their primary source of income. However, the demographics have evolved, and now many adjunct faculty are relying solely on courses taught to earn a living with aspirations of obtaining full-time employment (Eagan et al., 2015).

Professional Development in Higher Education

Professional development for higher education professors, including online adjunct faculty, is a critical element in helping expose faculty to new techniques, technologies, and pedagogical practices and how these new practices can be applied to teaching. Furthermore, professional development is considered to be an essential component in the success of individual professors, as well as the educational institution in which they serve. Professional development has the potential to address many areas associated with a faculty member's duties and responsibilities, including their connection to the mission and goals of the education institution (Burns et al., 2015).

Professional development for online instructors can be used to introduce them to teaching methodologies that will help improve their effectiveness and enable them to succeed as faculty members (Williams, et al., 2014). Many professional development opportunities are accomplished effectively by using a holistic approach to training instead of concentrating only on specific areas (Rhode & Krishnamurthi, 2016; Rhode et al., 2017). Professional development programs that allow for flexibility and self-paced scheduling have also been shown to be successful, and instructors in these types of programs are usually more receptive to learning when it can be immediately applied to their specific subjects and shared with their peers (Baran, 2018; Elliot et al., 2015).

Professional development programs differ among educational institutions and discussions have occurred for years regarding the theory and efficacy surrounding professional development (Webster-Wright, 2009). However, in general, professional development programs are usually delivered using multiple approaches since there is no single model used as a standard (Kennedy, 2016; Trust et al., 2016). There exists a great variance between institutions regarding their interactions with online adjunct faculty that affects development opportunities, supervision, and employment policies. Although there is no recognized standard model for professional development, many institutions follow the traditional models using various training options such as workshops, seminars, webinars, and teaching guides (Kennedy, 2016; Zuber-Skerritt, 1994).

Professional development for online adjunct professors should be diverse and varied to meet the specific needs of instructors based on their different experience levels and background (Opfer & Pedder, 2011), as well as the need to assist them in engaging within an online environment (Baran et al., 2018). Effective practices in online instruction rely on structures such as course designs that promote online instruction, interaction among course participants, and instructor preparation and support. These practices can be effectively mastered with proper professional development (Crawford et al., 2012). Although many higher education institutions have implemented an array of programs to facilitate faculty in the development and instruction of online courses and increase opportunities for knowledge sharing and recognition, online professors continue to be dissatisfied with the level of support for professional development of online teaching (Meyer, 2014; Terosky & Heasley, 2015). Adjunct faculty play a critical role in the expansion and sustainability of online education, but due to online educators' geographical diversity and infrequency of campus visits, challenges exist in providing the online faculty with adequate professional development opportunities without placing an additional time and financial burden on these professors (Cottom et al., 2018). Literature suggests that many distance learning instructors felt that while there has been a trend to address this highly desired asset, the structure of online courses and minimal physical campus presence has led to the exclusion of adjunct faculty from campus governance and collegiate interaction (Terosky & Heasley, 2015). Adjunct professors are more likely to participate in professional development when it is offered by their education department or program, when the development includes their colleagues, and when it is grounded in their specific work experience (Beach et al., 2016; Bolitzer, 2019; Moskal et al., 2015).

Although online adjunct faculty can provide meaningful expertise gained from actual experience, their teaching acumen must be developed through effective professional development (Rich, 2017). Online professors, due to their lack of face-to-face contact with the students, have special challenges. These challenges may include unclear lines concerning hours and days that the professor should be available, insufficient opportunities to give students adequate individual attention, and maintaining the quality of online instruction (Gregory & Martindale, 2016; Nash, 2015). A draw to online instruction for many higher education faculty is the ability to make higher education more accessible to a larger, more diverse student audience, many who might otherwise find higher education inaccessible; however, according to a study by Evans and Myrick (2015), a pedagogical challenge for online professors was finding the correct balance in providing educational access to a global student audience and providing the proper educational materials to meet the needs of the diverse student population.

Online adjunct instructors' pedagogical decision-making regarding their instructional approach has a significant impact on whether the student's online course experience and outcome are positive or negative. Although many online professors have extensive teaching experience within a classroom environment, they may not possess the specific skills needed to teach online with the same level of confidence. To assist these instructors with a smoother transition to online learning practices, they may need professional development support in the areas of student interaction, content management, and the use of technology (Baran, 2018). Online instructors have expressed that proficiency and familiarity with the use of technology are skills that are critical for positive online instructor/student experiences. In addition, access to dependable technology is a necessary component for a satisfying online education outcome (Evans & Myrick, 2015).

Problem, Purpose, and Research Questions

Research and literature addressing adjunct faculty and professional development exists, as has been explored in the previous sections. This literature focuses on topics such as the growth and future of online education and adjunct professors (Nash, 2015), the value of adjuncts (Rich, 2017), as well as the outcomes of professional development in higher education (Elliot et al., 2015) among others. Though these researchers have addressed several important educational issues, there is a need to continue to consider and address the specific pedagogical professional development needs of online adjunct faculty.

The problem this study sought to address was the lack of understanding concerning the specific and unique professional development needs of online adjunct professors. As the previous research has shown, although adjunct faculty bring real-world expertise and knowledge of current trends to the classroom, their teaching acumen must be developed and nurtured through effective professional development (Rich, 2017). This statement is also supported by Eagan et al. (2014), who acknowledged the fact that the majority of online adjunct faculty receive very little formal preparation or professional development in effective teaching practices.

With an increase in the number of students taking classes online, along with the additional number of online courses being offered in colleges and universities, more focus should be placed on promoting professional development skills and collaborative learning among online adjunct professors (Seaman et al., 2018). It has been recommended that scholars expand their research to include studies on pedagogical training of adjunct faculty to enhance job satisfaction and advanced education (Rich, 2017); this research study sought to expand this field based on these recommendations. Professional development for online adjunct professors may vary from the standardized curriculum used by traditional professors due to the unique challenges presented by a virtual environment, such as maintaining collaborative learning and technology awareness (Burns et al., 2015). Therefore, further research is needed to explore exactly what struggles adjunct professors encounter in their pedagogical tasks and how professional development can be catered to address these struggles.

Methods

This research used an exploratory case study design to further understand the pedagogical struggles and corresponding professional development needs of online adjunct professors. Case study applications provide the ability to describe real-life contexts and accounts of the participants and how their experiences may be explored and applied to the research problem (Yin, 2013). This methodology was appropriate for the stated problem because it enabled the researcher to develop an in-depth understanding of a problem using multiple sources of information and allowed the researcher to examine themes and patterns that emerged throughout the sources of data, all of which are essential to understanding the experiences of online adjunct professors (Creswell, 2014). Qualitative research possessed the appropriate characteristics best suited for this study because it relied on the encountered experiences of real people, sought to understand the world from a person’s perspective, allowed the researcher to personally gather data, and enabled understanding of the participant’s perspective. In this study, the overarching goal was to capture descriptions of the experiences of the professors, which could not be sufficiently accomplished using a quantitative design.

A case study was used as an exploratory method of investigation of the specific problem and circumstances, which were bounded by the experiences of online adjunct professors as participants (Yin, 2013). It should be noted that a case study methodology has specific limitations that limit the generalizability of the results, especially considering the small sample size used in most case studies. However, thick, rich descriptions employed in case study research allow the context of the study to be understood and decreases the impact of the limitations (Creswell & Poth, 2018). In this study, the researcher simply sought to explore the experiences of the participants who were recruited for this study. The results are meant to provide an in-depth understanding of this set of participants and may not apply to all adjunct faculty in other contexts. Instead, it is the hope that the results of this case study will continue to add to the literature surrounding adjunct professors and their struggles and professional development needs in an online educational environment.

Data Collection

Potential participants were solicited and recruited through the researchers' email contacts as well as distribution methods such as social media and personal contacts, with a link for them to participate in an online questionnaire. The study only recruited online adjunct faculty who taught at an accredited institution of higher education and were actively teaching online courses. Participants were also encouraged to solicit other informants through a snowball approach to reach an appropriate data saturation point. The online questionnaire included questions about the participants' background, such as how many online courses they have taught as well as open-ended questions about their pedagogical struggles and professional development experiences. The final question on the online open-ended questionnaire contained a space for informants to include their personal contact information if they were interested in participating in a follow-up interview. Twenty-one participants completed and submitted the questionnaire in the first phase of the research.

The group of participants who volunteered their contact information through the questionnaire received another letter asking for their participation in a follow-up interview. This study had approval from the Institutional Review Board (IRB) and once informed consent was obtained, an interview was scheduled with the participant. An interview protocol was developed by the researcher that focused on using open-ended questions to allow participants to respond using their own perspectives and descriptions of their experiences. To develop the protocol, the researcher relied first on the previous review of literature to highlight major topics and ideas in the field in which further exploration was needed, such as further understanding of challenges adjuncts face (Rich, 2017; Seaman et al., 2018). Besides the literature review, the answers received through the online questionnaire helped guide the development of the interview. By building the interview based on the questionnaire responses, the research was able to go deeper into participants' experiences.

The semi-structured interviews were conducted using open-ended questions that further elicited details surrounding the participant's experiences. These interviews lasted approximately 30 minutes in duration and, with permission from the participant, were recorded with an audio device, and a verbatim transcript was produced using the transcription service Rev (https://www.rev.com/). Six participants volunteered for and participated in the follow-up interviews. At the conclusion of each interview, the participants were asked for any documents, such as examples of academic schedules, training workshops, or other documents related to the research purpose. The researcher then gathered the documents and removed all identifying information to protect the privacy of the individuals. The documents were classified using pseudonyms for each informant that provided the data.

Following data collection, the researcher analyzed all sources of information including questionnaires, interview transcripts and notes, and documents to understand the nature of the participant's experiences as it related to their professional development as an online adjunct professor. The data was coded for salient categories of information using the constant comparative approach, which is the process of taking information from data collection and comparing it to emerging categories. The researcher began open coding the data for its major categories, which created a core from which to expand the prescribed list of categories. The researcher developed an axial coding paradigm to visually display the interrelated categories to help develop the connections between patterns and ideas (Creswell, 2014). By applying a practical data collection method and properly categorizing the information, the researcher ensured value, gained perspective, and attempted to eliminate extraneous and repetitive data. The following sections provide the thematic presentation of the findings from this research.

Context of Participants

The 21 online adjunct professors who participated in this study varied in acquired teaching experience and skills, levels of education received, and number and type of course subjects taught. The 21 respondents who completed the questionnaire and provided pertinent data were active and experienced online adjunct professors who met all prerequisites. The respondents varied in age, gender, ethnicity, geographic location, and were employed by different educational institutions. However, each professor was gainfully employed by an accredited university and possessed valuable knowledge that provided extensive data for this study.

The majority of the 21 participants, 14 (67%), had taught between two and ten online classes; two participants (10%), had taught between 11 and 20 online classes; one (5%), had taught between 21 and 30 classes; one (5%) had instructed between 31 and 40 classes; and three (14%) of the professors had taught between 41–50 online courses. These 21 participants, who were actively instructing online, collectively taught approximately 300 online courses, averaging over 14 each throughout their adjunct professor careers spanning more than fifteen years. This broad range of participants as well as the higher number of online courses taught by the participants supported the purpose of this study as an exploratory case study of online adjunct professors

Findings

The analysis of the collected data rendered four major themes pertaining to online adjunct needs and professional development. These themes were triangulated across the different sources of data to provide trustworthiness for the findings as well as to ensure that the data represented the intentions and purpose of the study. Only themes that were well supported by the coding process and data collection are presented here. These major themes will be further examined and supported by the collected data in the following sections.

Unprepared to Teach Courses

Professors consistently reported that they struggled with the fact that they were routinely expected to teach courses that they were not properly trained or educated to instruct. Though the participants admitted that they enjoyed teaching an array of courses within their respective career fields, they were often required to teach subjects that were not related to their specialties due to their institution's needs. Many of the participating professors admitted that they did not feel fully qualified to teach certain subjects or were required to instruct courses that full-time professors preferred to not teach. Several questionnaire respondents stated that they were expected to teach unanticipated courses without sufficient notification and preparation time, which created undue hardship and stress.

Besides in the questionnaires, multiple interviewed participants echoed the same idea of being unprepared to teach courses. One interviewee even stated, "So, in some ways I feel like a fraud because I haven't been educated in certain fields of study, but in other ways, I'm like, no, management is management, and I can apply those concepts to whatever things that students need to see," which indicated that he feels conflicted about teaching courses outside his area of expertise. Another also agreed that he feels like the courses he is assigned are the ones that full-time professors do not want to teach and not necessarily the ones for which he was the most qualified or trained. One interview even offered the following advice which supports this theme: "If you want to be an adjunct, then you need to be current in the subjects you are teaching, because that gets you in the mode of understanding the students you're going to be teaching along with their concerns." Overall, the participants consistently reported their concerns regarding unexpected teaching requirements, which resulted in their lack of preparedness.

Need for Time and Resources for Course Preparation

Another major theme identified by the data concerning pedagogical struggles is that online adjuncts were not necessarily afforded proper course preparation time, nor were they provided sufficient professional development concerning online teaching resources. This was especially noted when this lack of time and resources corresponded with a course in which they felt unprepared to teach, such as was discussed in the prior section.

The lack of time and course preparation assistance among the questionnaire respondents and interviewees was evident throughout the data. Many participants stated that they were often asked to teach classes that they were not ready to teach due to insufficient preparation time. This needed preparation included understanding the course material and familiarity with the IT requirements. Participants stated that educational institutions should help ensure that all professors are provided with all required supplies, textbooks, and course materials, as well as training needed to apply them, prior to each class beginning. Additionally, online adjunct professors must receive the appropriate training to properly engage online students, which often represent a diverse set of students. One interviewee commented, "One of the challenges that we face all the time, especially online, is that we've got to be able to provide materials that all students can work from. I'm talking about IT in particular, for instance…", which indicated a challenge working with providing online materials that were sufficient for all students.

Participants noted that their teaching skills were inhibited because they were not fully provided with required resources such as course materials, training for students with special needs, and training for student communication engagement and interaction methods that would help them prepare for their courses. The accessible resources offered to the online adjunct professors were either unavailable or inconsistent, and varied depending upon their employing educational institutions. Many participants noted that they felt they were not offered the same level of development as full-time faculty. Participants even offered suggestions in their responses that might assist school leaders in helping adjuncts. Participants suggested ideas such as ensuring that adjuncts are provided with all required supplies such as textbooks and other course materials prior to each course beginning and that adjuncts are offered development opportunities to enhance course preparation. Other ideas such as professional development opportunities for learning how to engage students in an online environment as well as adequately teach the diverse set of students often associated with online education were also suggested.

Learning Management System Technology Training

Along with the previous theme concerning the lack of time and resources for course development in general, many participants specifically described the need for significant computer technology training to mitigate problems associated with course delivery and mishaps that routinely occur. During their interviews, professors stated that instruction materials specifically relating to the universities' learning management system (LMS) platform and other technologies are needed to mitigate problems and ensure proper information sharing. One respondent stated that she relied heavily on her university's IT support team because her knowledge concerning the course delivery system was limited. She recommended that more attention be given to this issue and that IT support functions be added to faculty orientation courses. Other participants stated that while they did receive an overview of the university's online systems, they needed further and more consistent training to increase their skills in using the different platforms.

All participants relayed the importance of understanding the computer technology aspects associated with teaching online courses. Most respondents stated that they received some form of introductory training from their education institution such as one interviewee who commented, "I am thankful for the introductory IT symposiums provided by my university; however, I need more training to improve my computer skills;" however, many noted that this training was limited and did not necessarily meet their professional development needs.

Improved Communication Methods

Another theme supported consistently by the data was the need for improved communication methods with other professors and faculty, which was very important for these participants. As one interviewee lamented, "My college does not fully support adjuncts as they do full-time faculty." The ability to discuss academic issues and lessons learned with fellow faculty was noted as valuable to many participants in this study and a necessary part of continuing to improve their pedagogical skills. Another interviewee even noted, "It would be great if we could get a breather, a post-mortem, a hot-wash of what went right in the course, what went wrong in the course, and how we can improve the course." Several respondents identified the need for faculty engagement to not only enhance their understanding of academic policies and procedures related to teaching but to also help them improve their teaching abilities. One questionnaire respondent even specifically stated that she valued the opinions of her peers and tried to learn from others mistakes so that she could be a better teacher. Almost all respondents indicated that promoting effective communication was vital to their success as online adjunct professors.

Discussion

The online adjunct professors who participated in this study consistently stated that they face several common pedagogical struggles which, in turn, correspond with their professional development needs to mitigate these struggles. Many of the professors reported that they struggle with the fact that they are often expected to teach courses that they were not prepared to instruct because their roles are expanding to fill certain academic voids. The participants admitted that they did not feel fully qualified to teach certain subjects because they were expected to teach unanticipated courses without sufficient notification and preparation time. The participants within this case study also stated that their teaching skills were inhibited because they were not fully provided with required resources such as course materials and student communication engagement and interaction methods.

Many of the adjunct faculty reported that they were provided with insufficient instruction venues concerning online instruction. The participants also stated that professional development opportunities remain inconsistent for online adjunct professors, and that they did not typically receive the faculty development support needed to promote their pedagogy including LMS training. These assertions are consistent with findings of several other studies that address inadequate professional development opportunities for adjunct faculty (Bojarcyk, 2008; Eagan et al., 2015; Gehrke & Kezar, 2015; Keehn & Martinez, 2007; Meixner et al., 2010). These results indicate several challenges that online adjunct professors should be prepared to face including the need to prepare to teach courses they may not be experts in with little professional development to assist them. In turn, school leaders and administrators should constantly be aware of these issues and mitigate these struggles by developing methods to improve these conditions and the overall educational environment.

The majority of participants agreed that educational institutions should ensure that all professors are provided with all required supplies, instructions, and course materials prior to each class beginning (Windes & Lesht, 2014), and they should receive proper training regarding student engagement using online resources. The participants described the need for LMS training to mitigate problems associated with course delivery and issues that routinely occurred in their courses. The professors stated that instructional materials specifically relating to the universities' LMS platforms and other online resources are needed to mitigate problems and ensure proper information sharing. These are also important implications for administrators who facilitate online learning because they must predict, plan for, and schedule courses that can be properly sourced in a timely manner; thereby enabling professors' ample time to prepare and confidently teach such courses. Administrators should also be prepared to provide development opportunities for adjuncts that reflect the same requirements as full-time faculty as well as reflect the student-centered environment in which adjuncts teach. These results also have implications for other departments such as human resources who should be aware of adjuncts' qualifications including prerequisites of knowledge with the institution's LMS. Issues such as these should be addressed as higher education institutions continue to monitor and assess student population trends to meet their educational requirements and evolving needs (Stack, 2015; Nash, 2015).

Since this was a small, exploratory case study, the results raise a number of opportunities for future research. Future research should begin to examine the specific types of professional development available to online faculty and the potential impact of these professional development opportunities. This study also pointed to some specific areas of concern, such as LMS training and communication. These could be potential areas for more focused research to further identify challenges and needed support for online adjuncts. Further research could also consider the differences in professional development across different types and sizes of colleges and universities.

Conclusion

The participant responses concerning perceptions of important professional development were overwhelmingly consistent with one another within this case study. Such consistency among the participants implies that they share common concerns regarding their pedagogical needs and professional development. Although these results may be limited in their ability to generalize to other groups of professors, they do provide some specific findings that help shed light on the pedagogical struggles and professional development needs of online adjunct professors. First, the participants reported that initial and continuous professional development is important for all instructors, especially training related to technology awareness and capabilities. Second, access to course materials is vital for all online adjunct professors. Third, improved and constant communication methods with other professors and faculty are very important for online adjunct professors. The implications of these findings for leaders and faculty include additional training provided to adjunct professors regarding specific LMS requirements of the course and ensuring that online faculty have access to required course materials before and while conducting the class. Institutions of higher education should invest in professional development to support online adjuncts in these areas which in turn has the ability to impact student engagement.

These findings and implications add too existing literature in the field surrounding professors and how they fulfill their academic responsibilities to students (Eagan et al., 2015; Gerk & Kezar, 2015; Rich, 2017). As online education continues to expand to an increasingly diverse set of students, the faculty that interact and teach these students on a daily and weekly basis, whether full-time or adjunct, must continue to be at the forefront of this academic movement. Educational researchers must continue to expand on the growing research surrounding these faculty members and what they need to meet the needs of the diverse set of students they teach, while academic leaders must be willing to provide the development opportunities necessary to continue to promote and maintain a high level of professionalism in the higher education online environments.

Declarations
The authors declare no conflicts of interest.
Ethical approval for the study was granted by the Amridge University.
The authors declared no funding was received for this study.

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Get Connected: A Scoping Review of Advising Online Graduate Students

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Abstract
The rate of online graduate education programs grows annually. Yet, dropout rates and student satisfaction rates continue to lag behind in-person programs. Advising practices may offer unique opportunities to reverse or alter these challenges. While the body of literature about undergraduate advising and online advising is robust, literature on current online graduate-level advising is sparse. Therefore, a scoping review of the literature was undertaken to answer the research question: What does the literature tell us about advising in online graduate programs? The search revealed ten relevant studies, and after conducting a thematic network analysis, two global themes and five organizing themes were presented. There are two global themes, "Create Connections" and "Know Your Program." The "Create Connections" global theme is supported by three organizing themes: (a) Communication and Feedback, (b) Building Relationships and Community, and (c) Investment in student's personal and academic growth. The "Know Your Program" global theme is supported by organizing themes (d) Program Requirements and Policies and (e) Technical skills. Based on the data, three recommendations are presented to aid online graduate advisors, including building trusting relationships with advisees, building a community of students, and knowing program policies, requirements, and technology platforms.

Keywords: Distance learning, advising, online education, student perceptions, graduate education, research supervision, online mentoring, e-mentoring, virtual mentoring

Meyer, H. S., Preisman, K. A., Samuel, A. (2022). Get connected: A scoping review of advising online graduate students. *Online Learning, 26*(3), 274-292.

Online graduate education is here to stay (Allen & Seaman, 2016). It provides flexibility and increases access to certificates and degrees for adult learners (Exter et al., 2009). In 2018, 30% of graduate students in the United States were enrolled in fully online education courses. By 2029, this number is projected to increase by another three percent totaling 3.1 million students (*The Condition of Education*, 2020). While enrollment numbers are rising, this learning modality presents additional challenges, including declining retention rates (Mancini et al., 2018), students struggling to feel engaged (Shea et al., 2015), and a persistent need for students to feel a sense of belonging (Baxter, 2012). Enhancing student engagement is important because engagement improves student performance in courses and reduces a sense of isolation (Martin, 2020). In online learning, advisors play a key role in connecting with students and engaging them with the institution (German et al., 2019).

Advisors serve various critical functions within two broad classifications: general and research. General advisors typically focus on ensuring course requirements are fulfilled, managing program requirements, alerting advisees of program updates, and providing connection to university services (Ewing-Cooper & Parker, 2013; McConnell, 2018; Sutton & Sankar, 2011). Research advisors may fulfill all of these requirements and serve as a guide for the student's research project, including developing, designing, implementing, and disseminating the research (Spillett & Moisiewicz, 2004).

Both roles can involve complex academic and interpersonal skills in which supervisors are required to play multiple functions such as advisor, quality controller, and guide (Fynn & van Vuuren, 2017). Also included are aspects of mentorship and life coaching that extend beyond program requirements to ensure that the advisee is positioned for future success after graduation (Taylor et al., 2018). Without proper support and training, advisors cite feelings of isolation and workload inequity (Hart-Baldridge, 2020). Given the complexity of these tasks and the important role that advisors play in student experiences, it is important to look at the broader landscape of graduate student advising and examine the best practices that have been proposed in the literature (Erichsen et al., 2014; Spaulding & Rockinson-Szapkiw, 2012).

Review of Literature

A review of student support literature shows that minimal research has been conducted in advising online graduate students. Numerous scholars (McConnell, 2018; Omar et al., 2015; Shen et al., 2018) have published informative articles on graduate student advising. Unfortunately, these articles focus on traditional face-to-face learning environments and are not aimed at online graduate students. Deshpande (2017) exemplifies this in exploratory research of literature published between 1993-2015 to draw out the best practices for supporting doctoral students in completing their programs, including quality feedback, continuous support including peer-to-peer engagement, pairing new and experienced faculties, mentoring students, and developing sensitivity to cultural issues. A broader study of the complex landscape of advising graduate online learners is needed. Therefore, a scoping review of the literature was undertaken to answer the research question: What does the literature tell us about advising in online graduate programs?

Method

Guided by Arksey and O'Malley's (2005) five-stage framework, a scoping review was conducted to answer the research question. Scoping reviews enable researchers to broadly map complex topics (Arksey & O'Malley, 2005). Various types of literature can be included:

theoretical, empirical, and gray literature, which help identify gaps in the research and offer opportunities to inform future research and application. Throughout the review process, the authors met routinely to discuss findings and establish alignment before proceeding through the process (Colquhoun et al., 2014; Levac et al., 2010).

Stage 1: Identifying the Research Question

The research team included members with expertise in graduate education advising, distance learning, knowledge syntheses, and literature reviews. The authors are advisors in online graduate programs, hence incorporating stakeholder views. A broad research question was collectively developed, "Based on the literature, what are some recommended advising practices for online graduate programs?"

Stage 2: Identifying Relevant Articles

All authors collaboratively developed the search strategy. A search was conducted on November 2, 2020, using multiple databases, including Academic Search Complete, Web of Science, and ERIC. Search terms included a combination of keywords and controlled vocabulary terms optimized for each database, including, but not limited to, *online learning, distance learning, distributed learning, web-based courses, advising, academic advising, research advising, supervision, onboarding, orientation, registration, graduate education, continuing education, advanced degree, graduate program*. The research team hand-searched the citations of all included articles for additional manuscripts that met inclusion criteria. Additionally, the team used EndNote and Zotero to manage citations and remove duplicates. The authorship team collaboratively developed inclusion and exclusion criteria. The criteria can be found in Table 1.

Table 1

Inclusion and Exclusion Criteria

Inclusion criteria	**Exclusion criteria**
Focused on advising graduate students	Focused on postgraduate (e.g., postdoc)
Used an online, distant, or distributed learning	Types of publications: letters to the editor, reviews, and theses or dissertations
Published in 2015 or later	Published in a language other than English
Types of publications: empirical research studies, commentary, and position papers	
Program met face-to-face less $\geq$7 days over the course of an academic year	
Graduate-level degrees (e.g., Masters or Doctorate)	

Stage 3: Study Selection

The authors used a two-phase process to determine the alignment between the retrieved citations and the research question. This iterative process was managed in Covidence, a systematic review program. First, two authors independently reviewed the first twenty titles and abstracts to see if they fit inclusion criteria. After reviewing titles and abstracts, the authors refined the inclusion and exclusion criteria (e.g., clarifying the number of days the online program meets in person). The review also enabled the team to norm on a process. Each of the two authors independently reviewed all remaining records. All discrepancies (approximately 5%)

were discussed and, where alignment could not be reached, the article was retrieved for a full-text review. Table 1 shows inclusion/exclusion criteria.

Stage 4: Data Charting Stage

The authors collaboratively developed a data charting tool in Google sheets. All authors independently piloted the data charting tool using the same three articles. The results were reviewed and the charting tool was further refined. Next, two authors independently reviewed all articles, and the third author reviewed half. The three authors met to review all discrepancies, which were resolved by consensus. Articles were reviewed for inclusion criteria and were removed if all three authors agreed they did not meet the criteria.

The following elements were extracted from each included article:

- Article definitions of mentor, advisors, supervisor, distance, distributed learning, etc.
- Study purpose
- From perspective of the advisor, student, other
- Conceptual frame
- Duration of study
- Type of study
- Participants
- Methods: qualitative or quantitative or mixed methods
- Data analysis: steps and procedures
- Participant classification: mentor, advisor, supervisor, etc.
- Description of the program: distance, online, distributed, etc.
- Information about the program
- Type of institution: 4-year public, 4-year private, etc.
- Number of programs in the study
- Program discipline: nursing, education, etc.
- Cohort model or non-cohort model
- Research intensive (e.g., thesis, dissertation, heavy research focus)
- Faculty as advisors, professional advisors, or both
- Time on campus (if applicable)
- Purpose of time on campus (if applicable)

Stage 5: Collating, Summarizing, and Reporting Results

After completing the data extraction chart for each article, the data were coded using Attride-Stirling's (2001) thematic network analysis technique. All advising methods were extracted from the articles; however, they were not evaluated for effectiveness in keeping with the protocol for scoping reviews. Using the data extraction chart, a list of basic codes about advising were extracted from the articles such as a) *Provide quality interaction* (Kara & Can, 2019); b) *Help students make the transition to a new learning environment* (Cross, 2018); and c) *Know programs and policies* (Cross, 2018). The team collaborated on basic codes to identify a respective coding scheme. As needed, authors returned to the articles for context until consensus was met. Once consensus was met, the basic codes were categorized into organizing themes, with some basic codes fitting into more than one organizing theme. The categorization was reviewed collectively, and consensus on all organizing themes and categorizations of basic codes within was reached. Subsequently, the organizing themes were analyzed to develop two overarching global themes.

Results

The search strategy returned 1107 results, with 1074 records for review after duplicates were reviewed. Of these, 1042 articles were marked as irrelevant, leaving 31 articles for full-text review. Twenty-one additional articles were removed upon full-text review because they did not meet inclusion criteria resulting in 10 articles included in this scoping review (Cross, 2018; Fynn & van Vuuren, 2017; Grady, 2016a, 2018b; Gupta, 2018; Kara & Can, 2019; Kumar & Coe, 2017; Kumar & Johnson, 2017, 2019; Schroeder et al., 2016). See Figure 1 for a PRISMA flow diagram (Moher et al., 2010) and Table 2 for a summary of all articles included in the review. To best understand the context behind the advising provided, Table 2 highlights some key features, including the purpose of the article, type of study, type of advising (e.g., research vs. general), and type of program (e.g., discipline). Articles were published between 2016 and 2019 and represented institutions from three countries; most were published in the United States (n=8, 80%) (Cross, 2018; Grady, 2016a, 2018b; Gupta, 2018; Kumar & Coe, 2017; Kumar & Johnson, 2017, 2019; Schroeder et al., 2016), South Africa, (n=1, 10%) (Fynn & van Vuuren, 2017), and Turkey (n=1, 10%) (Kara & Can, 2019).

Figure 1

Search Results According to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Criteria

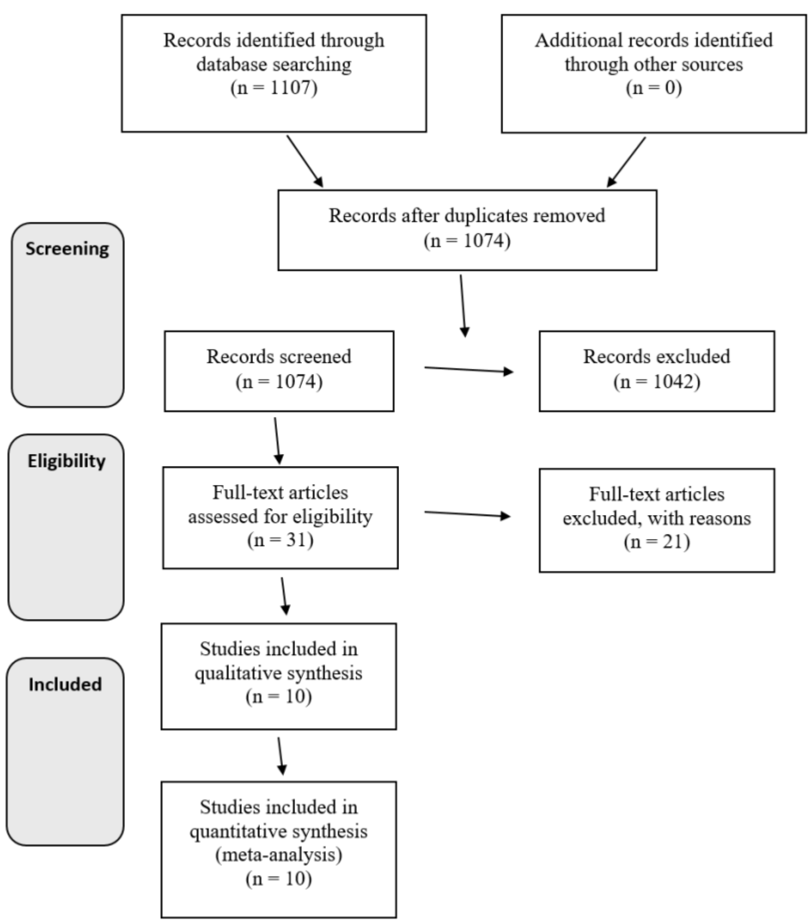


Table 2
Summary of Included Articles on Advising in Online Graduate Education Programs

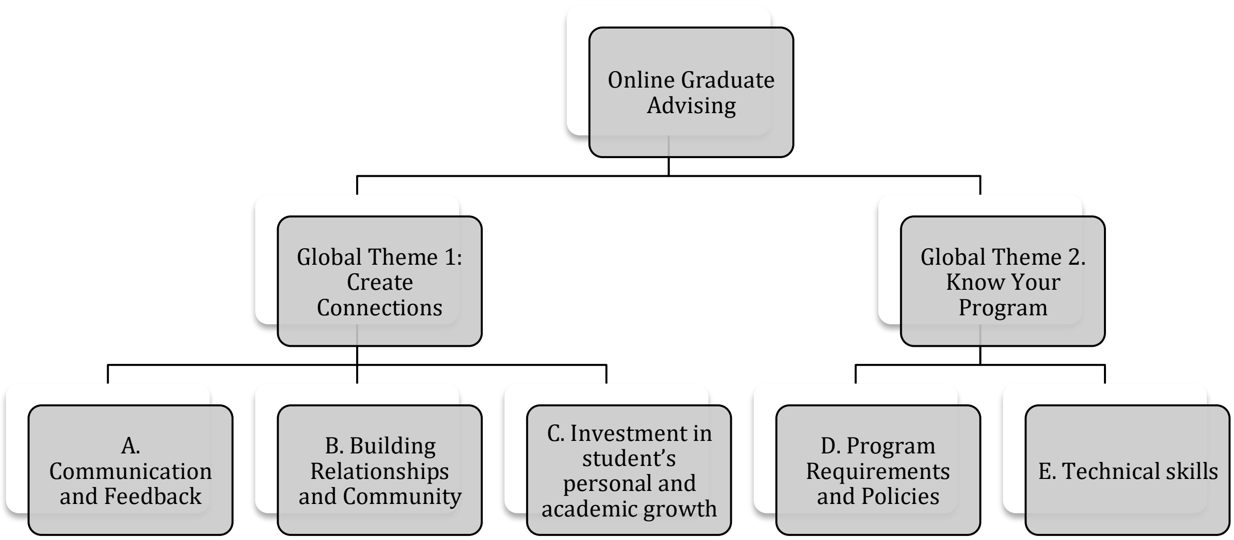
								Organizing Themes			
Article	**Country of 1st Author**	**Point of view**	**Advising Type**	**Type of Study**	**N**	**Discipline**	**Cohort Model**	**A**	**B**	**C**	**D**
Fynn & van Vuuren (2017)	South Africa	Student	General	Quantitative	65	Psychology	Yes		x	x	
Kara & Can (2019)	Turkey	Student	General	Mixed Methods	37	Unknown	Unknown	x		x	
Cross (2018)	USA	Student	General	Quantitative	32	Education	No	x	x	x	x
Grady (2016)	USA	Faculty	Research	Position Piece	NA	Education	Yes		x	x	x
Grady (2018)	USA	Faculty	Research	Position Piece	NA	Education	Yes	x	x	x	x
Gupta (2018)	USA	Researcher	General	Commentary	143	Education	No	x	x	x	x
Kumar & Coe (2017)	USA	Student	Research	Qualitative	10	Education	Yes	x	x	x	
Kumar & Johnson (2017)	USA	Faculty	Research	Qualitative	16	Education	Yes	x	x	x	
Kumar & Johnson (2019)	USA	Faculty	Research	Qualitative	10	Education	Yes	x	x	x	
Schroeder et al. (2016)	USA	Student	General	Qualitative	100	Education	Yes	x	x	x	x

Note. A: Communication and Feedback, B: Building Relationships and Community, C: Investment in student's personal and academic growth, D: Program Requirements and Policies, E: Technical skills

Five Organizing Themes for Investing in Advisees

Attride-Stirling's (2001) thematic network analysis technique resulted in two global themes, “Create Connections” and “Know Your Program.”’ The “Create Connections” global theme is supported by three organizing themes: (a) Communication and Feedback, (b) Building Relationships and Community, and (c), Investment in student’s personal and academic growth. The “Know Your Program” global theme is supported by organizing themes (d) Program Requirements and Policies and (e) Technical Skills. “Create Connections” entails connecting with advisees through communication and feedback; providing spaces for them to build relationships and community within the program; and demonstrating investment in their growth within and beyond the program. Figure 2 provides a visual of the hierarchy of global themes and organizing themes. “Know Your Program” incorporates the need to know the requirements and policies of the program an advisor supports in addition to the technology platforms the program uses.

Figure 2
Global Ideas and Themes



Under each organizing theme were codes. Table 3 provides an overview of the codes that make up each organizing theme, along with an example.

Table 3
Organizing Themes, Codes, and Examples

Organizing Theme	Code	Example
Communication & Feedback	Be available	Be flexible and available (Kumar & Johnson, 2017)
	Be proactive & timely	Practice proactive communication (Cross, 2018)
	Use a caring tone	Have caring and individualized interactions and communication with students (Kara & Can, 2019)
	Provide interactions	Hold 'online office hours'(Schroeder et al., 2016)
	Provide feedback	Providing clear and timely feedback; (Kumar & Johnson, 2017)
	Set expectations	Set expectations for time management, availability, submissions, and feedback (Kumar & Johnson, 2019)
	Be flexible	Set clear expectations- but provide flexibility when needed, deadlines, and timelines for students (Kumar & Coe, 2017)
Building Relationships & Community	Accommodate needs	Accommodate students' needs and individualizing the process (Kumar & Johnson, 2017)
	Be available	Be available (Gupta, 2018)
	Be caring & encouraging	Care about student success (Cross, 2018)
	Set expectations	Provide structure and scaffolds for interactions in the online environment (Kumar & Johnson, 2019)
	Use developmental advising	Use developmental advising advisors to form a more personal relationship with their advisees, which integrates academic, career, and personal goals (Schroeder et al., 2016)
	Use interpersonal interactions	Provide human link to the institution (Fynn & van Vuuren, 2017)
	Use personal knowledge	Reach out to colleagues for advice (Kumar & Johnson, 2017)
Investment in Student's Personal and Academic Growth	Enhance critical thinking	Support students in improving their critical thinking skills (Kara & Can, 2019)
	Use scaffolding	Provide structure and scaffolds in research education (e.g., job-aids, step-by-step activities, and template) (Kumar & Johnson, 2017)
	Use personal knowledge	Know your field - have subject expertise (Kara & Can, 2019)
	Provide individualized support	Accommodate students' needs and individualize the process (Kumar & Johnson, 2017)
	Be available	Be available (Gupta, 2018)

	Provide feedback	Provide timely feedback during the writing process; (Kumar & Coe, 2017)
Program Requirements & Policies	Offer orientation and guidance	Mentor students through the LMS advising modules (Gupta, 2018)
	Provide resources	Create academic plans for advisees early on (Schroeder et al., 2016)
	Use personal knowledge	Know programs and policies (Cross, 2018)
Technical skills	Hone technical Skills	Be comfortable working in the online environment (Kumar & Coe, 2017)

Organizing Theme A: Communication and Feedback

Eighty percent (n=8) of the manuscripts in this review included discussions of communication and feedback (Cross, 2018; Grady, 2018b; Gupta, 2018; Kara & Can, 2019; Kumar & Coe, 2017; Kumar & Johnson, 2017, 2019; Schroeder et al., 2016). Communication and feedback were a complex theme given the vast nature of these concepts and the multiple ways they can be enacted. Several articles posit that advisors should be available (Gupta, 2018; Kumar & Johnson, 2017), flexible (Kumar & Coe, 2017; Kumar & Johnson, 2017), and proactive and timely (Cross, 2018; Kara & Can, 2019; Kumar & Coe, 2017; Kumar & Johnson, 2017) in their communication. Additionally, articles shared that communication should convey a caring tone (Kumar & Coe, 2017; Kumar & Johnson, 2017), provide feedback (Kara & Can, 2019; Kumar & Coe, 2017; Kumar & Johnson, 2017, 2019), and set expectations (Kumar & Coe, 2017; Kumar & Johnson, 2017). Advisors were expected to be proactive and actively communicate with their advisees.

Organizing Theme B: Building Relationships and Community

Advisors build relationships and community with their advisees and across the institution. This theme was acknowledged in 90% (n=9) of the articles. Closely aligned with theme 1, advisors built relationships through skills including being available (Gupta, 2018), setting expectations (Kumar & Johnson, 2017, 2019), and practicing a caring tone (Cross, 2018; Fynn & van Vuuren, 2017; Grady, 2016a; Gupta, 2018; Kumar & Coe, 2017). Building relationships requires finding time in busy schedules to meet when students need advising support. Students need advisors to set expectations, provide structure, to scaffold experiences, and to set deadlines. Advisors that practice a caring and encouraging tone were specifically mentioned in half the articles either through directly acknowledging the need for advisors to care about their students (Cross, 2018) and/or advisors encouraging students to present at conferences (Grady, 2018b). Beyond the skills that overlap with the first theme, building relationships and community also entails accommodating needs (Grady, 2018b; Kumar & Johnson, 2017), practicing developmental advising (Schroeder et al., 2016), leveraging interpersonal interactions, and using personal knowledge (Fynn & van Vuuren, 2017; Grady, 2018b; Kumar & Coe, 2017; Kumar & Johnson, 2017, 2019; Schroeder et al., 2016). Developmental advising provides students with a more personal relationship whereby advisors are invested in their academic, career, and personal goals (Schroeder et al., 2016). Advisors are a human link to the institution and to other students. This means they can coordinate group meetings to support peer feedback (Kumar & Johnson, 2019) or create a video to provide dissertation strategies (Grady, 2018b). Advisors need to tap their colleagues for knowledge (21) (Kumar & Johnson, 2017) and use their own prior experiences to best support their advisees (Kumar & Johnson, 2017).

Organizing Theme C: Investment in Student's Personal and Academic Growth

All articles highlighted this theme. Several of the codes in this theme interconnect across themes. As seen in *Communication and Feedback* and *Building Relationships and Community*, advisors need to be available (Gupta, 2018). Availability demonstrated an advisor's investment in the student's personal and academic growth. Similarly, advisees need feedback to grow. This feedback should be provided throughout the writing process (Kumar & Coe, 2017) and in conjunction with meeting following asynchronous written feedback (Kumar & Johnson, 2019). Like other organizing themes, advisors tap into their knowledge, including knowing their field (Kara & Can, 2019).

Additionally, investment in students requires enhancing their critical thinking skills, scaffolding, and providing individual support (Cross, 2018; Kara & Can, 2019; Kumar & Johnson, 2017; Schroeder et al., 2016). Numerous articles highlighted the need for advisors to enhance advisees' critical thinking skills (Fynn & van Vuuren, 2017; Kara & Can, 2019) through presentations (Grady, 2016a), learning experiences (Gupta, 2018), assignments (Grady, 2018b). Articles emphasized the need for scaffolding, including structures for job searches (Kumar & Johnson, 2019), operating in an online environment (Kumar & Johnson, 2019), research examples and strategies (Grady, 2018b; Kara & Can, 2019; Kumar & Coe, 2017; Kumar & Johnson, 2017). Providing individual support feeds off the concept of providing quality and timely feedback as advisors need to accommodate advisee needs and individualize the process (Kumar & Johnson, 2017), and care about their advisee (Cross, 2018; Kara & Can, 2019; Schroeder et al., 2016).

Organizing Theme D: Program Requirements and Policies

Advisors need to know their program, its requirements, and policies. Advisors should orient and guide students through the requirements of the program (Grady, 2016a, 2018b; Gupta, 2018). This may occur through learning management system advising modules (Gupta, 2018), visual presentations of different aspects of campus (Grady, 2018b), and/or an overview of the steps for completing the program requirements (Grady, 2016a). To help students accomplish these requirements, advisors provide resources which include creating academic plans and providing hands-on work with programs of study creation registration, etc. (Gupta, 2018; Schroeder et al., 2016), . Lastly, advisors need to know the program, its policies, requirements, and protocols (Cross, 2018). Half the articles explicitly acknowledge the need for advisors to be knowledgeable in program requirements and policies.

Organizing Theme E: Technical Skills

Online programs need advisors with technical expertise. They need to be comfortable working in an online learning environment with synchronous and asynchronous technologies, utilizing various technologies, websites, and online environments, and be adept at learning new teaching styles and new technologies (Kara & Can, 2019; Kumar & Coe, 2017; Schroeder et al., 2016). In an online environment, these skills are essential.

Discussion

In this scoping review of advising in online graduate education programs, ten articles revealed concrete actions advisors can take to invest in the success of each advisee. Through Attride-Stirling's (2001) thematic network analysis of the data, two global themes "Create Connections" and "Know Your Program" emerged. The "Create Connections" global theme is supported by three organizing themes: (a) Communication and Feedback, (b) Building Relationships and Community, (c), Investment in student's personal and academic growth. The

"Know Your Program" global theme is supported by organizing themes (d) Program Requirements and Policies and (e) Technical skills. These themes build off the work of Deshpande (2017) reinforcing the need for connections, community, and feedback. However, the findings veered away from Deshpande's sensitivity to cultural issues and pairing of faculties and focused on the need for program knowledge and technical skills. Based on the themes identified, the researchers posit three recommendations to help advisors purposefully invest in their advisees. These recommendations are not sequenced in any order and should be provided in tandem with one another.

Recommendation 1. Build a Trusting Relationship with Your Advisees

Building a trusting relationship with each advisee means learning their motivators and goals and caring about them as an individual beyond being a student in the program (Masengeni, 2019). The data demonstrated that students needed to feel valued, connected, and important. This is consistent with the larger body of literature that relationships help students, in person or online, to mitigate feelings of isolation (Berry, 2017; McEvoy et al., 2018; Wang et al., 2019). Trust is particularly important to develop an advising relationship (Houdyshell & Kirk, 2018). Given that an advisor's role is to provide feedback and guidance, a fundamental pillar of that relationship needs to be trust. Feedback is more effectively delivered when trust is formed between individuals (Carless, 2013). Students are learning, and they need feedback to know how to improve, know when to improve, know what they are doing well, and prioritize and work on next. Advisors and advisees with a trusting relationship create a safe space for providing constructive feedback. Advisors will know if this is going well if the student acknowledges and demonstrates progress and improvement. Conversely, feedback delivered in a relationship not built on trust may be missed or, worse, detrimental to the student's sense of self. Based on the analysis of the data, the following are recommendations advisors can use to build trust:

1) Meet with students. Individually meeting with students at the start of the program to learn about their goals and motivators and at regular intervals to accommodate students' needs and individualize the process (Kumar & Johnson, 2017) helps build trust.
2) Set clear expectations. Programs have a responsibility to ensure advisors implement advising practices and policies consistently.

3) Deliver feedback via phone or video conference. When delivering written feedback (e.g., editing a paper), ensure a scheduled time to follow up and review the feedback. Delivering feedback synchronously is encouraged because miscommunications are inevitable, but they are worse online when tone and intent can be lost and/or misinterpreted.

Recommendation 2. Build a Community of Students

Engagement matters (Martin & Bolliger, 2018). Developing a sense of belonging among online graduate students is critical to preventing burnout, decreasing dropout rates, and easing feelings of isolation (Gillett-Swan, 2017). Group meetings are a chance for students to engage with other students outside of their coursework (Kumar & Johnson, 2019). These meetings can be held for multiple purposes, including meeting with the director of the program, hearing from alumni, providing context for programmatic requirements, enhancing students' technology skill set, creating a space for peer feedback, etc. (Martin & Bolliger, 2018; Stone & Springer, 2019).

The purpose of the meeting is to create a safe space where individuals can feel part of a community of students.

Group meetings can build a community of students, which helps students feel connected to one another and provides a collective feeling of getting things done (Peacock et al., 2020). They offer accountability and encouragement for students to overcome obstacles, whether personal, academic, or professional. Additionally, sharing challenges can ward off imposter syndrome and normalize the learning curve (Wilson & Cutri, 2019). Done in tandem with the first best practice, students can feel like they matter to a larger group rather than just one advisor. Beyond feelings of connectedness (De Pryck et al., 2021; Suhlmann et al., 2018), group meetings can serve practical purposes such as developing collective practices that can contribute to success (e.g., writing groups) (Maher et al., 2013), helping students make the transition to a new learning environment (Cross, 2018); providing a structure for offering peer feedback (Kumar & Johnson, 2019), and easing faculty/advisor capacity. Advisors might know if this is going well if students voluntarily attend sessions and if alumni describe their peers' influence on their progression.

During group meetings, the advisor needs to ensure all voices are heard and that one student does not dominate the group's time, agenda, or attitudes (Woodley et al., 2017). Grounded in the data analysis, it is recommended that advisors coordinate purposeful group meetings based on the following suggestions. First, set up group meetings at key points in the student's experience (e.g., at the beginning to get comfortable with the new learning environment, when new technology is rolled out), when students typically face challenges (e.g., developing a research question), or when there is programmatic information to share (e.g., describing the portfolio process). Second, use structured processes. For example, if the group meeting intends to offer programmatic feedback, consider using the Small Group Instructional Diagnosis (SGID) process (Bowden, 2004; Clark & Redmond, 1982), which ensures all voices are heard, and consensus is reached. If the purpose of the group meeting is to offer peer feedback, consider implementing Pendleton's rules for feedback (Pendleton et al., 2003) to help guide the process. Finally, provide opportunities for students to meet individuals outside of their usual interactions. For example, invite an alumnus, faculty member, or near-peer student to share on a topic. These activities can demonstrate to students individual and collective investment in their success.

Recommendation 3. Know Your Program Policies, Requirements, and Technology Platforms

Advisors must know their program. It is the advisor's role to know what students need to accomplish and how to get them there. Knowing the program can be particularly challenging in today's fast-paced environment where programs experience rapid growth and change. Despite the best intentions, these changes can make it hard for advisors (and students) to keep up with expectations/requirements. However, advisors must keep abreast of programmatic changes to best serve their advisees.

Additionally, advisors must be competent in using online technology, which is constantly evolving and changing. They must be willing and able to learn new technology as needed. Advisors need to adapt and learn new technology and see the implications technology changes may have on students. Competency in technology platforms is essential for clear communication without technology causing unnecessary interruptions. Based on the data analysis, it is recommended that advisors make the time to know their program and the technology it uses. First, program leaders, update the program handbook as needed, and ensure that students and advisors can reference policies and expectations for their specific year. Second, if there is a team of advisors, meet frequently to discuss changes and roll out communication together. Lastly, provide an overview of the steps in completing their graduate program (i.e., course completion, topic identification, proposal development and presentation to the doctoral committee, collection of data for the doctoral study, and the details of the final oral defense) (Grady, 2016a).

Limitations

Though the researchers were as thorough as possible when examining the literature on advising in online programs, there are limitations to this scoping review. First, the research team noted that there were multiple terms for advisor at the graduate level of education, especially at the doctoral level. Ultimately, the focus settled upon advisor and supervisor as the two most common roles in graduate education. More research could be conducted to focus on other terminology, such as mentor, to uncover all possibilities of advising in the graduate virtual setting. Second, the research focused on online graduate programs and did not include articles that focused on individual courses. Third, the research team opted to review literature from 2015 forward. This decision was made based on a previous review of literature that was completed by Deshpande (2017) who completed an exploratory research that examined journals from 1993-2015. It only made sense to review the literature written since that time to find the most current practices used in online graduate advising. Finally, the studies offered numerous advising strategies; however, the strategies were offered in groups. Additional research is needed to isolate the effectiveness of individual strategies.

Conclusion

In conclusion, online education is an enduring force in the education world. It will continue to grow as more institutions provide opportunities for learners to gain their degree in the virtual format. It is vital to attend to the needs of students not only in the classrooms but also through advising. The literature on online graduate level advising can be organized into five themes (a) communication and feedback, (b) building relationships and community, (c) program requirements and policies, (d) investment in advisee's personal and academic growth, and (e) technical skills. Three recommendations for online graduate advisors were explored from the themes in the literature, including building trusting relationships with advisees; building a community of students; and knowing program policies, requirements, and technology platforms. Following these recommendations may best support advisors leading students to graduation.

Acknowledgments
The authors would like to thank Candace Norton, a medical librarian at Uniformed Services University of the Health Sciences, for helping design, refine, and conduct the searches for this study.

Declarations
The authors declared no conflicts of interests.
The authors declared that they received no funding.
The authors declared that ethical approval was not required for this work.

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Faculty Perceptions of Online Education and Technology Use Over Time: A Secondary Analysis of the Annual Survey of Faculty Attitudes on Technology from 2013 to 2019

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Abstract

Research on faculty use of technology and online education tends to be cross-sectional, focusing on a snapshot in time. Through a secondary analysis of the annual *Survey of Faculty Attitudes on Technolog*y conducted by *Inside Higher Ed* each year from 2013 through 2019, this study investigated changes in faculty attitudes toward technology and online education over time. Specifically, the study examined and synthesized the findings from surveys related to attitudes toward online education, faculty experiences with online learning, institutional support of faculty in online learning, and faculty use of technology. Results showed a low magnitude of change over time in some areas (e.g., proportion of faculty integrating active learning strategies when converting an in-person course to a hybrid/blended course) and a large magnitude of change in other areas (e.g., proportion of faculty who believe that online courses can achieve the same learning outcomes as in-person courses). These results reveal that, prior to the widespread shift to remote and online learning that occurred in 2020 because of the COVID-19 pandemic, faculty perceptions of technology and online learning were static in some areas and dynamic in others. This research contextualizes perceptions towards online learning prior to the pandemic and highlights a need for longitudinal studies on faculty attitudes toward technology use going forward to identify factors influencing change and sources of ongoing tension.

Keywords: online learning, educational technology, higher education; *Survey of Faculty Attitudes on Technolog*y; online learning over time

Johnson, N., Velestianos, G., Belikov, O., VanLeeuwen, C. (2022). Faculty perceptions of online education and technology use over time: A secondary analysis of the annual survey of faculty attitudes about technology from 2013 to 2019. *Online Learning, 26*(3), 293-310.

Technology was a staple in higher education even prior to the rapid shift to online course delivery during the COVID-19 pandemic (Garrett et al., 2019; Selwyn, 2016) and, prior to the pandemic, faculty were generally expected to incorporate technology into their teaching and learning practices (Weller, 2011). Throughout this paper, the term *technology* refers to the broad use of digital devices and resources for varying purposes while *online education* (or online learning) refers to the delivery of course instruction and materials via the Internet.

While many studies have investigated faculty use of technology in higher education, the preponderance of them tend to be cross-sectional. Such studies offer important insights, but due to their focus on a particular snapshot in time, they yield little information about changing facets of faculty use of technology. As the higher education landscape changes, it is important to gain an understanding of whether and how faculty perceptions change over time and how this impacts their attitudes toward technology. An understanding of faculty attitudes leading up to 2020 is essential for assessing the impacts of shifts to online course delivery in response to the COVID-19 pandemic. The purpose of this study, therefore, is to explore changes in faculty attitudes toward technology prior to 2020.

Since 2013, *Inside Higher Ed* has conducted an annual *Survey of Faculty Attitudes on Technology*, exploring "how professors and campus digital learning leaders view online learning and other aspects of classroom technology" (Jaschik & Lederman, 2019b, p. 5). Each annual report provides a single-year snapshot of faculty perceptions of technology integration and insight into how faculty are incorporating technology into their practices. The 2019 report included trend analyses for several topics, revealing how faculty attitudes and use of technology were shifting over time. These analyses revealed that the percentage of faculty members who have taught online has grown over time, that an increasing proportion of faculty report that online courses are able to achieve equivalent outcomes compared with face-to-face courses, and that the proportion of faculty that always use Learning Management Systems (LMS) to conduct certain administrative tasks has increased over time. Considering that few studies have explored changes over time regarding faculty and technology, this investigation aims to discover what other changes might be revealed if more trend analyses were performed on the data for all years of the *Survey of Faculty Attitudes on Technology*. We begin by situating our study in the literature relevant to faculty use of technology, particularly how it has and has not changed over time. We then describe our methodology for performing a secondary analysis on the results of the *Survey of Faculty Attitudes on Technology* from 2013 through 2019. After detailing our findings, we conclude with a discussion of key findings and their implications.

Review of Related Literature

The literature exploring faculty members' use of technology centers on a few critical themes: faculty perceptions of online education and technology use, major topics related to technology use in higher education, and research exploring faculty use of technology over time.

Faculty Perceptions of Online Education and Technology Use

Previous studies investigating faculty perceptions of online education and technology use have shown that faculty believe that technology adoption will increase workload, that interactions with students will be more challenging in an online environment, and that there is less institutional support for teaching online than teaching in-person. Major (2010) and Wingo et al. (2017) conducted systematic reviews of the literature related to faculty, technology use, and online education. The findings from Major's study also suggest that faculty attitudes may change over time as faculty gain experience with online education. While the research Major analyzed indicated that faculty may initially feel a sense of trepidation towards the unknowns of teaching online, she identified that the intellectual challenge and creative aspects of the online environment may also result in professional rejuvenation, particularly as faculty overcome previous anxieties. Similarly, Wingo reported that faculty experiences of online environments are associated with positive perceptions of online education.

Other studies reiterate that faculty members experience numerous tensions related to teaching online and their technology use. In particular, these may relate to extra demands on faculty time associated with the flexibility of online education (Birch & Burnett, 2009; Conceição, 2006; Conrad, 2004), the presence of a ubiquitous educational environment impacting their ability to set clear boundaries around working hours (De Gagne & Walters, 2010), and the blurred boundaries between personal and professional uses of technology (Jordan & Weller, 2018; Lemon et al., 2015; Lupton, 2014; Veletsianos & Kimmons, 2013). Faculty have also expressed the desire to maximize the benefits that technology may offer, while minimizing they potential adverse impacts that it may yield, such as for example adverse effects on personal wellbeing (Veletsianos, Johnson, & Belikov, 2019; Veletsianos, 2016). The impact of technology on teacher-student interactions is also reported as being a concern, and faculty members have articulated feelings of ambivalence around how technology influences their communication with students (Hyndman et al., 2016; McSpadden, 2018; Major, 2010; Marzilli et al., 2014).

Major Topics Related to Technology in Higher Education

Annual reports other than the *Survey of Faculty Attitudes on Technology* are useful for understanding the changing contexts that faculty experience as well as the impact of technology on the higher education landscape. For instance, the *Horizon Reports* describe key trends influencing technology adoption in higher education (Adams Becker et al., 2017, 2018; Alexander et al., 2019) and the *CHLOE Reports* describe the changing landscape of higher education (Garrett et al., 2019; Legon & Garrett 2017; Legon & Garrett 2018). The collective findings of these reports indicate tensions between demands for innovation, evolving practices, and effective supports at a time of rapid technological advances.

In reports examining institutional and administrator beliefs and practices, such as the *2019 Campus + Computing Report* (Green, 2019) and the *2019 Survey of College and University Chief Academic Officers* (Jaschik & Lederman, 2019a), authors raise further concerns. Green (2019) reported that institutional leaders who are “very knowledgeable” about digital learning are in the minority. Considering the pressures that institutions face to adapt to student needs (Alexander et al, 2019), a lack of strong understanding among institutional leaders on how to effectively implement digital learning initiatives is likely to impact faculty attitudes on technology adoption. This concern becomes even more pressing in the current context of the COVID-19 pandemic as students, faculty, administrators, and policymakers face numerous emerging uncertainties around the state of education and educational institutions. At the same time, there are indications, certainly now, but also prior to the pandemic, that institutions are actively striving to support faculty in successfully integrating technology into their practices. Jaschik and Lederman (2019a) for instance noted that 90% of the provosts they surveyed reported offering professional development opportunities for faculty to learn how to use technology to promote active learning techniques and student success.

Research Exploring Faculty Use of Technology Over Time

Much of the work described above is cross-sectional, meaning that it represents a singular snapshot of a moment in time, which is typical of the kind of research conducted in the field of educational technology (Barbera et al., 2015). Cross-sectional research makes it “difficult for educational technology professionals to find reliable data on current trends” (Kimmons, 2020, p. 803). Examining faculty experiences and perceptions with online education over time is useful for identifying patterns of use or non-use. The identification and analysis of trends over time facilitates a more accurate and multi-dimensional understanding of faculty technology use than cross-sectional studies. For example, Pachnowski and Jurczyk (2003) explored faculty perceptions of the time burden involved in online teaching over three semesters. In their study, faculty reported that additional time was required for preparation and training in the first semester, but such time pressures eased in the second and third semesters of the study. Veletsianos, Johnson, & Belikov (2019) also found that that faculty experiences with social media are temporal: they shift over time in response to a variety of overlapping individual, social, and cultural factors, such as changes in careers, institutional demands, or technological shifts.

Similar to the present investigation, Allen and Seaman (2007, 2013) surveyed chief academic officers at U.S. post-secondary institutions about various aspects of online learning. At the five- and ten-year mark of this annual survey, they produced special reports with longitudinal findings. As a result of looking at the data longitudinally, they were able to identify multiple significant findings such as a decrease in the number of institutions with no online offerings, an increase in the number of completely online programs, an increase in faculty perceptions at public and non-profit institutions that online teaching requires more time and effort, and a decrease in faculty perceptions at for-profit institutions that online teaching requires more time and effort. Such studies demonstrate the value of analyzing change over time related to online education.

Survey of Faculty Attitudes on Technology

The annual *Survey of Faculty Attitudes on Technology* measured a range of faculty experiences and attitudes in relation to educational technologies and online teaching and learning, including points of tension that are mentioned both in the peer-reviewed literature and other annual reports. The questions included in the survey explored faculty perceptions of quality, faculty experience with different delivery modalities and course design, faculty perceptions of instructional designers and online program management companies, faculty use of technologies, faculty perceptions of institutional support, and faculty concerns associated with issues such as cybersecurity, academic fraud, and open educational resources. The issues addressed in the survey are aligned with the sources of faculty tensions with technology found in the broader literature.

Methods

The *Survey of Faculty Attitudes on Technology* began in 2012 and was conducted by Inside Higher Ed and the Babson Survey Research Group. The format changed in 2013 and the survey has been run by Inside Higher Ed and Gallup since then. This section describes the process used to answer our research question: how did faculty attitudes towards technology change over time prior to the COVID-19 pandemic?

Participants

Each report contained about two pages of aggregate information about the survey participants (Table 1). Information about participants was limited to the data provided in the reports. According to the information provided, the number of survey respondents ranged from 1,671 to 2,799 in various years and included a mixture of full-time and part-time faculty. Respondents were primarily from the United States, although there were some respondents from Canada and Mexico. In 2015, the survey was modified to collect additional information regarding the tenure status of respondents. This was further refined in 2016 to differentiate faculty who were not yet tenured, but in a tenure-track position, from those who were not in a tenure-track appointment. The total percentages for the breakdown of tenure status in 2018 does not add up to 100% due to the rounding of decimals in the report.

Table 1

Type of Faculty Position of Survey Respondents (Percentage)

Year	Participants	Full-Time	Part-Time	Tenured	Not tenured	Tenure-Track	Non-Tenure-Track
2013	2,251	76.8%	23.2%				
2014	2,799	77.5%	22.5%				
2015	2,175	75.7%	24.3%	49.3%	50.7%		
2016	1,671	79.4%	20.6%	52.2%		12%	35.8%
2017	2,360	75.8%	24.2%	46.2%		14.8%	39%
2018	2,129	75%	25%	47%		13%	41%
2019	2,145	76%	24%	49%		12%	39%

Data Collection

The data source used in this study was the annual reports for the *Surveys of Faculty Attitudes on Technology*, conducted by *Inside Higher Education*, between 2013 and 2019, which are the years for which the survey format is consistent, and a core set of questions remain unchanged (Jaschik & Lederman, 2013, 2014, 2016, 2017, 2018, 2019b; Straumsheim et al., 2015). As of July 2022, no further reports have been released. These reports are publicly available via the *Inside Higher Ed* website and provide aggregate data only. Raw data was not available.

Data Analysis

A trend analysis investigates change over time by examining how findings differ from one another at multiple points in time. To perform a trend analysis, we first identified the sections and questions that were consistently included in the survey reports over the time period under investigation. That first step led us to focus on the questions within four sections of the survey that were always present from 2013 through 2019: attitudes about online education, faculty experiences with online teaching and learning, institutional support of faculty in online learning, and faculty use of technology (these specific items can be found in Tables 2 - 6).

For the identified questions, we looked at the aggregate findings reported as percentages in the reports. We examined whether and how the proportion of affirmative responses to the core questions in these categories changed from year-to-year by comparing the differences in percentage points for each identified question in each year. We also calculated the difference between the 2013 responses and the 2019 responses in relative terms to explore overall change. To observe how the survey changed over time in terms of content and questions asked, we tracked all the new questions that were added each year and which questions were discontinued over time.

Results

We present results focused on each section of the survey under examination: attitudes about online education, faculty experiences with online learning, institutional support of faculty in online learning, and faculty use of technology. We describe how the survey has changed over time regarding that theme. For each question included in our analysis, we provide a table with results from each year and an analysis of how the results have changed over time.

Attitudes About Online Education

From 2013 through 2016, the questions pertaining to attitudes about online education, were part of a section titled “online education quality.” In 2017, the name of the section was changed to “attitudes about online education” and the questions pertaining to online education quality gradually disappeared with each new iteration of the survey. Until 2018, this section also contained questions on whether for-credit online courses were comparable to face-to-face courses in different ways (e.g., meeting course objectives, communication and interaction, ability to reach exceptional/at-risk/underserved students, academic integrity). Questions about perceptions toward administrators and vendors who promote technology use, whether technology can lower cost without compromising quality, and use of external vendors also appeared in this section over the years.

Four questions in the “attitudes about online education” section were consistent from 2013 through 2019. Faculty respondents were asked to rate their level of agreement as to whether online courses can achieve comparable learning outcomes to face-to-face courses (1) at any institution, (2) at their own institution, (3) in their department, and (4) in their own classes. The 2019 report included a trend analysis on the first question: “whether online courses can achieve student learning outcomes at least equivalent to in-person courses at any institution” (p. 25). Findings indicate that the proportion of faculty that selected “agree” or “strongly agree” increased over time and the authors noted that faculty have become more positive about the potential of online learning. The report included a graph with the trend analysis which showed a notable rise in the proportion of faculty who indicated agreement from 2017 onward. Less than 20% of respondents agreed or strongly agreed with the question from 2013 through 2016 and 30% or more of respondents agreed or strongly agreed with the question from 2017 through 2019. The remaining three questions (see Table 2) that persisted throughout all years of the survey showed a similar pattern to the trend analysis included in the report.

Table 2
Can For-Credit Online Courses Achieve Student Learning Outcomes That Are At Least Equivalent to In-Person Courses?

	% of faculty members that *agree* or *strongly agree*							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
At my institution	26	32	26	25	42	39	38	+46
In my department or discipline	24	28	24	25	36	35	36	+50
In the classes that I teach	25	29	26	28	37	35	38	+52

Overall, the results show sizable changes. The proportion of faculty who agree to some extent that online courses can achieve the same learning outcomes as face-to-face courses grew by around 50% between 2019 and 2019. While the trend analysis conducted in the 2019 report shows that faculty members have become more positive about the potential of online learning in general, this analysis indicates slight variations in specific contexts, such as individuals' own courses, disciplines, and institutions. In any given year, the percentage of faculty that expressed positivity about online learning (with the exceptions of 2017 and with respect to respondents' perceptions relating to their institution) remained less than 40%.

Faculty Experiences with Online Teaching and Learning

Over time, questions about faculty experiences with online teaching and learning became more and more granular. The questions that persisted over time were initially part of a section titled "faculty experiences in online learning." In 2013, the survey asked three questions (Table 3) about respondents' experiences teaching online courses, hybrid courses, and face-to-face courses. The survey also asked whether respondents had taken an online course as a student from 2013 through 2018. This question was not included in the 2019 report and the variation in responses to this question from 2013 through 2018 was minimal.

In 2014, new questions about experiences with converting courses from face-to-face to hybrid (see Table 4) appeared in this section and remained in the survey in future years. The name of the section changed to "experiences in online learning" in 2015 and new questions about the impact of teaching online on the development of pedagogical skills emerged. The section split into two sections in 2017: "effects of online teaching" and "online teaching and design experience." In 2018 and 2019, what had initially started as a single section on "faculty experiences in online learning" evolved into two sections: "online teaching experience" and "course design and use of instructional designers."

The analysis of the responses to the questions that remained constant revealed minimal change over time. Each year the survey asked faculty to respond "yes" or "no" to whether they had ever taught an online course for credit, whether they had ever taught a blended or hybrid course, and whether they had ever taught a face-to-face course. The one area where a considerable change occurred was the proportion of faculty who reported having taught an online course. The proportion of faculty who had taught online steadily increased each year, resulting in an overall relative increase of 53% from 2013 to 2019 (30% to 46%). As for the proportion of faculty that reported having taught a blended course, despite a temporary increase from 2014 through 2016, the results remained consistent from 2013 (39%) to 2019 (38%). Unsurprisingly, the vast majority of respondents reported having taught a face-to-face course, with results ranging from 95% to 99% each year. Less than half of faculty reported having taught online or blended courses throughout 2013-2019.

Table 3

Faculty Experiences Teaching Online

	% of faculty responding "yes"							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
Have you ever taught an online course for credit?	30	33	32	39	42	44	46	+53
Have you ever taught a blended or hybrid course?	39	50	40	43	36	38	38	-3
Have you ever taught a face-to-face course?	95	98	97	99	98	98	98	+3

From 2014 onward, the survey also asked several sub-questions to those faculty who responded affirmatively to having taught a blended or hybrid course. These questions asked faculty about their experiences converting face-to-face courses to blended or hybrid courses. Overall, little change occurred over time in the responses to these questions. Of the faculty who reported having taught a hybrid course, a substantial majority (ranging from 77% to 86%) reported that they had converted a face-to-face course to a blended course (vis-à-vis creating a new course online). In most years, the proportion of faculty who reported a decrease in lecture time in their blended/hybrid course compared to their in-person course ranged between 52% to 55% with a temporary increase to 64% and 65% in 2017 and 2018, respectively. Similarly, the proportion of faculty who reported incorporating more active learning techniques after converting a course from face-to-face to blended ranged from 66% to 69% in most years with a temporary dip down to 58% in 2017 and 54% in 2018.

Table 4
Experiences of Faculty Who Have Converted a Face-to-Face Course to a Blended or Hybrid Course

	% of faculty responding "yes"							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
Have you ever converted a face-to-face course to a blended or hybrid course?	n/a	86	79	81	82	78	77	-10
Did lecture time -- including online lecture time -- decrease when you converted from the face-to-face course to the blended or hybrid course?	n/a	53	52	52	64	65	55	+4
Did you incorporate more active learning techniques after you converted from the face-to-face course to the blended or hybrid course?	n/a	66	68	69	58	54	69	+4

Institutional Support of Faculty in Online Learning

The questions focused on faculty perceptions of institutional support were part of the "faculty experiences in online learning" section in the first year of the survey. In 2014, a new section titled "faculty and their institution" emerged to address this topic. The section was renamed "institutional support of faculty in online learning" in 2015. Along with the questions that persisted throughout the years of the survey (listed in Table 5), the "institutional support of faculty in online learning" section also included questions relating to student identity verification and plagiarism in 2017 and 2018. In 2019, an additional section titled "academic fraud" emerged to encompass questions on these topics.

Questions about institutional support for faculty who teach online that continued throughout all the years of the survey focused on compensation, technical support, and policies to protect intellectual property. When asked about the presence of institutional support for online learning, a significant proportion of faculty (often the majority) was either neutral or noted that such support was lacking.

Findings from the eight questions were mixed. Three questions showed a significant decline in perceptions of institutional support over time, and these were generally related to rewards and compensation. The proportion of faculty that believed that their institutions appropriately rewarded contributions made to digital pedagogy fell by 39%. The same drop was reported in the question focusing on whether the institution rewards teaching with technology in tenure and promotion decisions. The proportion of faculty who believe that their institution compensates individuals fairly for the development of an online course also fell by 31%. The data also show a decline in the proportion of faculty who believe their institution's compensation for online instruction is fair (12%) or that their institution acknowledges the workload associated with online courses (11%). We observed an increase in positive perceptions in two areas: a 11% increase when faculty were asked whether institutions were providing adequate technical support for teaching an online course and a 30% increase when asked whether institutions were providing adequate technical support for creating an inline course. In summary, these results show that while there was an increase in the proportion of faculty who perceived institutions providing adequate technical support, at the same time there was a decrease in the proportion of faculty who believed that they were adequately supported in terms of recognition and compensation.

Table 5

Faculty Perceptions of Institutional Support for Online Learning

	% of faculty responding 'agree' or 'strongly agree'							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
Appropriately rewards contributions made to digital pedagogy	36	36	37	32	32	30	22	-39
Rewards teaching with technology (in-person or online) in tenure and promotion decisions	36	29	33	30	27	24	22	-39
Compensates fairly for the development of an online course	32	27	27	26	27	20	22	-31
Compensates fairly for online instruction	40	38	38	40	39	34	35	-12
Acknowledges the time demands for online courses for workload	28	25	26	25	30	22	25	-11
Strong policies to protect intellectual property rights for digital work (2013, 2014, 2015); [Has] Policies that protect faculty members' intellectual property rights for digital work (2016, 2017, 2018)	37	34	37	31	37	30	36	-3
[Provides] Adequate technical support for online courses (2013); adequate technical support for teaching online courses (2014-2019)	47	51	49	47	57	53	52	+11
[Provides] Adequate [technical] support for creating an online course	n/a	40	48	49	54	50	52	+30

Faculty Use of Technology

Questions pertaining to faculty use of technology were part of the section called "use of technology" (2013-2015) and "faculty use of technology" (2016-2019). Some questions that began in the "attitudes about online education" section in 2017 moved to the "faculty use of technology" section in 2018 (e.g., reasons why faculty support or do not support the increased use of educational technologies, whether faculty perceive themselves as an early adopter of technologies). Questions pertaining to use of digital courseware emerged in this section in 2017 with questions relating to the effectiveness of digital courseware added in 2018. We combined these sections for the purposes of the analysis reported below.

The questions about faculty use of technology that were present in all the years of the survey focused on ways in which faculty use their institution's LMS. The 2019 report included a trend analysis for questions on LMS use. Specifically, the report identified whether, and to what extent, the percentage of faculty who indicated that they are "always" using an LMS for certain tasks changed over the years. This analysis found that the proportion of faculty who use their LMS system to carry out particular teaching tasks has mostly increased each year between 2013 to 2019 (see shaded columns in Table 6).

We conducted a similar analysis to compare whether the increase was as pronounced when the percentage of respondents who reported "always" using their institution's LMS was combined with the percentage of respondents who selected "usually" (see unshaded columns in Table 6). We did this exploratory analysis because the subjectivity inherent in "always" and "usually" indicates relatively frequent use such that that they should be considered together. The proportion of positive responses in our analysis also increased over time; however, the magnitude of change over time differed. Overall, we identify that the proportion of faculty reporting using the LMS for particular purposes increased over time; however, we found some substantive differences between our analysis and the analysis in the 2019 report. For example, the rate of change of faculty integrating lecture capture technologies or tracking student attendance is much lower, while the rate of change of faculty using the LMS to identify students who may need support is much higher. Ultimately, these results seem consistent but indicate that some of the change over time shown in the report may be attributed to shifts in intensity of use (i.e., from always to usually and vice versa) rather than changes in activity.

Table 6
Comparison of Change Over Time When Grouping Responses Differently

	% of faculty responding "always"			% of faculty responding "always" or "usually"		
	2013	2019	2013-2019 Change	2013	2019	2013-2019 Change
Share syllabus information with students	76	84	+10	86	90	+5
Track student attendance	24	34	+42	34	44	+29
Record grades	53	71	+34	66	79	+20
Provide e-textbooks and related material	36	41	+34	58	62	+7
Integrate lecture capture	11	19	+72	18	28	+55
Communicate with students	53	51	-4	74	76	+3
Identify students who may need extra help	24	24	0	39	47	+20

Discussion

In an era of technological advances and growth in online learning, our analysis of the annual *Survey of Faculty Attitudes on Technology* suggests that while there is change in numerous areas, the rate of change is sometimes pronounced while at other times relatively static between 2013 and 2019. The results reveal some changes in perceptions over time, with some items showing more change than others. Exploring faculty attitudes toward technology longitudinally has enabled the identification of persistent trends prior to pandemic-induced changes that occurred in 2020 and provides us with historical data to contextualize faculty attitudes towards technology going forward.

Without considering the rate of change, the results above also suggest that negative attitudes towards online learning persists. At no point prior to 2020, did a majority of faculty agree that online courses could achieve student outcomes that were equivalent to in-person courses and, while faculty experience with teaching online increased over time, those with online teaching experience remained in the minority. When considering rate of change however, we observe increased acceptance of online learning, at least as perceptions of quality are concerned. Quality beliefs however need to be contextualized in terms of support. Results shows that less and less faculty feel supported in terms of compensation and rewards for teaching online, while they report observing their institutions providing greater technical support. While it is likely that early adopters of online learning could have possibly received greater support or rewards for being trailblazers at their institution and that this support diminished over time, we find very little evidence in the literature to suggest that rewarding faculty for teaching online has ever been a common institutional practice. Instead, the literature suggests that faculty who either opted to, or were required to, teach online in the early 2000s reported challenges at the start (Birch & Burnett, 2009; Conrad, 2004). Further, the literature indicates that the motivators among faculty who continued to teach online tended to be intrinsic (e.g., intellectual challenge, professional rejuvenation) rather than rewards-based (Major, 2010). The collective findings that most faculty, and an increasing number of them, including many with no online teaching experience, believe that online learning was associated with poorer outcomes and inadequate compensation is concerning. The issue of compensation and rewards is especially concerning at a time when institutions have expanded their investments into digital platforms of all kinds because of the COVID-19 pandemic.

The data related to LMS use indicate that faculty tended to use their institution's LMS system for primarily administrative purposes (e.g., sharing the syllabus) rather than pedagogical purposes (e.g., identifying students who may need extra support). These finding highlight, once again, the predominant role of these technologies, which appears to be entered on managerial concerns rather than pedagogy (e.g., Veletsianos & Kimmons, 2013). We acknowledge that these findings may not solely reflect faculty attitudes toward LMS use but may be influenced by other factors such as the provision of training for effective LMS use and institutional policies requiring that the LMS be used for certain administrative tasks. Further research is needed to better situate faculty attitudes in institutional and environmental contexts.

It is important to consider whether these trends are likely to persist into the future. As institutions develop their digital learning strategies during and beyond the pandemic, understanding the relevance of these findings within the present context is critical. For instance, knowing that perceptions of institutional support for teaching online were trending downwards regarding compensation and rewards may signal to institutions that progress in these areas is necessary if an institution wishes for more faculty to teach online as part of their strategic plan. To support greater faculty adoption of online learning, more research is needed to better understand what kinds of supports faculty perceive to be necessary and adequate to foster the growth of online education and technology integration in their teaching practices.

Results also show a general improvement in faculty attitudes toward technology over time. The body of research on faculty attitudes towards technology tends to be cross-sectional and focused on identifying sources of tension. The need to conduct longitudinal studies that investigate the factors influencing change (or lack thereof) in attitudes over time remains. When investigating faculty attitudes toward technology, there is also a need to consider the future of higher education, whether it be the near post-pandemic future or the state of higher education several decades from now. Questions that probe the nature of faculty experiences teaching online, their preferences regarding technologies used, and the types of support available to them through their institution might provide insight as to persistent challenges and areas of change or innovation. Questions focused on understanding why faculty feel positively or negatively toward teaching with technology, why they implement certain pedagogical practices in digital contexts, and how these reasons change over time can help us better identify areas where faculty need enhanced support and can offer strategies for improving online learning overall. The COVID-19 pandemic has likely affected faculty perceptions towards technology discussed in this paper. Research that provides a pre- and post-pandemic comparison may be fruitful in assessing the impacts of the pandemic on faculty perceptions and use of technology.

Significantly, this study faces several limitations and readers are cautioned to examine whether the findings presented here reflect their own contexts. For instance, the survey upon which results are based is grounded in the North American contexts and may have limited transferability. Further, the survey sample changed from year-to-year, and dips or spikes in the results could be attributed to sample changes. As our study was a secondary analysis, we did not have access to the survey instrument or the raw data. Our knowledge of the recruitment process and sample was limited to the information and aggregate data provided in the *Methodology* and *Institution and Personal Demographic* sections of the reports. Finally, these findings, while yielding some insights into faculty attitudes, provide little explanatory power as to the reasons behind the changes observed. Future research into such reasons is both necessary and worthwhile.

Conclusion

The collective findings of the *Survey of Faculty Attitudes on Technology* reports show that faculty attitudes toward technology prior to 2020 show both high and low magnitudes of change. Past research has identified areas of tension reported by faculty regarding technology adoption, but factors mitigating these tensions and influencing change need further investigation. Developing a better understanding of how faculty attitudes toward online learning and technology have changed as well as the influencing factors driving such change will help us to better understand the support that faculty need when using technology in their teaching.

Declarations
The authors declared no conflicts of interests.
The authors declared that this paper draws on research supported by the Social Sciences and Humanities Research Council of Canada.
The authors declared that the research is exempt from research ethics board review as it relies exclusively on information that is anonymized and in the public domain.

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