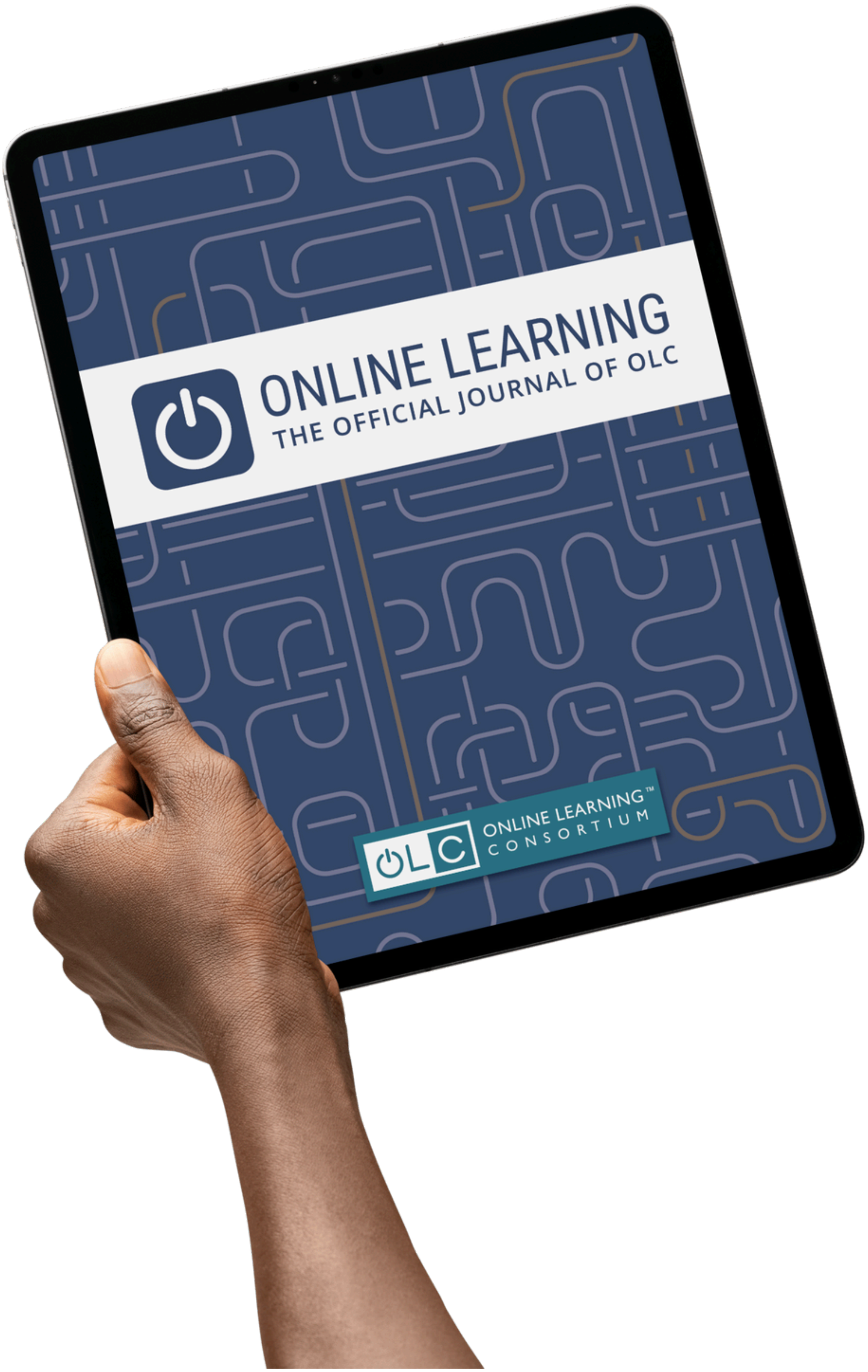
ONLINE LEARNING
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Introduction to the Special Issue: Select Papers Presented at Recent OLC Conferences

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Each year, the September issue of the Online Learning Journal (OLJ) highlights select articles showcasing research presented at one of the past year's Online Learning Consortium (OLC) conferences, OLC Accelerate, OLC Innovate, or this year's new conference, OLC Elevate. We also target research submitted to Online Learning and encourage them to present at OLC Accelerate 2026, November 16-19 in Orlando, Florida. This special issue continues this tradition by presenting **5** studies that demonstrate the breadth and depth of current scholarship in online and digital learning.

The Online Learning Consortium Quality Scorecard for K12 Blended Learning by Kaye Shelton (Lamar University) addresses the absence of a K12-specific framework for evaluating the quality of blended learning programs. While tools such as Quality Matters and iNACOL offer course-level design rubrics, no comprehensive scorecard previously existed for the broader design, leadership, implementation, and administration of K12 blended programs. Using a four-round Delphi methodology, the study convened a panel of 20 U.S.-based experts in K12 blended teaching, administration, and research to evaluate 65 quality indicators adapted from OLC's 2023 Quality Scorecard for Blended Programs (originally developed for higher education). Panelists voted on relevance, proposed new indicators, and refined language for a K12 audience using a 6-point Likert scale, with consensus defined as a mean of 5.0 or higher and 70% panel agreement.

The resulting OLC K12 Blended Learning Scorecard organizes quality indicators into eight categories: School District Support, Technology Support, Course Development and Instructional Design, Course Structure, Teaching and Learning, Teacher Support, Student Support, and Evaluation and Assessment. Findings show that quality blended learning in K12 settings depends on the interplay of organizational leadership, infrastructure, instructional design, pedagogy, and ongoing evaluation, rather than any single, isolated intervention. This study contributes a practical, research-informed tool to guide K12 educators, administrators, and policymakers in designing, implementing, and evaluating blended learning programs, and it lays a foundation for future research on scorecard implementation, blended teacher training, and program evaluation.

Doing It All: Exploring Roles and Responsibilities of and Support for Online Program Coordinators by Yvonne Earnshaw (Kennesaw State University) examines the roles, responsibilities, and support needs of online program coordinators, a common but under-researched and largely informal administrative position in U.S. higher education. Through semi-structured interviews with 16 online program coordinators across institutions and disciplines, the study found that responsibilities varied widely and were rarely defined by a formal job description, encompassing enrollment management, curriculum and program infrastructure, faculty support, student support, personnel-related tasks, and open-ended "other duties as assigned." Grounded in role socialization theory, the findings reveal that coordinators frequently experience role ambiguity, overload, and conflict as they attempt to balance these quasi-administrative duties with their standing faculty responsibilities in teaching, research, and service.

The study also identified the types of support coordinators receive—including emotional support, shared workload arrangements, and financial incentives such as stipends or course releases—and found that this support is often inconsistent or insufficient. Coordinators expressed a need for greater administrative recognition of their workload, fairer compensation, additional resources, and formal onboarding or mentoring for the role. The findings offer practical implications for institutions, including recommendations for formal review processes, structured onboarding, and clearer job descriptions, along with directions for future research across a broader range of disciplines and institutional types.

Making Generative AI Expectations Visible: Extending the TILT Framework for Transparent Assignment Design by Andrew Wiss (George Washington University), Karen Singer-Freeman (George Washington University), Jennifer Pattershall-Geide (George Washington University), Kyle Dobbeck (Montclair State University), Christina Heminger (George Washington University), Scott Quinlan (George Washington University), Joy Volarich (George Washington University), and George Gray (George Washington University) extends the widely used Transparency in Learning and Teaching (TILT) Framework to address generative AI (genAI) in assignment design. The authors introduce the TILTai Framework, which applies TILT's three pillars—Purpose, Task, and Criteria—specifically to genAI use and describe a pilot faculty development program built around it that drew over 80 participants from a school of public health. Building on this work, they developed and piloted the TILTai Scale, an 11-item instrument for measuring students' perceptions of assignment transparency regarding genAI, administered across eight graduate-level courses in public health and health administration ($N = 70$).

Exploratory factor analysis identified three reliable subscales—Purpose (Support Learning), Purpose (Role and Future Success), and Task Criteria—with good overall scale reliability. Regression analyses linked higher perceived transparency, particularly around an assignment's purpose and its connection to students' future success, to reduced student concerns about fairness, accusations of academic integrity violations, and grading uncertainty related to genAI use. Qualitative responses reinforced these findings, though they also surfaced persistent worries, such as fear of being wrongly flagged for AI use or being disadvantaged by classmates' undisclosed AI use in group work. The authors conclude that the TILTai Framework offers a practical, adaptable tool for faculty development and assignment design, while calling for further research with larger and more diverse student populations and pre/post study designs.

Online STEM Education Before COVID-19: An Integrative Review and Thematic Framework for Higher Education by Alejandra M. Pickett (University at Albany) synthesizes 33 studies published between 2011 and early 2020 to establish a historical baseline for online STEM teaching and learning in higher education prior to the COVID-19 pandemic. Using an integrative literature review methodology and searches across EBSCO, ERIC, and Web of Science, the study identified scholarship dispersed across 31 outlets and used inductive thematic analysis to organize it into eight categories: online STEM learner support, integrated online STEM education, course quality and design, learner engagement strategies, communication in online STEM environments, equity and inclusion for underrepresented learners, workforce development, and faculty preparation.

Across these themes, the review found that learner experiences and outcomes were tied more closely to the intentional integration of instructional design, interaction, facilitation, authenticity, assessment, learner support, access, and equity than to instructional modality alone. The synthesis also revealed uneven methodological rigor and theoretical grounding across the literature, along with a persistent gap between STEM reform initiatives and preparation for online teaching specifically. The author argues that this pre-COVID baseline offers a lens for interpreting pandemic-era and post-pandemic developments in the field, and calls for future research with stronger theoretical grounding, more diverse and rigorous designs, a cross-cutting focus on equity, and attention to the emerging role of artificial intelligence in online STEM teaching and learning.

Beyond the Thread: Reimagining Online Discussions for Authentic Learning by Diane Johnson, Kelly Brown, and Kaye Shelton (Lamar University) and J. Kenneth Young (Tarleton State University) presents a collaborative self-study in which five graduate faculty members at two Texas universities reflected on their shift from traditional threaded discussion boards to collaborative discussion formats in fully online programs. Drawing on the Community of Inquiry framework (social, cognitive, and teaching presence), the researchers met regularly over several semesters to document their experiences, finding that threaded discussions consistently felt performative and compliance-driven, producing shallow, deadline-driven participation rather than genuine intellectual exchange.

In contrast, collaborative discussions—in which students chose their own platforms, meeting times, and conversational approaches—were associated with deeper critical thinking, stronger relational bonds among peers, and greater student ownership of the learning process. Faculty described richer, more sustained dialogue, increased student comfort and engagement, and unexpected benefits such as reduced grading fatigue and lower reliance on AI-generated text. At the same time, the format required iterative refinement to address challenges like verifying citations in spoken discussions, balancing participation within groups, and managing scheduling logistics. The authors conclude that carefully scaffolded collaborative discussions offer a promising alternative to threaded discussion boards in graduate-level online programs and call for future research incorporating student perspectives and measurable learning outcomes.

These studies provide valuable contributions to illustrating effective practice and providing actionable insights for practitioners who focus on improving educational outcomes in digital learning environments. We invite readers to consider submitted to OLC conferences and Online Learning to disseminate your future research.

Thank you to the OLC community, conference organizers, authors, peer reviewers, and presenters whose work makes these important scholarly exchanges possible. A special thank you to the OLJ copyeditors for their hard work at getting these articles online as well as the OLJ Editor-in-Chief, Dr. Peter Shea, and Managing Editor, Dr. Carrie Miller, whose expertise helps us maintain the quality of the research published in OLJ. We encourage readers to reflect on these findings and consider how they can inform future practice, research, and scholarship in the evolving field of online and digital learning.

Doing It All: Exploring Roles and Responsibilities of and Support for Online Program Coordinators

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Abstract
Academic program coordinators are one of the more common administrative positions in higher education in the United States. However, there are very few studies on program coordinators, particularly those who oversee online programs. This is a critical position at institutions that has not been formalized and is under-researched. Therefore, the purpose of the study was to explore the roles and responsibilities of online program coordinators and the support they receive and need. Sixteen online program coordinators were interviewed from across institutions of higher education in the United States. The findings suggest that the roles and responsibilities of online program coordinators are not consistent. They included duties such as enrollment management, curriculum and program infrastructure, faculty support, student support, personnel-related tasks, and "other duties as assigned." Types of support also vary such as emotional support, workload support from others, and receiving incentives for the work. Sometimes these types of support are not effective. Online program coordinators want to have recognition from administration for the workload involved in the role, compensation for the work, additional resources, and more training and mentoring. Implications for practice and research are also discussed.

Keywords: Program coordinator, program director, online programs, higher education, faculty roles and responsibilities

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Academic program coordinators represent one of the most common faculty administrative appointments in higher education (Ingle et al., 2020). However, as noted in multiple studies, program coordinators lack both formal authority (Ingle et al., 2020; Marshall et al., 2021; Rost & Hover, 2022) and an official job description with a clearly defined list of responsibilities (Rost & Hover, 2022). These responsibilities have been documented in existing research in educational leadership (Coleman & Reames, 2020; Hackmann & Wanat, 2008, 2016; Ingle et al., 2020; Ingle et al., 2018; Reames, 2016) and higher education student affairs (Olt et al., 2026; Shelton et al., 2025), where most of the research has been conducted.

Unfortunately, there is a dearth in the literature regarding program coordinators who oversee online programs. Hoey and McCracken (2021) noted that the lack of research is surprising given the importance of the role and called for research to be done specifically with online program directors. Peterson et al. (2017) also noted that despite the critical importance, the position of the program director has not been fully formed or institutionalized and is under-researched. Therefore, the current study looks across disciplines and institutional types, but specifically within online programs. The purpose of the study is to explore the roles and responsibilities of online program coordinators and the support they need. The following research questions are the foundation for this study:

1. What are the roles and responsibilities of online program coordinators?

2. What kinds of support do online program coordinators receive and what support do they need?

Literature Review

The following section reviews the literature on online program coordinators in higher education, and specifically, their role and responsibilities, the support they receive, and challenges they encounter.

Defining Program Coordinator

There is not a consistent title for those faculty who also manage programs, either at the undergraduate or graduate level. Director (Ortega, 2003; Petersen et al., 2017; Wiener & Peterson, 2019) and coordinator (Coleman & Reames, 2020; Hackmann & Wanat, 2008) are the two most common titles. This paper will use “program coordinator” for consistency, except where the original work from cited authors uses a different title.

As Ingle et al. (2020) noted, the program coordinator represents one of the most common faculty administrative appointments in higher education. Program coordinators may also be responsible for research, teaching, and other service requirements. They are typically embedded in the programs in which they teach.

Program Coordinator Responsibilities

Current research notes that most coordinators do not have an official job description (Rost & Hover, 2022). Therefore, they do not have a clearly defined list of responsibilities. However, existing research studies in educational leadership (Coleman & Reames, 2020;

Hackmann & Wanat, 2008, 2016; Ingle et al., 2018; Ingle et al., 2020; Reames, 2016) and higher education student affairs (Olt et al., 2026; Shelton et al., 2025) have looked at the range of job duties. Hackmann and Wanat (2016) identified that the duties included,

> serving as the program's point of contact, maintaining a vision of the program, guiding curricular revisions, leading regular program meetings, coordinating student recruitment and admissions, determining faculty course teaching assignments, addressing student concerns, fulfilling state and national accreditation requirements, and representing the program within the institution and with constituent groups. (p. 102)

Other studies have identified similar responsibilities with assessment and accreditation (Hackmann & Malin, 2016; Hackmann & Wanat, 2008; Parkes et al., 2023), admissions (Wiener & Peterson, 2019), recruitment and retention (Ingle & Marshall, 2024; Petersen et al., 2017; Wiener & Peterson, 2019), curriculum-related items (Coleman & Reames, 2020; Hackmann & Malin, 2016; Hackmann & Wanat, 2008; Ingle & Marshall, 2024; Wiener & Peterson, 2019), contingent faculty (Ingle & Marshall, 2024), student advising (Ingle & Marshall, 2024; Wiener & Peterson, 2019), building external partnerships (Ingle & Marshall, 2024), and representing the program on various committees (Ingle & Marshall, 2024; Wiener & Peterson, 2019).

In fields where curricula need to be revised to comply with new legislation (i.e., educational leadership or K-12 educator prep programs) or where the programs have partnerships with school district or community partners, additional workload compounds existing job responsibilities (Coleman & Reames, 2020; Jones & Lewis, 2024; Marshall et al., 2021).

Program Coordinator Support and Challenges

As noted in previous studies, support can come in different forms, such as a course release or some type of financial compensation (Hackmann & Wanat, 2016; Ingle et al., 2018, 2020). In a survey conducted by Ingle et al. (2020), faculty also received support through clerical support or graduate assistant support to assist in the program coordination tasks. The majority of program directors at UCEA-member institutions received one course reduction (46.7%) per academic year and over 60% received 1-3 reductions per academic year; however, 33.7% did not receive any reductions in teaching. Bieber et al. (2024) also found there was a "lack of negotiated release time from other responsibilities" (p. 41).

In Ingle et al.'s (2020) study, the majority of program directors did not receive a stipend (61.9%) nor supplemental professional development funds (73.8%), nor graduate assistants (70.6%), nor clerical support staff (70.7%). Therefore, an overwhelming number of program coordinators are not receiving incentives or support. Ingle and Marshall (2024) conducted a follow-up study post-pandemic to determine if there was a change in responsibilities and incentives. Unfortunately, many of the support mechanisms in place prior to the pandemic actually decreased.

The amount of work that a program coordinator must do contributes to one of the most common challenges of being a program coordinator—time. Hackmann and Wanat (2008) found that program coordinators spend between 10-30 hours per week on coordinator duties. Their follow-up study reported that program coordinators estimated between 20-35 hours per week

(Hackmann & Wanat, 2016). This work is in addition to the program coordinator's research and teaching responsibilities. Hackmann and Wanat (2016) discussed that dedicated time for research is typically what is decreased by the amount of work a program coordinator must undertake. For this reason, some faculty specifically avoid doing program coordination because of the workload and stress associated with the role (Bieber et al., 2024). Ingle et al. note that,

> Without clearly defined duties, program coordinators risk being placed in untenable situations, devoting hours to program obligations while attempting to balance these quasi-administrative duties alongside their more typical faculty responsibilities, including teaching, advising, scholarship, and service. (2020, p. 121)

Theoretical Framework

This study used role socialization theory (RST) (Richards, 2015) which examines how individuals are socialized into their roles and how their roles in turn shape their behavior in the workforce. It evolved from the intersections of role theory (RT) (Biddle, 1979) and occupational socialization theory (OST) (Pennington, 2021). According to Biddle (1979), social positions can be defined as the expectations and characteristics of a particular role (p. 5), while OST posits a reliance on mentorship as a socializing agent (Pennington, 2021). RST suggests that one's understanding and performance within their role is shaped by a socialization process and is based on "reliable guidelines for behavior" (Richards, 2015, p. 382). Without these guidelines or expectations, individuals will experience stress. Within RST, there are three stressors: role ambiguity, role overload, and role conflict (Richards, 2015). Role ambiguity is due to not having clear expectations of the role. Role overload occurs when there is too much work to be completed within a reasonable amount of time. Finally, role conflict occurs when meeting the expectations of the role is perceived to be impossible. RST is the appropriate choice for this study to examine the role of the online program coordinator and how that role is impacted by the socialization process within higher education.

Methodology

This study used a basic qualitative approach (Merriam & Tisdell, 2016). The goal of conducting a basic qualitative study is to "*understand* how people make sense of their lives and their experiences" (Merriam & Tisdell, 2016, p. 42). The researcher wanted to focus on how participants make sense of their experiences as an online program coordinator, and, as a researcher, to "uncover and interpret these meanings" (Merriam & Tisdell, 2016, p. 43) A basic qualitative approach was appropriate because of the focus on constructing meaning, having a purposeful sample, collecting data through interviews, analyzing the data through inductive thematic analysis, and reporting findings that are richly descriptive (Merriam & Tisdell, 2016, p. 57).

Positionality

The researcher has been a program coordinator of an online graduate program at an R1 institution and has been a program coordinator of an undergraduate program at an R2 institution in the southeastern Carnegie region (Carnegie Classification of Institutions of Higher Education [CCIHE], n.d.) of the United States. She has taught online for several years. The impetus for this study arose from her experience as a program coordinator, and, as a quasi-insider among the study participants, the researcher was also familiar with what questions to ask and how to ask follow-up questions. The researcher also maintained a reflexive stance throughout the study.

Trustworthiness

Rich detailed data were collected from multiple sources and institutional types across three Carnegie regions (CCIHE, n.d.). This process established trustworthiness for the study and allowed the researcher to triangulate the data (Creswell & Miller, 2000). Peer debriefing (Nguyễn, 2008) was used to enhance confirmability and mitigate researcher bias.

Participant Selection and Recruitment

Purposive sampling (Robinson, 2014) was used for the intentional selection of participants. For this research study, eligible participants were between the ages of 18 and 89, a current program coordinator of an online program, currently teaching in a public institution of higher education in the United States, and physically present in the United States at the time of the questionnaire completion and interview.

After receiving IRB approval, the researcher sent a recruitment email through various professional organizations' listservs as well as posted on social media websites within the researcher's professional network. This email included information about the purpose of the study, the inclusion criteria to qualify for the study, and a Qualtrics link to the informed consent form and demographic questionnaire. After participants consented to participate in the study and completed the questionnaire, the researcher then emailed the participants to set up a phone or Zoom interview. The semi-structured interviews (Schwandt, 2015) consisted of nine questions that focused on roles and responsibilities, the review process, incentives, workload, and support and developmental needs (see Appendix for the interview protocol). The interview protocol was developed by adapting prior established research from Ingle et al. (2020), in which they created a questionnaire with both quantitative and open-ended questions (W. K. Ingle, personal communication, May 6, 2024) and from the researcher's own experience as a program coordinator. The interviews were no more than 1.5 hours. They were recorded and transcribed verbatim by transcription software.

Participants

There were 27 respondents to the recruitment email. Three participants were screened out due to eligibility, two completed the demographics questionnaire but did not provide contact information to set-up the interview, two did not respond to multiple email requests to set-up the interview, one consented but did not complete all of the demographics questionnaire nor their contact information, two consented but did not complete any of the questions on the demographics questionnaire, and one exited the questionnaire prior to consenting. In total, 16 participants were interviewed.

Pseudonyms were assigned to protect participants' identities. Thirteen of the participants were female and three were male. All but two participants identified as white/European American and two identified as Asian/Asian American (see Table 1).

Table 1

Participant Identifiers

Participant pseudonym	Sex	Age	Race/ Ethnicity
Alexandra	F	30*	W/EA
Amanda	F	49	W/EA
April	F	39	W/EA
Barbara	F	48	W/EA
Brenda	F	49	W/EA
Carl	M	65	W/EA
Cindy	F	55	W/EA
Gina	F	48	W/EA
Kevin	M	50	W/EA
Lisa	F	51	W/EA
Putri	F	39	A/AA
Rebecca	F	31	W/EA
Susan	F	60	W/EA
Tianyi	F	50	A/AA
Troy	M	45	W/EA
Wendy	F	52	W/EA

Note. *30-something, W/EA (White/European American), A/AA (Asian/Asian American)

Participants had experience teaching in three of the Carnegie regions in the United States with eight participants teaching at an R1, seven participants teaching at an R2, and one participant teaching at an M2 (CCIHE, n.d.). They also coordinated a variety of credentialed and non-credentialed programs (see Table 2).

Table 2

Participant Institutional Identifiers

Participant pseudonym	Faculty position	Time in higher ed	Time in current position	Carnegie classi-fication	Carnegie region	Time as PC/Dir	Program coordinated
Alexandra	Tenure-equiv admin	12 yrs	2 yrs	R1	SW	5 yrs	Other
Amanda	NTT	21 yrs	13 yrs	R1	SW	8 yrs	Other
April	NTT	2 yrs	2 yrs	R2	SE	2 yrs	M, End, Cert
Barbara	TT	20 yrs	20 yrs	R1	SE	4 yrs	M, Doc
Brenda	Tenured	27 yrs	11 yrs	R2	SE	4 yrs	M, Cert
Carl	Tenured	45 yrs	7 yrs	R1	SE	5 yrs	M
Cindy	Tenured	16 yrs	16 yrs	M2	TP	8 yrs	Min, B, M, Cert
Gina	Tenured	22 yrs	8 yrs	R2	SE	On/off for 15 yrs	B, M
Kevin	Tenured	30 yrs	18 yrs	R1	SW	2 yrs	Min, Cert, Doc
Lisa	NTT	18 yrs	8 yrs	R2	SE	7 yrs	M, Cert
Putri	TT	4 yrs	4 yrs	R2	SE	3 yrs	M, End
Rebecca	NTT	7 yrs	5 yrs	R2	SE	4 mos	M, Cert
Susan	Tenured	22 yrs	15 yrs	R2	SE	8 yrs	Sp, Doc
Tianyi	NTT	2 yrs	2 yrs	R1	SE	1 yr	M, Cert, Doc
Troy	Tenured	15 yrs	7 yrs	R1	SW	2 yrs	M, Cert, Doc
Wendy	TT	17 yrs	5 yrs	R1	SE	5 yrs	M

Note. NTT (Non-tenure track), TT (Tenure-track), SW (Southwest), SE (Southeast), TP (The Plains), M (Master's), End (Endorsement), Cert (Certificate), Doc (Doctorate), Sp (Specialist), Min (Minor), B (Bachelor's)

Data Analysis

The researcher used thematic analysis to analyze the data (Braun & Clarke, 2006). Thematic analysis is a method that can be used to "identify patterns within and *across* data in relation to participants' lived experience, views and perspectives, and behavior and practices" (Clarke & Braun, 2017, p. 297). Thematic analysis was selected for this work because of its flexibility. It focuses on patterns of meaning and gives voice to the participants using a deductive or inductive approach (or both) and semantic or latent codes (or both).

For the purpose of this study, the researcher used an inductive (data-driven) approach and followed the six phases of thematic analysis from Braun and Clarke (2006). As part of data familiarization, interview transcripts were checked thoroughly, de-identified, and reviewed again. Initial codes were generated through two cycles of open coding; potential themes were generated and then reviewed against the coded data and the data set of interviews, and refined. The themes were then defined and named. Finally, examples from the data set were selected and then the report was written (Clarke & Braun, 2017).

Findings

The study sought to explore the roles and responsibilities of online program coordinators and the support they receive and need. The findings are described based on the two research questions.

RQ 1: What Are the Roles and Responsibilities of Online Program Coordinators?

All the participants described a range of responsibilities for their role as an online program coordinator. In many cases, there was ambiguity about what was included in the role because a formal job description did not exist. Tianyi stated that she was told her job duties were "it's everything...you'll get it when you get hands on what are the things you need to do."

Troy stated that he was not aware of what was involved in the work prior to stepping into the role. He shared, "That was the kind of granular curricular work I wasn't expecting to do…You can only appreciate [it] if you've done it. Like, you describe it to other people, and you sound like you're unwell."

In the following section, the following six themes are presented: enrollment management, curriculum and program infrastructure, faculty support, student support, personnel-related tasks, and "other duties as assigned." Each will be discussed in the following subsections.

Enrollment Management

Enrollment management played a large role in online program coordinators' job duties. It encompasses tasks such as recruitment and marketing for prospective students, retention for current students, and assessment and accreditation reporting for the institution and regional accreditors.

Many of the participants spoke about their role with recruitment. April hosts virtual information sessions that can take place either weekly or monthly. She shared, "Recruitment is a big part of my role and I host monthly information sessions…I work with another department to create the ads, and when those ads are running, I do information sessions every week to help with that recruitment." For Barbara, recruitment also involved in-person recruiting. She said, "If we go to a conference, then I'm the one sitting at the table."

Some other participants were heavily involved in the marketing and social media for their programs. Tianyi said that she designed the flyers and was responsible for marketing and social media. She shared, "I put together the project plan, like considering what kind of promotional channels I could use, like the Facebook groups, and then what kind of email listserv I could use, and things like that."

Participants also discussed their roles in the admissions process for their programs, which included working with the applicant to ensure their application is complete or making admission decisions. Brenda shared,

> I help students get their packets together…If they have questions about letters of reference or their statement of purpose, I answer those. I try to meet with, either via Zoom or phone or in person, every applicant ahead of time.

Lisa discussed being responsible for making admission decisions year-round. She stated, "I do all the admissions and rejections…I'm typically the sole person making admit, denying decisions for my programs. And we do rolling admissions…So, I'm doing that all year – summer, spring, fall."

Program coordinators may also be responsible for course scheduling and monitoring enrollment numbers, which requires ongoing work throughout the year. Putri shared,

> I have three different cohorts that are taking three different programs of study right now…so it's a lot to juggle right now, deciding how many course sections need to be open, and then what cohort takes what course, what course sections, how is this communicated to the students, to other program coordinators, so their students are not in my sections, [what] instructors are going to teach the courses.

Troy also spoke about course scheduling and finding faculty to teach the courses. He stated,

> Probably the biggest headache I have right now is just trying to figure out what needs to be taught when and by whom, and then, invariably, what am I going to do when, you know, turnover [of faculty]. Thankfully it slowed. But yeah, every spring is like, who am I going to get an email from?

Both Kevin and Brenda discussed developing a manual system for enrollment management. Kevin stated that he developed surveys to determine what classes were needed by students. He shared,

> One of our other issues is that students were not getting the classes that they wanted, and they didn't know far enough ahead that they could switch things over, and they would get very angry. This way I can head that off by cancelling classes earlier.

Brenda shared that she creates her own spreadsheet to track active, inactive, and potential students. “I have my own special enrollment strategy that is time intensive and not probably smart health-wise for me.”

Accreditation and reporting was another major responsibility for many participants and an area where participants talked about having difficulty. Susan shared, “That’s been the toughest part of the job for me to get a handle on actually. Because we have the two tracks, I actually have two different reporting duties.” April and Troy spoke about not receiving a lot of guidance on the reporting process. April shared,

> None of that had been done in our program before. So, I kind of got handed a template that you have to fill out. And then I was like, “we don’t have any of this data.” So, a large part of my first two years here has been trying to figure out what do we actually need to do.

Troy said,

> You’re sort of inheriting things, and my predecessor did a good job, I think, of making do with what was available. But now…[I’m] trying to think about more appropriate methods or principles, like, you know, what data should be reflective of this or that?

Kevin noted that his responsibility with the accreditation report shifted from the department chair to him. He shared,

> I have to write the annual accreditation report, which didn’t used to be the responsibility of the [program] director. It used to just be the department chair, but they have now delegated that, which is probably better, because I review all of them.

<u>Curriculum and Program Infrastructure</u>

Most of the participants spoke about their role with overseeing the curriculum; however, those responsibilities varied from being fully in charge to not having authority over making changes. Alexandra shared that her program had multiple courses with a shared curriculum.

> I’m in charge of developing, maintaining, updating, revising all of those things, distributing, making sure everything goes smoothly by overseeing the policies that kind of govern how instructors use these courses…so, everything from developing new assignments or introducing a new digital tool.

Both Carl and Amanda stated that they had significant responsibilities with curriculum decisions. Carl shared that any changes to the curriculum required the department faculty vote, but “the responsibility for thinking about whether our curriculum is meeting the needs of our audience, and you know, helping them prepare for contemporary practice and future practice, and all those sorts of questions, that’s largely my impetus.” Amanda shared “I am the decider about curriculum. I ultimately make decisions about how we change the curriculum.”

Wendy noted that she was solely responsible for updating every course in her program. She shared,

> I have to prep the courses for adjuncts because we don't pay adjuncts for prep, we only pay them to facilitate the course. So, all the course content for my courses, plus adjuncts. Sometimes I'm prepping upwards of eight to nine courses a semester at the beginning of each semester for these courses to go.

However, in other cases, the online program coordinator may not be responsible for curriculum revisions. Tianyi spoke about some confusion about who should make revisions. She shared, "That is not clear. I still don't know what the process is, what the decision tree is. I have no idea." Rebecca noted that curriculum was not part of her job responsibility because she was not the subject matter expert. She stated, "I am not qualified to make curriculum decisions. I am here to inform from an advising and course sequencing standpoint, but I'm ultimately not going to make decisions about course content."

Curriculum responsibilities may also include supervising capstone projects, portfolios, and internships, developing comprehensive or qualifying exams, and hosting in-person residencies. Lisa shared, "We do have a required internship and our required student capstone project, where they have to complete the project and present at the conclusion of the class to a committee…I chair them all. Last semester, I had 17." Kevin was additionally responsible for the logistics of planning the annual multi-day residency for his program. He stated, "So, I have to plan that conference, which is a full blown 12-15 hour-a-day conference. And we have speakers and all sorts of activities and events and everything else this year."

In many cases, program coordinators had to establish and maintain partnerships with outside partners for advisory boards, guest speakers for professional development, and internships for students. April shared, "I'm trying to bring in local businesses and non-profits to have projects in our work. So, I do some networking and meeting with folks around that idea." Barbara shared that she had outside guest speakers. "I invite speakers, and I invite students to attend these different programs, and they're all online, because it's an online program. But to get students to actually participate is exhausting."

Supporting the curriculum and program infrastructure may also include developing policies and creating handbooks and other documentation. Troy shared,

> One of the things I've been responsible for is sort or writing or updating and revising [the grad student handbook], or how that process is described and the guidance that we provide students in the handbook. So, at the policy level, I'm kind of coordinating our discussions.

<u>Faculty Support</u>

Providing faculty support in some capacity is another responsibility for many online program coordinators. However, this level of support varied across participants. Susan spoke of sending out a newsletter to all the program faculty to keep them informed. "I like to think I am [providing support to faculty], but I think I can do better there. I think the newsletter helps." Rebecca supported faculty by "offloading a lot of those responsibilities in order to free them up to do the teaching and the research that they want and the mentorship that they want to do…I'm hoping my role is like freeing people up."

For programs that had adjunct faculty or contingent faculty, the online program coordinator may also be involved in supporting those faculty. Alexandra and Amanda provided support that was intended to directly benefit the adjunct faculty. Alexandra shared that her responsibility was,

> mostly just preparing them for teaching online…We have weekly meetings…where we come together, discuss recent ideas, topics in [our field], share concerns, or any current updates, share ideas and strategies, any sort of issue of the day or whatever, technical issues, curriculum questions.

Similarly, Amanda shared that she hosts virtual brown bag sessions twice a year for professional development. "I see my job as really about making sure that I'm translating to them where the field is at in terms of best practices."

<u>Student Support</u>

Participants spoke about the various ways in which they offer student support. Often, this was through advising or building community within the online program. Gina shared that she was building an onboarding system for students,

> I've got a series this week and next week of advising where I say, "take these classes" and [it] could be an email, but we're going to onboard because we still want high touch. So, high touch it is and it works…Do it up front, and it'll be great for the long run…I have some ideas on how to consistently do that to reduce my workload, which is the ultimate when you find that synthesis in the system.

Brenda spoke about being the primary contact for students so she can help direct them to the appropriate contact. She shared,

> Once they get accepted to the graduate college and we accept them to the program, I say, "I'm the person you ask the questions of, I might not be able to answer them, but I can tell you where to go."

Rebecca stated that she does all the advising for the program. She shared, "The only reason I would refer a student to a faculty member is if it is a subject matter expertise situation…but everything is with me centralized for the purpose of consistency." Cindy shared that she used to be responsible for all the advising but was not able to continue because of the workload.

> I had 100+ advisees, all in different programs that I had to meet with every semester. At the end of last semester, I went to the head of the department. I was like, "five years is

> enough, I cannot continue this. I'm finished." And so, I have trained someone over this summer to do that job.

Many participants spoke about being involved in building an online community for students through hosting a webinar, sharing information through a newsletter, or having students follow a cohort-model. Susan discussed the importance of building a community for online students. She stated, "For online [students] who are distributed, I can only imagine that it feels much more isolating. So, I think that that community building piece is really important."

Student support may also be through finding graduate assistantships for students. However, in Wendy's case, offering those graduate assistantships means she is taking on additional workload to have them funded by a different office. She shared,

> I'm responsible for upkeep of our graduate assistant program. And in order to get graduate assistant program money, I have to do some volunteer work across campus for our student affairs program…throughout the year. And in exchange for that, I can get a 20-hour a week job that pays about $1000 a month stipend.

<u>Personnel-Related Responsibilities</u>

Several of the programs had adjunct faculty and the program coordinators had some level of personnel-related responsibilities. However, that responsibility varied. In some cases, they were only responsible for providing recommendations on adjunct faculty hiring. Both Putri and Tianyi discussed being included in the conversations, but they were not making decisions. Putri shared, "When I need [an] instructor for different course sections, usually [the] department chair will ask, 'who do you think is a good fit to teach this course?'" Tianyi was sometimes included in the conversation with the other program faculty, but it was not consistent. She shared, "Sometimes, they [other faculty] would loop me in, in the email. Sometimes…I was engaged in the conversation…and then if there's any meetings, then I would join." In other cases, participants were much more involved in the hiring process. Lisa shared,

> I'm the hiring manager, I guess you would want to say. I choose who those people are going to be. Of course, they get vetted through the department and through the graduate school before it's official that they are teaching with us.

Amanda spoke about being responsible for personnel-related duties outside of the hiring process. She shared,

> There's other things personnel-related, like when somebody's spouse dies or child. I've had people lose like very close family members, and then, trying to think, figure out what resources are available when a faculty member has a health issue or some other issue come up…I've had to fire people, like not renew their contracts. I've had to have hard conversations with people about their performance.

Gina noted that she had to have a difficult conversation with an adjunct who received poor teaching evaluations. She stated, "I know that it will fall on me, even though it's not my role. This is the like, what we're expected to do versus what we really do situation."

<u>“Other Duties as Assigned”</u>

Online program coordinators may also be responsible for taking on additional duties. Barbara shared, “I get put on several committees that [admin] see is tangential to my work…And so there are other things that enveloped in the role as [program coordinator], just because of, I see the big picture of all of the programs.” As a solo faculty member and program coordinator, Wendy had to take on all the assigned duties without being able to delegate them. She shared,

> I’m drowning in “other duties as assigned,” and “oh, you’re the program coordinator, so you should take care of that.” At some point, you need to recognize that I am the program coordinator, but unlike other program directors and coordinators, I have no one to help share that work with. I’m directing no one to help take over that, like I’m doing the whole kit and caboodle.

RQ 2: What Kinds of Support Do Online Program Coordinators Receive for Their Role and What Support Do They Need?

In the following section, three themes are presented: it’s meeting my support needs, it’s not meeting my support needs, and where I need support. Each of these will be further discussed.

<u>It’s Meeting My Support Needs</u>

There were different types of support that met the participants’ needs. Sometimes it was having emotional support or having an additional person or office take on the responsibility or for having a reduction in other workload responsibilities.

Emotional Support. Receiving emotional support can come from different sources, including colleagues, administrators, and other program coordinators. Gina shared, “I have amazing colleagues…they are very helpful for conversations on how to move work forward.”

Both Alexandra and Carl discussed receiving emotional support from administrators. Alexandra shared that she feels support from “understanding from higher admins that online courses are different from face-to-face courses.” Carl noted that he feels appreciated by his colleagues and Dean because of how they speak about online programs. He said,

> The one thing I can say is that I know from my colleagues, and I know from my Dean, that they genuinely value the online programs, that they see them as important...And I know that because, like the Dean will talk about that in big public settings. And, you know, that messaging is important to me. It’s also important to our students.

Sometimes the support comes from talking to others in similar positions. Susan, Lisa, and Tianyi all attend a program coordinator meeting at their institutions. Susan shared that as a program coordinator she attends both a campus-wide graduate program coordinator meeting and a doctoral program council meeting. She stated, “It’s been a nice communication channel, I think, to learn about what’s coming down the pike, and to perhaps provide some feedback or ideas for what should come down the pike.” Susan also shared that there is a college-wide program coordinator meeting as well. “We’ve re-written the [College] handbook for doctoral students. And it's been good to have discussions around well, 'what do y'all do?' 'what do y'all do?' And that's been a supportive network as well."

Lisa shared that she attends a program coordinator meeting at both the college and university levels. "So, there is a group that you have access to for support that do the same job that you do. And that's helpful at times to be able to talk to people that have similar functions."

Sharing the Workload. Sometimes the support comes from having another person such as other faculty or an assistant to share the workload. Cindy shared,

> The workload, it's okay, because I do feel like I have some fabulous faculty that I work with. And whenever we get together, and we sit in a room and talk to each other, we can get some things done…I feel like my job is to drive the bus and just make sure everybody's doing what needs to be done. I don't have to think of it all myself.

Putri shared, "I also have a program assistant who helped me revamp a course."

Sometimes an institution has centralized services across campus such as marketing and communication, instructional design, assessment, and a graduate school, where professional staff have expertise in a particular area and can complete the work more effectively and efficiently. Rebecca, Barbara, and Amanda spoke about how they were receiving support from various institutional offices. Rebecca shared, "So, we have a person who manages our website, managing marketing and social media within the [college]." Barbara also shared having support for marketing and outreach. "They actually push out our programs on platforms that sometimes I'm not even aware of, which I think is helpful, because they're reaching people that I would otherwise just not have the bandwidth to reach." Amanda shared that her online college has provided additional support in various ways, such as "helping with ramping up the amount of instructional design…data support, like trying to help provide more support with enrollment planning."

Barbara stated that the centralized graduate studies office within the school is helpful for keeping student records and reducing some of her workload so she can focus on other tasks. She shared, "And that's helpful, because that's where I get a little aggravated. I could be doing a whole slew of other things, but I'm filing forms. They have graduate assistants that can help with that process."

Incentives for the Work. Several participants received incentives in the form of a reduction in the workload, either with teaching or with other service obligations, in order to have time to be able to address all the online program coordinator tasks. Some participants also spoke about receiving a stipend.

Putri shared, "I get a course release [for fall and spring], but I also, in the past, had to fight for it, and it could be taken any moment…We get a stipend [for summer]." Brenda noted that other service requirements have been reduced. She shared,

> I don't do a lot of service outside the department, because we had about three years where [former chair] and I wrestled with the amount of service I was doing outside of the department in addition to the graduate coordinator role.

Alexandra has both a reduction in workload and an assistant director. "I have 1-1 teaching. I have an assistant director, which helps a lot. It's kind of a very limited time position, I want to say, but it's something."

<u>It's Not Meeting My Support Needs</u>

Participants spoke about receiving support that was not effective. Brenda shared that sometimes the support that is in place is not useful (or accurate). She said, "We have data systems…I can pull who are active students. It's not accurate…[so] I make my own spreadsheets."

Gina and Wendy both shared that there may be support offered from another person, but it may not be very effective for a variety of reasons. Gina said,

> I, until this year, have been a co [online program coordinator]. So, our roles and responsibilities were divvied by time, not by task, so that meant, like we alternated semesters…and that proved to be complicated in terms of consistency and oversight and style.

Wendy noted that there is a graduate assistant available in the department that can be shared across programs. However, it was not very beneficial. She shared,

> Their first job is to take care of things for the department. So, rarely, are they free to do anything. And then when I do have them to work with, I have them for like 30 minutes to an hour. And so, it's not like I can accomplish a whole lot because it'll take me that long to sit down and catch you up on why we're doing this process and how the process needs to be done. And by the time you're ready to start the work, your time with me is up, you gotta go someplace else.

Susan discussed doing the work herself but chose not to. She shared, "I could lean on [administrative assistant] for stuff if I wanted to…But I do try to do now as much of that for myself as I can, just because it's almost easier."

<u>Where I Actually Need Support</u>

Every participant spoke about needing additional support in some capacity, either from having administrators recognize the workload that went into being an online program coordinator and receiving support from them, receiving appropriate compensation, having additional resources, or receiving training and mentoring for the role.

Recognizing the Workload. In most cases, participants wanted administrators to recognize the amount of workload that was involved in being an online program coordinator, often a full-time job in itself. This was the case for Kevin who was trying to justify having a graduate assistant due to the 80 hours a week that he was working. Before the COVID-19 pandemic, every program coordinator had a graduate assistant. After the pandemic, those graduate assistant positions were cut. He shared,

> When you're arguing to someone, "hey, this is an obscene amount of time" to someone who's never done the job, it's challenging. But, then I show them my calendar, and everything on the calendar for the [program] is [color-coded]. And they see that most of my week is taken up with [color] from 8 o'clock in the morning until 10 o'clock at night, it's a little harder to argue with.

Gina and Carl described not having enough time to complete all the tasks, which often led to the work not being done. Gina said, "I do not have sufficient resources to accomplish all the tasks that I'd like to, so it becomes what's on fire." Carl shared,

> I wish we had people to do that [social media]. We don't. So, what happens is, there are a number of us [faculty] that are varying degrees of active on social media. And so, we use our personal accounts to push messaging…We have these meetings about twice a year where we're all wringing our hands to talk about how important marketing and social media is, and then none of us has the time to do it.

Other participants spoke about having to juggle their coordinator duties with their other faculty responsibilities. Barbara shared, "If being a [program coordinator] was my sole job, I could come up with lots of things, update it, keep it fresh, and what have you. But you know, I'm teaching class and research[ing] and writing."

Cindy and Putri shared their concerns about the workload impact on earning tenure and promotion. Cindy became a program coordinator at the beginning of her third year as a tenure-track faculty. She shared,

> I was junior faculty, which made it very difficult for me to meet all the requirements for tenure and promotion. I was able to do that, but I was forever having other people say "you need to be protecting your calendar better. You shouldn't be doing as much as you're doing as junior faculty."

Putri echoed this concern. She shared, "We know that service is not what is gonna get us promoted and tenured."

Almost all the participants shared that they did not have a formal review process, but they wanted one. In most cases, their role as an online program coordinator was not seen as a separate role but was tied in with their overall faculty review process. Lisa shared,

> I wouldn't be opposed to it because I do know of other program directors or program coordinators that aren't as involved in the multiple roles that I do for their programs…I think that would help consistency for the role across the university and the college. Maybe would raise the bar a little bit for the role.

Tianyi shared, "If there could be a solid reviewing process, then we could sit down and have a clearer overview, or review of what's put in there and then [discuss] is the workload fair."

In addition, several participants commented on the lack of authority they had despite being in an administrative position as an online program coordinator. Rebecca shared,

> I am a little concerned about the fact that my title is now "coordinator" instead of "director." I do think internally that's not an issue, but if we start looking externally, and like people listening to me, that's an issue.

Amanda spoke about the role of online program coordinator being included in more strategic conversations. She wanted support and more information from administrators for "long-term planning, strategies, growth to meet, you know, how are we going to grow to meet demand? How are we gonna balance these things?"

Administrators may not be addressing the bigger issues that online program coordinators need. Wendy wanted more support from administrators than just a check-in on enrollment management. She shared,

> I have check-ins where somebody comes along and says "just checking in, how are things going? You doing okay? Could you provide your numbers for us? Looks like you're down a little bit this semester, you think you get more by the end? Okay, thanks for the update." So, I get check-ins. I don't get support, and I think that's problematic.

Receiving Compensation for the Work. There was no consistency across all participants in terms of what they received (if anything) for compensation. Several participants spoke about the role being year-round, although that does not fit into a typical nine-month contract. This off-contract work may or may not be compensated financially. Brenda shared,

> I have a ten-and-a-half month contract instead of a nine-month contract…and it should be a 12-month contract because it's not like grad students go away that other month and a half [during the summer]. And I fought for that to be a 12-month position, but [administration] don't seem very open to that. So, this year for the first time…I did not do work while I was off-contract.

April shared,

> I'm on a nine-month contract, which is often extended to a 10-month contract. For program coordinators, we get that extra month, usually it's just not promised…Because our students are still applying and the applications are not done, they need advising when they're getting onboarded… So, I'm paid for May, and then June and July technically not [paid] unless I'm teaching. But of course, I continue to do all of our students work, at the very least.

Cindy shared, "I don't get a course release. I don't get a stipend. I get to put it in my signature on my email. I get the title 'coordinator,' but coordinators don't get any kind of compensation for anything."

Additional Resources Needed. Several participants spoke about wanting additional resources, both in terms of financial resources or additional personnel. Carl and Lisa spoke about wanting resources for their program but not necessarily needing it for themselves personally. Carl shared that he wanted to be able to support students attending conferences. He said,

> I wish I had money to help my students get out to conferences because we always make the assumption that their home departments wherever they work, because they're all working professionals, that their home departments are going to take care of this. But my experience is they don't always.

Carl also shared that he wanted more money for marketing. "I think there's a story to be told that would help us bring more students and, but also, that could help other institutions that want to build successful online programs learn how to do that." Lisa shared,

> I think to have a successful program, and what I've been wanting support in, is additional faculty and software. And so, the program quality can be better, not just bigger. And sometimes I feel like it's quantity over quality that's supported.

Cindy and Amanda wanted more transparency with the budget. Cindy wanted to purchase gift cards for her online students and then all meet synchronously together with the beverage or food that students purchased with the gift cards. She shared,

> I feel like the budget thing is kind of a big deal. I never have any idea what might be approved and what might not be approved and what could I do. So, I would dream differently if I knew what my limits were.

Amanda also wanted more "transparency around [the] budget, and what we could do and what we can't."

Alexandra wanted more on-going instructional support for faculty teaching online classes. She shared,

> If you're developing a new course, we'll hook you up with instructional designers. But, once [the course is] developed…I feel like there could be more of instructional support for maintenance updates…and working regularly with instructional designers or with specialists who are in charge of our technology that's provided whether it's LMS or any of the external learning tools that the university purchases.

In some cases, participants wanted to be able to focus on the bigger picture of supporting their programs and have someone else to do some of the other day-to-day tasks. Kevin shared that he would like support from people, "because I'm not really directing. I am doing pure operations, management, and day-to-day staff type work, which, as a full professor trying to juggle everything, is not fun."

Lisa echoed this as well. "Anything that could create more time for me to dedicate to the important things that I think are for teaching and being program director and things that are less, you know, administrative tasks." Amanda shared that she would like some administrative support for scheduling, in particular.

> I don't want to schedule anymore. I should be doing big picture stuff, right. And then I get bogged down in these little tasks. I want to give the scheduling to other people to do, so I can do other things.

Onboarding and Mentoring for the Role. Many online program coordinators were not prepared for the roles they had been given or taken on because no one had provided them with a clear expectation of what they would be doing. April, Troy, Susan, and Putri spoke about having onboarding for the role. April noted wanting to know about the overall structure of the different offices and systems at the institution. She shared,

> I found that probably the most challenging thing to really figure out are the systems and who's in charge of each of them, and what things you can do within each of those… There's no onboarding that kind of explains these different systems, and all the different technologies and reporting softwares that we have….It's all trial and error or orally passed on.

Troy started his online program coordinator position during application season. He shared,

> My first thing out of the gate was applications will be here. And so, they had just switched the system by which those things came. There was no training to the support point. I kept asking, like "how do I learn to use this?" They're like "ah, you just click around."

Susan shared she wanted more support with accreditation and reporting. She stated, "I think I would have liked…a little more support for figuring out the accreditation piece or the reporting piece for data… It took me a long time to figure out how best to do that process." Putri also shared about reporting, "I think that needs to be a more structured support in terms of completing reports."

Wendy and Tianyi spoke specifically about wanting a mentor to be able to transition into the role and have ongoing support. Wendy shared that she "would have loved to have someone to come in to mentor. I would have loved to have some of the processes already defined for me." Tianyi echoed this. "I think it would be ideal if there could be a mentor and then a transitioning period."

Discussion

The findings show that online program coordinators are not being effectively socialized into the online program coordinator role (Richards, 2015). They do not have a clear definition of their role and do not have a formalized job description, which was consistent with prior research (Rost & Hover, 2022). The variety of job responsibilities was also consistent with prior research (Coleman & Reames, 2020; Hackmann & Wanat, 2008, 2016; Ingle et al., 2020; Ingle et al., 2018; Olt et al., 2026; Shelton et al., 2025). Additionally, there was a lack of consistency of the level of involvement from some program coordinators with any given task. The lack of clear expectations for the role and a formal review process to assess the online program coordinator's performance indicates that online program coordinators are working with a high-level of role ambiguity (Richards, 2015).

Some online program coordinators were receiving support in various areas, but it was not always clear about who was responsible for what task. In many cases, the support was not what the online program coordinators needed. They are suffering from role overload (Richards, 2015), sometimes more than doubling what they would be doing as faculty who are not also working as online program coordinators. Administrators did not seem to be aware of how much work is involved in the actual job duties, which was also a point of frustration for many of the participants. This lack of time to complete their responsibilities is problematic as they are focusing on program-related tasks that could be completed under a centralized office or by a staff person, while also being responsible for their faculty workload (Ingle et al., 2020).

Several participants spoke about having to navigate their role as an online program coordinator with their role as a faculty member. The expectations of the role promote role conflict (Richards, 2015) because the work conflicts with the expectations of being a faculty member who is responsible for teaching (and research and service, depending on the specific faculty role), with research having the most negative impact (Shelton et al., 2025). As Bieber et al. (2024) noted, this is why some faculty specifically avoid doing program coordination.

Institutions of higher education have onboarding programs or mentoring for new employees, early-career faculty, and often department chairs. However, for the participants, there was no onboarding for their online program coordinator roles. In many cases, online program coordinators were left to their own devices to perform the tasks with little to no help. Most faculty are not prepared to be in an online program coordinator role, nor do they have expertise or even basic knowledge in areas like enrollment management, accreditation, social media and marketing, recruiting, admissions processes, and hiring processes. However, they are expected to be able to work in each of these areas effectively and efficiently.

The online program coordinator role is vital to student success and wellbeing (Taylor et al., 2023) and online program quality (Shelton et al., 2025). However, it should receive the recognition that it is due. If online program coordinators who are also in faculty positions are to remain in these positions, they also need support to accomplish the tasks. Moreover, the compensation either through a course release or stipend sometimes is not worth the amount of work when the workload itself is more than a full-time job.

Limitations

This study had participants from predominantly humanities and social science disciplines. Additional research could be conducted from other disciplines, including business and STEM-focused.

Implications for Practice

Based on the findings, there are five suggestions for practice. First, administrators need to be much more aware of the workload that online program coordinators are taking on. Much of the work is invisible labor because online program coordinators and administrators are not tracking all the duties that require year-round work. Because of the online nature of the work, online program coordinators do not just work traditional business hours. They are constantly engaging during the evenings and weekends to meet the needs of online students who may be across time zones or working full-time positions and need support after business hours (Earnshaw & Bodine Al-Sharif, 2024). This is impacting their other academic duties. Second, having a formal annual review process in place to determine what work is being done by online program coordinators is critical. In addition to an annual review, regular meetings should be taking place to discuss the workload. Third, re-thinking the role of online program coordinators and providing effective support for them is critical. There are centralized services across campus which could help reduce the load for online program coordinators who are doing staff-related roles such as admissions processing, marketing, and social media development. Fourth, online program coordinators need to have formal onboarding and mentoring. Introducing online program coordinators to systems, policies, and procedures would help with efficiency. Finally, there should be discussions happening across campus for online program coordinators. Having larger conversations about the roles and responsibilities would be beneficial. This would also help to determine what support infrastructure is already in place and what is needed.

Implications for Research

Additional research is needed across institutions and disciplines. There is a lot of inconsistency about what an online program coordinator is responsible for. Much like how department chairs have a general job description, an online program coordinator should have a general job description as well. Another area for research could be interviewing administrators who oversee online programs to determine what support is being provided to online program coordinators.

Conclusion

The purpose of the research was to explore the roles and responsibilities of online program coordinators and the support they receive and need. The research suggests that there are a multitude of responsibilities that online program coordinators undertake, sometimes without any assistance or guidance, which contributes to a very heavy workload. These responsibilities are in addition to their faculty positions that are already demanding. Administrators need to be aware of this workload and help to offload some of the work and put infrastructures in place.

Declarations

Ethics Statement
This study was conducted in accordance with recognized ethical standards. Informed consent was obtained from all participants, and data were collected and reported with respect for confidentiality and anonymity.

The study protocol was reviewed and approved by the Institutional Review Board of Kennesaw State University, Approval No. IRB-FY24-625.

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References

Biddle, B. J. (1979). *Role theory: Expectations, identities, and behaviors*. Elsevier.

Bieber, J., Jan, S., & Mirakhur, Z. (2024). Examining role strain among academic program coordinators. *Journal of Faculty Development, 38*(2), 39–44.

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

Carnegie Classification of Institutions of Higher Education. (n.d.). *About Carnegie Classification*. https://carnegieclassifications.acenet.edu

Clarke, V., & Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology, 12*(3), 297–298. https://doi.org/10.1080/17439760.2016.1262613

Coleman, L. B., & Reames, E. (2020). The role of the educational leadership program coordinator (PC) in university–K-12 school district partnership development. *Journal of Research on Leadership Education, 15*(4), 241–260. https://doi.org/10.1177/1942775118803335

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into Practice, 39*(3), 124–130. https://www.jstor.org/stable/1477543

Earnshaw, Y., & Bodine Al-Sharif, M. A. (2024). Supporting tenure-seeking faculty in online programs: A critical discourse. *Online Learning, 28*(4), 258–278. https://doi.org/10.24059/olj.v28i4.4136

Hackmann, D. G., & Malin, J. R. (2016). If you built it, will they come? Educational leadership program coordinators' perceptions of principal preparation redesign in Illinois. *International Journal of Educational Reform, 25*(4), 338–360. https://doi.org/10.1177/105678791602500401

Hackmann, D. G., & Wanat, C. L. (2008). The role of the educational leadership program coordinator: A distributed leadership perspective. *International Journal of Educational Reform*, *17*(1), 64–88. https://doi.org/10.1177/1056787908017001

Hackmann, D. G., & Wanat, C. L. (2016). Doing the work or sharing the work? The educational leadership program coordinator's role. *International Journal of Educational Reform, 25*(2), 100–124. https://doi.org/10.1177/105678791602500201

Hoey, R., & McCracken, F. (2021). Assessing faculty leadership of online programs. *Online Journal of Distance Learning Administration, 24*(2). https://ojdla.com/articles/assessing-faculty-leadership-of-online-programs

Ingle, W. K., & Marshall, J. M. (2024). Program coordination at UCEA-affiliated universities in the wake of COVID-19. In N. A. Paufler & E. H. Reames (Eds.), *Navigating the ubiquitous, misunderstood, and evolving role of the educational leadership program coordinator in higher education* (pp. 97–133). Information Age Publishing.

Ingle, W. K., Marshall, J., & Hackmann, D. (2020). The leaders of leadership presentation programs: A study of program coordinators at UCEA-member institutions. *Journal of Research on Leadership Education, 15*(2), 120–149. https://doi.org/10.1177/1942775118803334

Ingle, W. K., Worth, J. J., Marshall, J. M., & Hackmann, D. G. (2018). The incentives and costs of program coordination in P–12 educational leadership programs. *Journal of Education Finance, 44*(2), 175–198. https://doi.org/10.1353/jef.2018.a721605

Jones, K. D., & Lewis, T. (2024). Connecting the dots: Program coordinator as school-district university partnership facilitator. In N. A. Paufler & E. H. Reames (Eds.), *Navigating the ubiquitous, misunderstood, and evolving role of the educational leadership program coordinator in higher education* (pp. 17–32). Information Age Publishing.

Marshall, J. M., Ingle, W. K., & Hackmann, D. G. (2021). Roles and responsibilities of the educational leadership program coordinator in challenging times. *UCEA Review, 62*(1), 32–34.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). John Wiley & Sons.

Nguyễn, T. S. T. (2008). Peer debriefing. In L. M. Given (Ed.), *The SAGE encyclopedia of qualitative research methods* (Vol. 2, p. 604). SAGE Publications. https://doi.org/10.4135/9781412963909.n312x

Olt, P. A., Nasser, M., Vital, L. M., Tolman, S., Archibald, J. G., Bodine Al-Sharif, M. A., Brazelton, B., Carducci, R., Houdyshell, M., McMickens, T., Meixner, C., Mistretta, M., Paciej-Woodruff, A., Stevens, R., Wendle, A., & Mayo, C. E. P. (2026). Solo faculty program coordinators in student affairs-related graduate programs. *The Qualitative Report*, *31*(4), 5686–5709. https://doi.org/10.46743/2160-3715.7935

Ortega, S. (2003). Enhancing the infrastructure of graduate education: The crucial role of the Director of Graduate Studies. *Journal for Higher Education Strategists, 1*(1), 51–64.

Parkes, C., Brundson, J. J., & O’Leary, N. (2023). Influence of secondary organizational socialization on how physical education teacher program coordinators execute their administrative roles and responsibilities. *Journal of Teaching in Physical Education, 42*, 547–555. https://doi.org/10.1123/jtpe.2022-0115

Pennington, C. G. (2021). Concepts in occupational socialization theory. *Curriculum and Teaching Methodology, 4*, 1–3. https://doi.org/10.23977/curtm.2021.040101

Petersen, J. C., Chesak, L., Saunders, R. B., & Wiener, W. R. (2017). The central role of the Director of Graduate Studies: Ten years of data from a mid-sized public university. Council of Graduate Schools. *Occupational Paper Series, 5*. https://legacy.cgsnet.org/ckfinder/userfiles/files/CGS_OccPaperFeb17_CentralRole_Final.pdf

Reames, E. H. (2016). From coordination to compliance: The program coordinator's changing role during redesign. *Planning and Changing, 47*(3), 263–278.

Richards, K. A. R. (2015). Role socialization theory: The sociopolitical realities of teaching physical education. *European Physical Education Review, 21*(3), 379–393. https://doi.org/10.1177/1356336X15574367

Robinson, R. S. (2014). Purposive sampling. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 5243–5245). Springer. https://doi.org/10.1007/978-94-007-0753-5_2337

Rost, J. K., & Hover, A. (2022). Carrying bricks: Guiding pre-tenure program coordinators from survival to superstars. *Journal of Higher Education Policy and Leadership Studies, 3*(4), 118–126. https://doi.org/10.52547/johepal.3.4.118

Schwandt, T. A. (2015). *The Sage dictionary of qualitative inquiry* (4th ed.). SAGE Publications.

Shelton, L. J., Mollet, A. L., & Broido, E. (2025). "I feel like I'm seen as the homemaker for the program": Exploring higher education and student affairs program coordinator roles. *Journal of Diversity in Higher Education, 18*(Suppl 1), S651–S664. https://doi.org/10.1037/dhe0000614

Taylor, A., Milne, A., Tam, A., McGee, S., & Stirling, A. (2023). Program coordinators' support or student wellbeing in online work-integrated learning (eWIL). *International Journal of Work-Integrated Learning, 24*(2), 261–275.

Wiener, W. R., & Peterson, J. C. (2019). Strengthening the role of graduate program directors. *Innovative Higher Education, 44*, 437–451. https://doi.org/10.1007/s10755-019-09480-y

Appendix

Interview Protocol

Introduction

Thank you so much for your willingness to participate in the study. Just as a reminder, the purpose of the study is to explore the roles and responsibilities of online program coordinators and the support they need. At any point during the interview process you are welcome to refuse to answer a question or to stop the interview. Likewise, you may also choose to withdraw from the study. If you withdraw, no data that have collected from you will be utilized in the study. Do you have any questions before we begin?

Roles and Responsibilities

1. In general, how do you define your role as a program coordinator? What does that look like?

2. How did you become a program coordinator?
    a. Did the program exist? Did you contribute to its development?
    b. How long is your term as program coordinator?

3. What are your roles and responsibilities as an online program coordinator? This may include things like:
    a. Recruitment
    b. Admissions
    c. Enrollment/retention
    d. Marketing/social media
    e. Course scheduling
    f. Curriculum
    g. Exams
    h. Advising
    i. Community-building
    j. Personnel - contingent faculty
    k. Faculty support
    l. Data collection for accreditation
    m. Quality assurance

4. Is there a review process for your role as a program coordinator?
    a. If so, what does that look like?
    b. If not, would you like to have one and why?

5. What incentives do you receive as a program coordinator? (Stipends, course release, grad assistant, clerical help)

6. How does your role as a program coordinator fit into your workload and the tenure and promotion process?

Support and Developmental Needs

7. In general, how do you define support for you in this role? What does that look like?

8. What types of support do you receive as a program coordinator related to your job duties? This may include things like:
    a. Recruitment
    b. Marketing/Outreach
    c. Advisement
    d. Course scheduling
    e. Part-time faculty hiring/mentoring/assessment
    f. Curriculum development (including textbook selection)
    g. Orientation and program activities
    h. Legal
    i. Accreditation requirements/assessment and reporting requirements
    j. Financial support/budget
    k. Program assessment
    l. Are there other types of support that we have not addressed that you receive?

9. What types of support would you like to have a program coordinator?

Wrap-up

10. Is there any information that you would like to provide that we have not asked for that you think would be pertinent to this discussion?

Beyond the Thread: Reimagining Online Discussions for Authentic Learning

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Abstract
Traditional threaded discussion boards have become a staple of online education, yet faculty and students both report dissatisfaction and frustration with their capacity to foster intellectual engagement. This collaborative self-study examined the perceptions of five graduate faculty members at two Texas universities who transitioned from threaded to collaborative discussion formats in their fully online programs. Using reflective practice and regular collaborative meetings as the primary methods, the researchers documented their experiences across multiple semesters of implementation. Utilizing the Community of Inquiry (CoI) framework of encompassing social, cognitive, and teaching presence, the study explored faculty perceptions of learning outcomes, student engagement, and participation quality. Findings revealed that collaborative discussions, in which students selected their own platforms, meeting times, and conversational approaches in smaller groups, produced deeper critical thinking, stronger relational development among peers, and greater student ownership of the learning process compared to traditional threaded discussions. Faculty consistently described threaded discussions as performative and compliance-driven whereas collaborative formats encouraged authentic dialogue, higher-order thinking, and real-world application of course content. Iterative refinement was necessary to address challenges such as citation accountability, participation balance, and scheduling logistics. The study concludes that carefully scaffolded collaborative discussion formats offer a promising alternative to traditional threaded discussions, particularly in graduate-level online programs. Researchers included implications for instructional design, faculty professional development, and future research directions.

Keywords: Collaborative online discussions; Community of Inquiry; student engagement; higher-order thinking

Johnson, D., Brown, K., Shelton, K., & Young, J. (2026). Beyond the thread: Reimagining online discussions for authentic learning. *Online Learning, 30*(3), 29-54. https://doi.org/10.24059/olj.v30i3.6269

As teaching online developed, threaded discussion boards were used to try to simulate face-to-face class discussion. Douglas et al. (2015) noted that when assessed, students felt critical of discussion boards; however, when unassessed, students felt a greater sense of collaborative sharing but did not feel critical thinking was important. Overall, especially since the COVID pandemic, discussion boards can play vital roles for student success in achieving objectives as well as increasing engagement in asynchronous classes (Kaushik, 2023; Schulz & Sandidge, 2022); however, both instructors and students are often disappointed in the results.

In this paper, we offer preliminary research for another option for online class discussions: collaborative discussions in which students, with a small group of peers, choose when and how to complete them. Lohmann and Boothe (2023) support the necessity of collaborative discussion boards for student learning but note they must include structure and student choice to be viable and educational, similar to Chou's (2012) original outline of utilizing various platforms with guidance and structure in place. This research study centers on the perceptions of five online instructors who use collaborative discussions instead of threaded discussions.

Literature Review

Student Perspectives of What Works

Student autonomy in choice of platform can assist in alleviating the frustration of having only one option. Students do perceive their learning as student-centered by addressing the needs of multiple learning styles within discussion boards when given choices (James et al., 2022, p. 12). For example, students found more emotional connections to the group as well as investing more thought into discussion boards when completing via a video chat (Milovic & Dingus, 2021). Furthermore, James et al. (2022) found that students internalized more when assisting and mentoring peers in discussion board interactions. In addition, Mohebi (2023) uncovered students' knowledge of external platforms that enhance communication, such as WhatsApp, Google Docs, Zoom, Telegram, Nearpod, Padlet, and even Twitter (now X), and their preference for these as modes of communication with peers.

Issues

Sandidge and Schultz (2024) reported that most online students found traditional discussion boards boring, with the majority of their learning coming from writing the original post and interacting with the instructor. Brunton et al. (2022) claimed discussion boards should be re-labeled, as most are question-and-response only, limiting actual discussion; however, using platforms that encourage discussion-like behavior, such as "liking" a post, creates avenues for students to discuss openly. In addition, Faulconer et al. (2022) emphasized that students exhibit lower levels of cognitive presence in traditional discussion boards. Students decrease their activity on discussion boards when only one format is used due to frustration stemming from technical issues with the platform (Irvin & Hee-Joo, 2022). Even with some choice, students do not derive value from online discussion boards without autonomy and a sense of community building through innovative formats and tools (Leow Wai Yee & Lee Cheng Ean, 2020).

Additionally, Schultz (2021) found that students did not perceive a collaborative practice or feel discussions were worth participating in unless graded and scaffolded with instructor guidance and interaction. Finally, Cooper (2022) noted that instructors belabored the amount of time needed to grade a fully text, back-and-forth style discussion while implementing a "tweet"-based style of online collaborative discussion.

Current Best Practices

Common best practices can help establish better online discussion boards that foster both discussion and collaboration. In general, one suggestion is to use different formats and form smaller groups (Kaushik, 2023). Another is to set posting timelines or dedicated time slots to complete the initial post, followed by a second dedicated time period for responses or per-response (Casebeer & Pontoriero, 2022). Hasani et al. (2022) identified two areas of best practice: group connectivity and students' knowledge gained through drawing conclusions. Both rely on instructors establishing collaborative groups as well as higher order of thinking inquiries. Groups need a framework for being selected to help in building community, then provided a framework for how to collaborate (Oyarzun & Martin, 2023). Allon et al. (2025) even attempted to use a platform that ranked student responses based on their interest and connection to the topic. Because students preferred to read and respond to innovative rather than redundant ones, this platform increased participation and engagement.

When online students actively participate in meaningful activities, they reach levels of Bloom's Taxonomy such as application, analysis, and evaluation (Kerrigan & Aghekyan, 2022). Students are more engaged when completed in an innovative format (Hamadi et al., 2023). Carr (2020) allowed students to use three online recording options, to which students responded positively, and recommended further research on expanding optional formats. Mohebi (2023) perceived discussions work best in platforms that allow for personal characteristics and voice to be shown when sharing experiences. In a study where students created audio/video posts, students perceived positive impacts such as higher engagement, creativity, and support for diverse learners (Lane, 2025). Furthermore, Shin et al. (2025) discovered that students within groups assumed leadership and support roles when students collaborate outside of a traditional structure. Student satisfaction increases with interactivity, but the medium of the discussion needs to be further considered and developed (Irvin & Hee-Joo, 2022). Payne (2021) asserted that instructors proctoring online discussions must embody a cognitive, social, and teaching presence while facilitating online discussions utilizing personalization methods such as social media, personal humor, and Socratic questioning to fully engage students.

AI Misuse

While these best practices demonstrate how intentional design can foster higher-order thinking and meaningful engagement, the growing use of artificial intelligence introduces challenges that may undermine these gains if left unexamined. In graduate-level contexts, where synthesis, critique, and original contribution are essential, the misuse of AI can shift learning from active engagement to passive completion. Students may rely on AI-generated responses in place of constructing their own ideas, limiting opportunities for deep learning and weakening critical thinking. This form of cognitive offloading reduces the development of independent reasoning and disciplinary expertise that discussion-based learning is intended to cultivate (Zawacki-Richter et al., 2019).

The use of AI also complicates traditional definitions of plagiarism and authorship. AI-generated work often appears original, yet it does not reflect the student's intellectual effort. This creates ambiguity around academic integrity and challenges the validity of assessments designed to measure learning. Kasneci et al. (2023) noted that generative AI enables the production of coherent, high-quality responses that may mask a lack of understanding. In collaborative discussions, this is particularly problematic, as authentic engagement and individual perspective are central to knowledge construction. When AI substitutes for participation, both the integrity of the learning environment and the purpose of discussion are diminished.

AI systems further present risks through hallucinations, at times, generating false or fabricated information with confidence. Graduate students may unknowingly incorporate inaccurate claims or non-existent citations into their work, which weakens both scholarly rigor and information literacy (Alkaissi & McFarlane, 2023). Despite these concerns, AI can support learning when used with intention and accountability. Ethical use includes refining grammar, organizing ideas, and serving as a tool for brainstorming rather than authorship. Students must remain responsible for verifying information and maintaining their own intellectual voice. When used in this way, AI aligns with the goals of graduate education by enhancing, rather than replacing, critical engagement.

Framework: Community of Inquiry

Garrison and Arbaugh (2007) defined the Community of Inquiry (CoI) framework as combining social presence, cognitive presence, and teaching presence in an online learning environment to establish a meaningful educational experience. The CoI framework best fits our study as we center our experiences as instructors within the collaborative discussions and reflect on the social and cognitive outcomes we perceive occurred from our students. Shea et al. (2022) pointed out the combination of the three presences as a theoretical framework for online classes aids in building and maintaining best collaborative practices. Popescu and Badea (2020), as well as Wertz (2022), added learning essence to the framework to show that social media-based instructional practices, such as innovative discussion boards, enhanced online learning environments, as long as the learning was authentic, collaborative, and complex. The learning essence in combination with the three original dimensions from Garrison form a framework to outline our own experiences with assigning our version of collaborative online discussions rather than traditional discussions.

Social

The social presence of the framework outlines students' interactions within an online learning environment (Garrison & Arbaugh, 2007). The framework outlines social presence being fostered through meaningful and supportive collaborative practices to enhance the online experience and increase knowledge (Rahmatalla et al., 2024). Pham et al. (2022) emphasized establishing effective and open collaboration to increase engagement and social presence. Students ascertain that social presence increases when faculty present structure, organization, and intentional design for online collaboration to be student led (Wang, Y., 2022). Furthermore, social presence occurs when collaboration shows unity and common respect during online discussions (Chandrawati et al., 2024). However, Bromer (2021) declared students will experience isolation without collaborative structures in place to ensure social connectedness. For this study, social presence included student engagement and dialogue in our collaborative discussions versus traditional online discussions.

Cognitive

The cognitive presence within the CoI framework focuses on students' perceived cognitive achievement, gains in knowledge, and higher-order thinking engagement (Martin et al., 2022). Chandrawati et al. (2024) assert cognitive presence appears when educational tasks, such as discussions, trigger enhanced processing and learning. Aslan and Turgut (2021) outlined the process of establishing higher-order thinking questions followed by reflective discussion to increase cognitive presence, which aligns with social and teacher presence. The highest level of cognitive presence only occurs during creation of the initial post (Faulconer et al., 2022). This emphasizes the importance of well-crafted questions that lead to discussion rather than recall.

Teaching Presence

Teaching presence within the COI framework is "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001, p. 5). In fact, Garrison (2019) refers to teaching presence as the "connective tissue within a functional framework" (para 1) and recommends that both facilitation and direction of the course are needed. His research supports how important the role of the online instructor is in student satisfaction. In addition, Alfoldi (2025) discovered that high instructor presence enhances cognitive, social, and learner presence in online discussion boards, with social presence being the most impacted. Overall, the literature now shows that online teaching presence is central to creating meaningful, inquiry-based learning communities online.

Quality

For the purpose of this study, we defined "participation quality" as the product produced by students due to the social and cognitive impact. Since students could communicate in various ways (voice, written, etc.), the focus was not on the quality of text but rather in the quality of content given during active collaboration within the discussion. Through CoI, constant communication in collaborative discussions showcases a composition and application of the knowledge at a higher order of thinking (Bongiwe Zulu, 2024). This aligns with the CoI framework in that our perceptions center around social, cognitive, and learning presence with our commentary as the instructors.

Gap in Literature

Milovic and Dingus (2021) conducted a study of students utilizing video to help build social bonds in an online discussion but further recommended student choice in selecting a format to address varying learning styles and student time zones. Tawalbeh and Al-husban (2023) requested further research in online discussions that analyzes student engagement to help instructors further understand best practices. Lane (2025) noted students' perceptions of various tools in a collaborative discussion but called for more research on how the tools were used collectively in the collaborative discussion process. Finally, Alsayer et al. (2025) observed a lack in the literature regarding studies covering all four elements of CoI in regard to higher-order thinking within online learning. This study hopes to address all of the gaps by allowing for student choice in format in online, collaborative discussions.

Methods

A collaborative self-study is an explorative practice of reflection on educational experience to understand how the process works for all parties involved (Nash et al., 2023). In this current and preliminary study of collaborative discussion boards, we sought to explore our practices in implementation effectiveness, student engagement, and student participation. The researchers met approximately every six weeks via TEAMS to discuss as well as write reflections of their experiences with implementing the collaborative discussion boards.

The following research questions guided the study:

RQ 1: How do online faculty members perceive the effectiveness of collaborative discussions compared to threaded discussions in achieving learning outcomes?

RQ 2: In what ways do collaborative and threaded discussion formats differ in terms of student engagement as observed by faculty?

RQ 3: In what ways do collaborative and threaded discussion formats differ in terms of participation quality as observed by faculty?

Participants

Participants for this research were five full-time professors teaching graduate courses in fully online programs. Two different institutions are represented, both in Texas. Three of the participants taught in their university's doctoral program with class sizes averaging 15-20 students covering topics such as innovation in leadership, program evaluation, and adult learning theories. Two participants taught graduate students in an applied digital learning program with class sizes averaging 20-45 students. Topics covered innovation and digital resources in education, organizational change, and assessing digital learning and instructions. In all classes, discussions were weighted between 10-20% of a student's grade. The participants had a range of experience teaching online from 4 to 26 years. All five had become unsatisfied with the results of threaded discussions.

Design

The study lasted over six months with the instructors meeting monthly to bi-monthly to discuss collaborative discussions and changes made within the assignments for the discussions. One example from the original participant can be seen outlining why the students would be completing the new discussion format and suggestions for best practices (see Appendix A); however, due to the results from the first round, this was later changed. Changes made to the assignments from the original included a set list of options based on the university Appropriate Use policy per campus, timing limits, inclusion of course material and/or research, as well as how groups were formed. Each instructor adapted the specifics to the needs of their own courses.

Results

Research Question 1

Research question 1 explored how online faculty members perceive the effectiveness of collaborative discussions compared to threaded discussions in achieving learning outcomes. Overall, all five of us consistently described threaded discussion (or forums) as producing a pattern of participation centered on assignment completion rather than meaningful dialogue. In addition, we all noted participation in traditional threaded discussions often prioritized completion of the assignment for students rather than sustained dialogue or meaningful exchange among students. In addition, all of us described a consistent pattern in which students posted their initial responses at or near the assignment deadline. Even when we implemented structures intended to encourage earlier participation, the resulting engagement often remained performative. As KB noted, "the experiences of threaded discussions in online classrooms had become performative and redundant." Long time instructor KS stated:

> I have felt like threaded discussion boards were dismal failures in really simulating class discussion. I have tried numerous things to improve them, such as requiring an initial post earlier in the week so that the discussion can begin much sooner than the last two days of the week. I have made sure as an instructor that I am engaged and trying to prompt or redirect. I have provided clear rubrics and even for my undergraduate classes, I provided a model of what an A discussion posting would look like, a B discussion, etc.

We also observed students' initial posts frequently summarized assigned readings rather than engaging with, critiquing, or connecting ideas to students' broader contexts. Responses to classmates similarly tended to consist of brief affirmations, encouragement, or agreement rather than substantive engagement with the ideas presented. As GH explained when he, himself, was a student, "I responded to my classmates on Sundays because I was simply trying to 'check the box' and complete my discussion responsibilities."

All participants perceived that threaded discussions failed to stimulate genuine intellectual engagement, despite extensive and varied scaffolding to try to achieve deeper intellectual engagement. Instead, the structural design produced compliant but shallow behavior. It was out of frustration with not observing intended student engagement results within threaded discussion boards that we began to explore other options for collaborative knowledge construction. We were inspired to experiment because of conversations with other online teaching faculty and desires for innovation.

Even with the initial use of collaborative discussions, we each noted immediate improvements that moved beyond the use of traditional text-based discussion threads, as well as affirmations from the students regarding their innovative approaches to construct new knowledge and reinforce course learning objectives. Four themes evolved in addition to remaining challenges to be addressed in emerging collaborative discussions seamlessly into online courses: depth of student thinking, relational development, student development, and iterative refinement.

Depth of Student Thinking

We all found incorporating innovative collaborative discussions in our online class consistently led to a noticeable increase in the depth of student thinking during discussions. Rather than summarizing assigned readings, students frequently connected course concepts to their personal and professional contexts, thus creating an important social presence and interpersonal accountability that produced qualitatively richer learning exchanges. Most of us also observed that collaborative discussions encouraged greater creativity in how students engaged with course material. Instead of relying on traditional threaded responses within the course shell, students often selected alternative formats such as podcasts, Padlet boards, or Canva presentations. KY observed:

> The first semester of trying this, the results seemed to be close to what we were able to do in f2f [face-to-face] meetings, if not better. Unlike the f2f discussions, some of the students in the threaded discussions included sources and would integrate outside, self-directed readings into their discussions. The other positive I saw was that all the students engaged, unlike the f2f course in which some of the more introverted or underprepared students would often sit silently while more verbose students dominated conversations; even when I set class expectations to limit domination by any one person.

Overall, we observed a shift from information recall toward deeper critical engagement with course material. Students increasingly demonstrated higher-order thinking, moving beyond summary toward analysis and application. This level of engagement is more aligned with our expectations for graduate-level learning.

Relational Development

We also noticed the development of stronger relational connections, which are often stripped away in online learning environments, among students during collaborative discussions. Conversations became more personal, reflective, and sustained than those typically observed in threaded discussion forums. Some of us reported recorded discussions occasionally extended to nearly an hour, suggesting a level of engagement that exceeded minimum participation requirements.

These relational dynamics were often reinforced as students connected course readings to their professional and personal experiences. KB explained:

> Interestingly, most students chose Zoom, which allowed them to see and hear each other and engage in genuine conversation. After reviewing the first set of discussions, I was deeply impressed. The quality of thought and connection far exceeded what I would have seen in traditional discussion boards. Students were not only building relationships but also delving more deeply into course topics and making meaningful real-world connections.

Taken together, these interactions appeared to strengthen both academic dialogue and peer relationships within the learning environment.

Student Ownership

All of us described an increase in student ownership of the discussion process. In traditional threaded discussions, instructors typically developed the discussion prompts, monitored participation, and evaluated responses. In the collaborative model, however, two of these responsibilities shifted toward students, thus restoring student agency and personal accountability. Students were responsible for determining when to meet with their discussion partners and how they would structure their conversations. For some students, this shift initially felt unfamiliar. However, we concluded students should be given flexibility on varying fronts provided their discussion remained connected to the course readings and content. Although several of us offered general guidance about possible formats, students were encouraged to approach the discussion creatively in their mode of collaboration and responses.

Iterative Refinement

As we all continued implementing collaborative discussions over multiple semesters, each of us began refining the structure of the discussion activity in response to both pedagogical and logistical considerations. Over time, we modified the collaborative discussion model in response to early implementation experiences. As both faculty and students, we adapted to the new format and introduced several adjustments to improve structure and sustainability (see Appendix A and B). For example, some of us observed that early discussions occasionally extended to nearly an hour. Although these conversations were often rich and engaging, they also required more time for the instructor to review and evaluate than traditional threaded discussions. In response, KY limited discussions to approximately 30 minutes while KB and GH suggested 20-30 minutes. KB and KS asked students to submit transcripts of their conversations so that the discussions could be reviewed more efficiently when listening to the entire recording was not feasible.

Additional refinements focused on maintaining academic accountability. KY required students to submit reading notes prior to the discussion to ensure that students continued engaging with the assigned material even when conversations were particularly dynamic. KS incorporated a post-discussion reflection to encourage deeper connections between the course content and students' personal or professional contexts. Although not every instructor adopted each of these strategies, we all described adjusting the collaborative model in response to student engagement and practical considerations. These iterative refinements allowed us to preserve the conversational strengths of the format while improving its structure and manageability.

Remaining Challenges

Despite these improvements, we also identified several ongoing challenges associated with collaborative discussions. One concern involved verifying citations during conversational discussions. When assignments required students to reference sources, several of us noted it could be difficult to confirm citations within spoken dialogue, particularly when conversations were not accompanied by written references.

Three of us also observed occasional imbalances in participation during discussions. In some cases, one student would dominate the conversation, limiting opportunities for more balanced dialogue. We addressed this issue by providing guidance about equitable participation, though the group dynamics could still influence the quality of interaction. Scheduling discussions also presented logistical challenges for some students. While asynchronous participation remained an option in some courses, synchronous conversations sometimes required students to coordinate meeting times across varying work schedules.

Finally, we all noted in the earliest iterations of the model; some conversations resembled threaded discussions in structure. Even though students were speaking with one another, discussions occasionally leaned toward summarizing course readings rather than engaging in deeper dialogue. However, we all decided these challenges represented design considerations rather than fundamental limitations of the collaborative format. We each continued refining the approach and providing guidance to students in order to minimize these issues and strengthen the quality of discussion over time. Taken together, we conclude collaborative discussions shifted the focus of participation from completing assignments toward engaging in meaningful dialogue with peers and course content.

Research Question 2

Research question 2 asked us to consider whether the collaborative discussion produced a variation in engagement from students. Three distinct themes arose from our reflections: performative tasks versus authentic communication, the depth of the communication versus breadth, and connective engagement leading to learning.

From Performative Compliance to Authentic Dialogue

Based on our findings from RQ2, the experiences of threaded discussions in online classrooms have become performative. While students were able to complete the assignments, the intended conversation dissolved into a simple question-and-answer format. However, faculty participants across varying contexts believed that the collaborative formats led to a qualitative shift in engagement.

Overwhelmingly, participants described traditional threaded discussions as feeling more like a checkbox than authentic learning or something to complete, as opposed to learning from them. KB reflected, “While most students completed the assignments, the engagement often felt performative. It became a task to check off rather than an authentic opportunity for deeper learning and reflection.” Students also internalized this as some calculated that the discussion simply was not worth their time. As DJ recalled, “In previous online classes with traditional discussion boards, there would be students who accepted zeroes but managed to pass… This indicated a lack of value for the student in completing the discussion.”

Over time, each faculty member lost confidence in threaded discussions as a vehicle for deep learning or quality dialogue. KS, drawing on decades of experience, stated, “I have been teaching online for 26 years… and I have felt like threaded discussion boards were dismal failures in really simulating class discussion.” The conclusion for many was decisive. As KY put it plainly, “I determined I was never going to do threaded discussions again.”

Depth Over Breadth

Faculty recognized traditional threaded discussions tended to spread participation thinly, prioritizing breadth of response over depth of thinking. The move to collaborative discussions changed that dynamic considerably. KB remarked that whereas students in traditional discussions “might spend ten minutes writing perfunctory responses, with the dyads they were engaging in authentic, in-depth conversations lasting up to an hour.” Most understood that this time spent with a peer meant longer, richer exchanges than a discussion board could produce.

Students also embraced the change, often in ways faculty did not anticipate. KS reflected, “I expected some resistance from the students but I actually had one student state she was so glad that I did that because the two classmates she was assigned to work with were new to her in spite of them being in a cohort for over a year.” That single detail quantifies the depth of the shift. When students are given the opportunity to hold genuine conversations instead of “talking” to a passive asynchronous audience, deeper learning can occur.

Faculty described a marked improvement in both the relational and cognitive dimensions of discussion. KB noted “the quality of thought and connection far exceeded what I would have seen in traditional discussion boards,” with students more deeply addressing course topics and making meaningful real-world connections. The intended impact of deeper engagement with both peers and content had been realized.

Human Connection as a Catalyst for Learning

The limitations of threaded discussions extended beyond logistics or design. They reflected a deeper absence of the sensory and relational cues of human conversation. KY identified this gap directly: “They can see facial expressions and hear voice inflection that is missing in the threaded discussion with written or even recorded text.” Threaded discussions could measure engagement through a rubric, but the deep conversations and learning were difficult to achieve without the relational foundation that collaborative formats provided.

What threaded discussions could not replicate, regardless of how they were designed, was the kind of connected, authentic conversation that grows from relational trust built over time. GH captured the longer arc of this: “I have watched students who likely would not have communicated with each other throughout their ten-course program and probably wouldn't have met until graduation 18 months later, come together for deep, authentic, and meaningful conversations.” That trust also carried forward because the same participant noted group members would reconnect when the next course started, having developed comfort with one another from previous sessions.

When faculty introduced collaborative formats, the effect on participation was immediate and, for many, unexpected. One faculty member observed that across six courses, they had yet to see a student not participate or engage in some manner and had not assigned a zero since implementing the collaborative format. Even among students predisposed to resist group work, the response defied expectations. As KS noted, “Many online students hate anything to do with group work. However, that was not the case. They had had a positive experience in their prior course and were willing to use the same process.” The accountability created by live, face-to-face interaction produced a qualitatively different relationship to participation and to one another.

Taken together, these observations suggest that human connection was the impetus to deeper engagement with both classmates and course material. Faculty described not simply more participation, but a different kind of participation, one grounded in relational presence rather than tacit completion. When students can see and hear one another, they engage more deeply, both intellectually and personally. GH captured this shift through the words of his students: "I received feedback from students who emailed or called me, expressing that they were initially hesitant or even disliked working in groups…but eventually found the collaborative discussion format very beneficial and thanked me for implementing it." The smaller, more intimate group, along with choice, encouraged engagement on all levels rather than a participatory mandate.

Research Question 3

Research question 3 asked how collaborative and threaded discussion formats differ in terms of participation. Three themes emerged in our shared reflections: authenticity of the engagement, student empowerment in choice, and deeper learning in the structure.

Authentic Engagement and Meaningful Conversations

When reflecting on our experiences with students' participation quality, two different themes emerged as positive concerning engagement and the enhancement in the conversations occurring. First, our notes revealed an increase in involvement on an individual student level while a second presented an increase in the meaningful conversations presented in whole-group participation quality.

Concerning individual contributions, GH noted, "I have seen students come out of their shells, so to speak, and witnessed their involvement grow from the initial class discussion to the fourth or fifth, showing a clear change in personality as they developed trust and comfort within the group." Participant KS recalled an interaction with a student after assigning groups where "I expected some resistance…but…she was so glad that I did that because the two classmates she was assigned to work with were new to her in spite of them being in a cohort for over a year." In regard to the same student and her group, KS further exclaimed, "Their first discussion transcript from their video was 29 pages long!!!" When focusing on the types of individual engagement, DJ articulated, "Reading and rating responses felt more like an educational journey with students rather than a forced and still individualized form of learning." Participant KB further corroborated this idea, noting, "Instead of discussing ideas broadly with the entire class, students would engage deeply with one partner. The goal was to move from a wide but shallow model to a deep and meaningful exchange between two learners." This correlates with Lin and Wang (2023) expressing that individual learner contribution enhances in environments of positive interaction, such as threaded discussions.

A second aspect of the interaction theme centered around the quality of group participation as a whole. Authentic engagement must go beyond individual student efforts and be grounded in group efficacy. Within this new practice, we discovered that authentic group collaboration grew naturally. Participant GH confirmed, "I have watched students who likely would not have communicated with each other throughout their…program and…come together for deep, authentic, and meaningful conversations." Additionally, Participant DJ expounded that she found herself "enthralled in the responses, noting similar precedents, fresh epiphanies, and communing where educators began to focus on solutions for each other rather than commiserating." Almahmoud et al. (2025) suggested when discussions were community based, student and group contributions enhanced learning and the quality. However, DJ did caution against groups potentially getting off topic and disclosed, “The rubric helped keep this in check to ensure students kept on task.”

Student Empowerment through Autonomy and Choice

The second theme to emerge from our reflections centered on student empowerment through collaborative discussions versus traditional discussions. One definitive area of student choice empowering students was on getting to select the online tool, while we all, based on the slight variations in requirements, noted additional areas of enablement for students.

Lohmann and Boothe (2023) explained student choice of the discussion format makes it more hands-on and personal and emulates modern social media culture. KB observed, “Interestingly, most students chose Zoom, which allowed them to see and hear each other and engage in genuine conversation.” However, KY revealed after granting choice of platform, “Some students continued to use threaded discussions, while others utilized tools provided by the university to video record their conversations or used AI tools to create professionally sounding podcasts.” Student choice in platform further encourages innovation and participation (Doss et al., 2025). KB further mentioned, “Some groups took a particularly creative approach; one created a podcast, others used interactive Canva presentations or Padlet discussions. Across all groups, the exchange of ideas was rich and dynamic.”

Beyond student selection of the discussion format, we recorded additional elements of student choice in the process. KB noticed that students looked beyond “the how” and chose “the where and when” because “They became responsible for determining when to meet, what to discuss, and how to make authentic, meaningful connections between the readings and their lived experiences.” KB’s reflections additionally reflected on timing when they “also allowed them to set their own pace with the supplementary text. They could move as quickly or slowly as they wished, if they met the established deadlines for submitting their dyad discussions.” Participant DJ expressed student choice in the responses and not just the timing showed when “students would comment in surplus with clips, but also memes and pictures, wanting to continue the conversation far beyond any requirements.” The additional effort and selection of how to respond led to discussions exploding “into a creative, think tank of educators sharing their experiences, research affirming the response, in addition to establishing group efficacy by the end of the semester.” However, KB cautioned, “At first, this freedom was unsettling for some. Many were unsure what to talk about or how to begin.” To get students excited about the new format, examples and a scaffolded introduction to the discussion were provided and would be beneficial for future classes.

Deep Learning through Structured Interactions

The third and final theme to arise from our responses centered around the depth of learning that evolved from collaborative, student-centered discussions. While much of the discussion was left to the discretion of students, we structured certain elements to ensure these remained academic, reflected best practices, and ascertained our students’ grasp of the class objectives.

As instructors, we all realized quickly that some structure had to be incorporated into the collaborative discussions, or the topics and students would spiral into a discussion not based upon or proving mastery of objectives. By implementing time limits, the number of students per group, and specific topic outlines, KY recorded that "these subtle changes resulted in much richer conversations around the more pertinent topics in the readings and kept some students from being able to fake their way through the conversation." The structures added were not intended to hinder but rather to add guidance for students to establish deeper conversations while remaining focused and on topic. In regard to the depth these structures brought, KB added, "The quality of thought and connection far exceeded what I would have seen in traditional discussion boards. Students were not only building relationships but also delving more deeply into course topics and making meaningful real-world connections."

When mixing media of communication, we discovered that some formats require additional structures to ensure fairness and academic integrity. Professor KS claimed, "One challenge I found was that I required literature citations to support their responses." Students typically struggle to incorporate and embed literature into threaded discussions; however, seamlessly integrating it into filmed and live discussions adds an additional challenge. KS further added, "While I still encourage that in the live discussion, I didn't ask them to provide a references page of any author they mentioned outside the text. I should have done that for me to be able to check validity of sources." For DJ's courses, once setting the structures for all formats to include citations and references, she discovered, "One [student] emailed me exclaiming she was in a discussion with her principal when she found herself telling her principal about an article she had read in my class for her discussion as support for her idea she was pitching." While the usage of references takes frontloading in the case of structure, students quickly adapted and successfully included all required elements of the discussions, regardless of the group's use of videos, Padlet, or a Word Document.

In developing structures for collaborative discussions, the three themes of establishing best practices remained: timing, groups, research, and topics. Participant GH recommended allowing groups "to come together for a 20 to 30-minute virtual meeting, which often extends longer due to in-depth conversations." Without some cap on time allowed, a majority of us noticed student groups would typically surpass the time. KY agreed and "capped the discussions at 30 minutes, gave students discussion prompts more closely tied to specific topics in the readings, and provided mental models for how the discussions should proceed" to ensure the structure supported the best discussions. One additional structure KS suggested was that she "assigned the groups myself to make sure the students would not get too comfortable with each other." The practice of assigning the groups brought more diverse and unique discussions rather than allowing students to pick their own partner and just settling on an agreement. To ensure collaborative discussions stayed on topic and relevant to the objectives for the week, DJ advocated for "even comments had to be backed by research. In doing so, students would groan at first, but many found it became a habit." Finally, regarding topic selection, KY proposed, "I scaffolded the process by providing some broad topics to discuss, such as the most important or most confusing topics from the reading. Students were told they could use whatever means they wanted to record their meetings, if I was able to verify their participation." This practice perfectly balanced student choice with scaffolding necessary to produce academic discussions.

Discussion

Authentic student engagement for deep learning in online environments has been a longstanding concern and topic for debate and exploration. Research on learning has consistently shown the importance of practices such as the use of asynchronous tools, such as threaded discussion boards and journals, in online and hybrid courses (Saripudin, 2022; Sweet, 2022). As such, most learning management systems (LMS) used by online educators have included integrated tools to facilitate student reflection and asynchronous discussions. For years, virtual journals and threaded discussion boards within the LMS were the primary tools used, but with varying results (Hammond, 2020; Wu & Hiltz, 2019). Such tools were intended to increase engagement and build community within an online environment. However, offering multiple formats may foster creative expression but may not improve student collaboration or group efficacy in ways that deepen and broaden student discussions. This study examines the potential benefits of combining these approaches.

Over the last 10 years, the proliferation of low-cost and easily integrated tools into online environments has broadened the choices for online educators to explore as alternatives to the traditional tools provided by LMS providers. Tools that allow for recorded, synchronous discussions or alternative formats to the integrated discussion tools create space for online educators and students to engage in ways that were not previously possible or considered. The findings from our study overwhelmingly support the use of these tools as alternative formats for authentic dialogue that engages critical reflection behaviors and deeper learning in a more authentic manner, like what is often encountered in environmentally rich, face-to-face settings. When paired in dyads or in small groups for meaningful discussion, around topics of significance, students move from discussion as acts of compliance to acts of meaning. They also expressed a heightened sense of engagement with subject matter beyond the limits of the course curriculum and expectations.

One of the potential drivers of this may be the importance of real-time dialogue. Research has consistently shown that real-time dialogue and student interaction are important factors for improving or increasing student engagement in online and blended courses (Tsai et al., 2021), and that students valued frequent interactions as key drivers of engagement (Wang, Q. et al., 2022). The variations of discussions provided by the faculty in this study not only gave students an opportunity for real-time interactions but also provided faculty an opportunity to provide further instruction and interaction with the student dyads, which research has also suggested improved student engagement with the content as well as feelings that the course as a whole was less tense and more interesting (Wang, Q. et al., 2022).

Another potential driver is the role that agency, or self-directiveness, plays in student engagement. A common refrain from students to the faculty in this study was appreciation for being able to choose their preferred methods of discussion and to exercise creativity. The ability to practice self-directed learning has been found to have positive effects on increased motivation, satisfaction with learning (Chakraborty, 2024; Loeng, 2020; Morris, 2019), and engagement (Agonács & Matos, 2021). It is important, though, that agency is dependent on interpersonal factors, skills, and context (Pratiwi & Waluyo, 2023), so faculty seeking to integrate the flexibility of assignments that increase agency, such as the discussions used by faculty in this study, consider learners' readiness and exercise intentionality in how students are paired and the supports for tools that can be integrated into their courses.

In essence, the use of other methods for discussions besides the threaded discussion boards provides the historical benefits of discussion, as well as providing learning experiences and tools for an increasingly digital culture. Although grading, especially of videos, may have taken longer, the discussions no longer felt like a burden. Discussions held on various platforms with innovative practices took less time to grade due to the flow of the conversation and seamless references to class resources and relevant examples. An added benefit for faculty who bear the responsibility of grading, it also breaks the monotony of grading the written word for assignments and poses a potential practice that limits the use of tools such as generative AI. Because of the unreliability of AI detection tools, there have been growing recommendations for faculty to find alternative assessments of student learning (Surahman & Wang, 2022). As such, the findings from this study provide a creative and engaging form of collaborative assessment that allows student voice to enhance class learning and content.

Conclusions

Implications for Best Practice

The findings from this study have important implications for both online instructors and learners, especially adult learners, as was the case of the participating faculty's students, where collaboration, critical reflection, and professional dialogue are important to the act of learning. Collectively, the experiences of study participants suggested that traditional threaded discussions may no longer adequately support the authentic intellectual engagement with content or peers in a fully online graduate program. Additionally, with the growing use of generative AI, there was a need to create assessments that were not as reliant on tasks that could easily be carried out with AI tools. The faculty found the use of collaborative discussion formats that incorporated synchronous or multimodal interaction appeared to foster deeper learning through engagement, stronger relationships, and a greater sense of agency in the learning process.

First, the findings challenge the long-standing assumption that threaded discussions are inherently effective for promoting graduate-level discourse for adult learners in online environments. Across the findings from this study, faculty consistently described threaded discussions as performative and compliance oriented, often lacking substantive reflection on learning or dialogue on course content. As such, students often considered the task as "busy-work" and less as an opportunity for authentic engagement, despite attempts to provide numerous mental models or guidelines for expectations for discussion threads. Although threaded discussions provided students with the logistical convenience of completing discussion assignments, the findings suggested that they rarely met the expected outcomes, such as spontaneity, relational trust, and dialogical exchanges associated with meaningful academic discourse. As such, faculty tasked with teaching graduate and adult learners in an online environment should consider some of the methods being reflected on in this study for creating opportunities for cultivating a scholarly identity, critical thinking, and deepening the relational aspect of the academic community with which they are tasked to create in graduate level programs.

Another implication from the current study is the importance of social presence for deep learning in online graduate programs. According to the participants, students engaged more deeply when they could see facial expressions, hear tone and inflection, and interact conversationally with peers. These findings align with social constructivist perspectives and Community of Inquiry frameworks that emphasize the interconnectedness of cognitive, social, and teaching presence in online learning environments (Garrison, 2019). The collaborative discussion formats appeared to reduce the transactional distance experienced in asynchronous online courses by humanizing interactions and strengthening interpersonal accountability. In graduate courses, where persistence and cohort cohesion are critical, these relational dynamics may contribute not only to learning outcomes but also to student retention and sense of belonging.

Third, the findings suggest that increased student autonomy can positively influence engagement and ownership of learning. Allowing students flexibility in selecting discussion platforms, determining meeting logistics, and shaping conversational approaches appeared to encourage creativity, innovation, and authentic participation. Rather than viewing structure and autonomy as competing forces, the experiences of the faculty participants in the current study suggested that carefully scaffolded autonomy may better reflect the expectations of both faculty and adult learners enrolled in online graduate programs. These findings imply that online graduate instruction may benefit from moving away from rigid participation structures toward more flexible, student-centered approaches that mirror authentic professional collaboration.

Additionally, the findings carry implications for the design and assessment of online discussions. The transition from the broad but shallow interactions often encountered in asynchronous threaded discussions to deeper conversations suggests the quality of engagement may be more educationally meaningful than the quantity of posts. Despite attempts to include criteria for post quality, students often focused on frequency and compliance, whereas collaborative discussions encouraged sustained analysis, reflection, and application of course concepts. However, the findings also indicate innovative collaborative formats required intentional scaffolding and iterative refinement. Faculty needed to establish expectations regarding participation balance, academic rigor, citation practices, time management, and accountability measures. Institutions and faculty should recognize that alternative discussion models are not inherently self-sustaining; rather, they require thoughtful instructional design and ongoing adaptation. Furthermore, for graduate programs focused on practitioners, institutions and faculty should consider using tools that best replicate what learners use in daily communication or introducing tools that serve as proxies for face-to-face communication.

Finally, this study has implications for faculty professional development and innovation in online teaching. The shift away from threaded discussions emerged largely from faculty frustration, experimentation, and collaborative reflection rather than institutional mandates. This suggests that faculty-driven pedagogical innovation may serve as a powerful catalyst for improving online learning environments. Institutions should create structures that encourage faculty experimentation, collaborative inquiry, and the sharing of emerging practices related to online engagement. Supporting instructional innovation may be especially important as online graduate programs continue expanding nationally.

Recommendations for Future Research

There are a few limitations to the current study that have implications for future research. One limitation was that this study was based on the perceptions of faculty teaching in relatively large online doctoral and graduate programs at two R2 Carnegie Classification university in Texas. Further investigations of the phenomena described in this study should be conducted within different fields, levels of study, and types of universities. Another limitation concerns the diversity of scaffolding and instruction provided to students who engaged in the threaded discussions and the alternative synchronous methods offered by the participating faculty. Future research should consider addressing this limitation by investigating specific types of scaffolding and instructions, and their potential in mediating or moderating the perceptions of faculty. Similarly, the findings of the study lacked student voice to validate the perceptions of the participating faculty. Future research should consider including student evidence to substantiate or refute faculty perceptions.

In addition to addressing limitations, future research should investigate the relationship between collaborative discussions and measurable learning outcomes. While faculty consistently perceived deeper critical thinking and richer engagement, this study relied primarily on reflective and observational data. Quantitative or mixed-methods research could compare collaborative discussions and threaded discussions across variables such as critical thinking performance, knowledge retention, course grades, persistence, or dissertation readiness. Such research would help determine whether perceived improvements in engagement correspond to measurable academic gains. Likewise, additional research could investigate how various technologies influence communication quality, accessibility, creativity, cognitive engagement, and social presence. As artificial intelligence and multimodal tools continue evolving, understanding how these technologies can support authentic collaboration will become increasingly important in online higher education.

Finally, additional research is needed to determine which scaffolds most effectively support meaningful dialogue while maintaining academic rigor. Studies examining faculty workload, scalability, and sustainability would also be valuable, particularly in large enrollment online programs. Longitudinal research could examine whether collaborative discussions contribute to stronger cohort cohesion, reduced isolation, improved retention, or enhanced professional collaboration after graduation. Such findings could further inform the design of online graduate programs seeking to foster both intellectual and relational development among adult learners.

Declarations

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This study was conducted in accordance with recognized ethical standards. Informed consent was obtained from all participants, and data were collected and reported with respect for confidentiality and anonymity. According to the guidelines of Lamar University, this type of research did not require formal ethics approval.

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References

Agonács, N., & Matos, J. (2021). Learner agency in distance education settings: Understanding language MOOC learners' heutagogical attributes. In Hase & Blaschke (Eds). *Unleashing the power of learner agency* (Ch. 9). EdTech Books. https://edtechbooks.org/up

Alfoldi, E. A. (2025). Yellowdig discussion boards as communities of inquiry: The impact of instructor participation on online student discourse. *Journal of Education for Business, 100*(1), 45–56. https://doi.org/10.1080/08832323.2024.2438659

Alkaissi, H., & McFarlane, S. I. (2023). Artificial hallucinations in ChatGPT: Implications in scientific writing. *Cureus, 15*(2), e35179. https://doi.org/10.7759/cureus.35179

Allon, G., Carlstein, J., & Gur, Y. (2025). Leveraging consensus effect to optimize ranking in online discussion boards. *Manufacturing & Service Operations Management*, *27*(6). https://doi.org/10.1287/msom.2022.0451

Almahmoud, J., Facciotti, M., Igo, M., & Sripathi, K. (2025). Enhancing user engagement in large-scale social annotation platforms: Community-based design interventions and implications for large language models (LLMs). arXix, 1. https://doi.org/10.48550/arxiv.2501.01545

Alsayer, A. A., Templin, J., Niileksela, C., & Frey, B. B. (2025). Examining the structure of the revised community of inquiry framework: A multi-level approach. *Education and Information Technologies, 30*(5), 6785–6807. https://doi-org/10.1007/s10639-024-13090-3

Anderson, T., Rouke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2), 1-17. https://www.doi.org/https://doi.org/10.24059/olj.v5i2.1875

Aslan, S. A., & Turgut, Y. E. (2021). Effectiveness of community of inquiry based online course: Cognitive, social and teaching presence. *Journal of Pedagogical Research, 5*(3), 187–197. https://doi.org/10.33902/JPR.2021371365

Blackmon, S. J. (2012). Outcomes of chat and discussion board use in online learning: A research synthesis. *Journal of Educators Online, 9*(2). 1-19.

Bongiwe Zulu, F. Q. (2024). Enhancing the quality of online teaching and learning of a research module through the community of inquiry framework. *South African Journal of Education, 44*(4), Article 2558. https://doi.org/10.15700/saje.v44n4a2558

Bromer, B. L. (2021). Social presence in an online learning environment. In C. Crawford & M. Simons (Eds.), *eLearning engagement in a transformative social learning environment* (pp. 1-21). IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-7998-6956-6.CH001

Brunton, R., MacDonald, J., Sugden, N. A., & Hicks, B. (2022). Discussion forums: A misnomer? Examining lurkers, engagement and academic achievement. *Australasian Journal of Educational Technology*, *38*(5), 27-44. https://doi.org/10.14742/ajet.7627

Carr, J. (2020). Teacher candidate perceptions on alternative asynchronous online discussion boards. *Journal of Educational Technology and Online Learning, 3*(3), 288–310. https://doi.org/10.31681/jetol.752283

Casebeer, D., & Pontoriero, K. (2022). Promoting democratic engagement with low-stakes discussion board interventions. *Pennsylvania Teacher Educator, 21*(1), 1–9. https://www.pac-te.org/files/PTE_Spring_22_Journal_-_Final.pdf

Chakraborty, S. (2024). Empowering and engaging adult learners: Strategies to facilitate self-directed learning in adult education. *International Journal for Multidisciplinary Research, 6*(3). https://doi.org/10.36948/ijfmr.2024.v06i03.22216

Chandrawati, T., Dewi, L., Nurhikmah H, Afriani, A., Arwadi, F., Safitri, H., & Shahbodin, F. (2024). Student's learning experiences in an online learning environment using Garrison's CoI framework. *Inovasi Kurikulum, 21*(3), 1359–1370. https://doi.org/10.17509/jik.v21i3.62813

Chou, P. N. (2012). Teaching strategies in online discussion boards: A framework in higher education. *Higher Education Studies, 2*(2), 25–30. https://doi.org/10.5539/HES.V2N2P25

Cooper, A. D. (2022). Using the discussion board during your online synchronous class to engage students. *Marketing Education Review, 32*(2), 177–180. https://doi.org/10.1080/10528008.2022.2062606

Doss, K., Poor, J., & Bloom, L. (2025). Student choice in online asynchronous higher education courses. *ELearn Magazine, 2025*(9). https://doi.org/10.1145/3760213.3708894

Douglas, T., Mather, C., Murray, S. A., Earwaker, L., James, A., Pittaway, J., Robards, B., & Salter, S. (2015). A comparison of undergraduate student experiences of assessed versus non-assessed participation in online asynchronous discussion groups. *ASCILITE Conference Proceedings*, 424–428. https://doi.org/10.14742/apubs.2015.944

Faulconer, E., Griffith, J., & Gruss, A. (2021). The impact of positive feedback on student outcomes and perceptions. *Assessment & Evaluation in Higher Education, 47*(2), 259–268. https://doi.org/10.1080/02602938.2021.1910140

Garrison, D. R. (2019). Online Community of Inquiry review: Social, cognitive, and teaching presence issues. *Online Learning, 11*(1). https://doi.org/10.24059/olj.v11i1.1737

Garrison, D. R. (2021, January 18). T*he Community of Inquiry.* *https://www.thecommunityofinquiry.org/editorial29*

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

Hamadi, H., Tafili, A., Kates, F. R., Larson, S. A., Ellison, C., & Song, J. (2023). Exploring an innovative approach to enhance discussion board engagement. *TechTrends, 67*(4), 741–751. https://doi.org/10.1007/s11528-023-00850-0

Hammond, M. (2020). A review of recent papers on online discussion in teaching and learning in higher education. *Online Learning*, *9*(3). https://doi.org/10.24059/olj.v9i3.1782

Hasani, L. M., Santoso, H. B., & Junus, K. (2022). Designing asynchronous online discussion forum interface and interaction based on the community of inquiry framework. *The International Review of Research in Open and Distributed Learning, 23(*2), 191–213. https://doi.org/10.19173/irrodl.v23i2.6016

Irvin, C., & Hee-Joo, I. (2022). College students' perceptions of the use of collaborative discussion boards during COVID-19. *Multimedia-Assisted Language Learning, 25*(3), 39–60. https://doi.org//10.15702/mall.2022.25.3.39

James, A. J., Douglas, T. A., Earwaker, L. A., & Mather, C. A. (2022). Student experiences of facilitated asynchronous online discussion boards: Lessons learned and implications for teaching practice. *Journal of University Teaching and Learning Practice, 19*(5). https://doi.org/10.53761/1.19.5.9

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kaushik, N. (2023). Online discussion boards: Expectations and outcomes. *Journal of International Management Studies, 23,* 32–45. https://doi.org/10.18374/jims-23-1.3

Kerrigan, J., & Aghekyan, R. (2022). Beyond the discussion board: Engaging students in asynchronous online activities. *International Journal of Teaching and Learning in Higher Education, 33*(3), 488–495. https://files.eric.ed.gov/fulltext/EJ1366170.pdf

Lane, S. F. (2025). *To post or not to post, that is the discussion: An exploration of students' perceptions and experiences with using online collaboration tools in threaded discussion board postings* (doctoral dissertation). University of South Carolina. https://scholarcommons.sc.edu/etd/8066

Leow Wai Yee, S., & Lee Cheng Ean, C. (2020). Malaysian private university students' perceptions of online discussion forums: A qualitative enquiry. *Sains Humanika*, *12*(2). https://doi.org/10.11113/SH.V12N2.1610

Lin, L., & Wang, F. (2023). Research on the influence mechanism of instructional interaction and course content on online learning engagement. *ICETM Proceedings of the 2023 6th International Conference on Educational Technology Management*, 169–175. https://doi.org/10.1145/3637907.3637970

Loeng, S. (2020). Self-directed learning: A core concept in adult education. *Education Research International*, *2020*. https://doi.org/10.1155/2020/3816132

Lohmann, M. J., & Boothe, K. A. (2023). Developing asynchronous online discussion boards to increase student engagement and learning. In I. Management Association (Ed.), *Research anthology on remote teaching and learning and the future of online education* (pp. 155-173). IGI Global. https://doi.org/10.4018/978-1-6684-7540-9.ch009

Martin, F., Wu, T., Wan, L., & Xie, K. (2022). A meta-analysis on the community of inquiry presences and learning outcomes in online and blended learning environments. *Online Learning, 26*(1). https://doi.org/10.24059/olj.v26i1.2604

Milovic, A., & Dingus, R. (2021). How to not disappear completely: Using video-based discussions to enhance student social presence in an online course. *Marketing Education Review*, *31*(4), 311–321. https://doi.org/10.1080/10528008.2021.1943447

Mohebi, L. (2023). Students' online engagement and usage of discussion boards on Blackboard: A study from the UAE. *Journal of Educators Online, 20*(3). https://doi.org/10.9743/JEO.2023.20.3.6

Morris, T. (2019). Self-directed learning: A fundamental competence in a rapidly changing world. *International Review of Education, 65*, 633–653. https://doi.org/10.1007/s11159-019-09793-2

Nash, B. L., Karkar Esperat, T. M., Mitchell Pierce, K., Shimek, C. H., Rose, C. D., Ivanyuk, L., & Fletcher, L. (2023). Investigating new literacies among teacher educators: A multi-institution collaborative self-study. *Literacy Research: Theory, Method, and Practice, 72*(1), 238–257. https://doi.org/10.1177/23813377231179192

Oyarzun, B., & Martin, F. (2023). A systematic review of research on online learner collaboration from 2012–21: Collaboration technologies, design, facilitation, and outcomes. *Online Learning, 27*(1). https://doi.org/10.24059/olj.v27i1.3407

Payne, A. L. (2021). A resource for e-moderators on fostering participatory engagement within discussion boards for online students in higher education. *Student Success*, *12*(1), 93–101. https://doi.org/10.5204/ssj.1865

Pham, C. K., Chong, S. L., & Wan, R. (2022). Students' experience of social presence in online learning. *Proceedings of the 14th International Conference on Education Technology and Computers,* 299–303. https://doi.org/10.1145/3572549.3572597

Popescu, E., & Badea, G. (2020). Exploring a Community of Inquiry supported by a social media-based learning environment. *Journal of Educational Technology & Society, 23*(2), 61–76. https://www.jstor.org/stable/26921134.

Pratiwi, D., & Waluyo, B. (2023). Autonomous learning and the use of digital technologies in online English classrooms in higher education. *Contemporary Educational Technology*. https://doi.org/10.30935/cedtech/13094

Rahmatalla, F., Harun, J., & Abuhassna, H. (2024). Mapping research trends in the community of inquiry framework within online courses: A bibliometric analysis. *International Journal of Academic Research in Business & Social Sciences, 14*(11). https://doi.org/10.6007/ijarbss/v14-i11/23598

Sandidge, C. R., & Schultz, B. F. (2024). Building connections and enhancing learning: Student perspectives of traditional discussion boards in online courses. *Journal of Educators Online*, *21*(4), n4. https://doi.org/10.9743/JEO.2024.21.4.1

Saripudin, M. (2022). Deeper learning, dialogic learning, and critical thinking: research-based strategies for the classroom. *Educational Review, 75*(3), 587–588. https://doi.org/10.1080/00131911.2022.2028416.

Schultz, S. L. (2021) Discussion boards in the online classroom: Are they actually influencing instructor mediated immediacy, student motivation, student affective learning, student connectedness, and online learning climate? *Theses and Dissertations.* 1621. https://doi.org/10.30707/ETD2022.20221020070314422393.999967

Schultz, B. F., & Sandidge, C. R. (2022). Improving online discussion boards: What do students say? *The Northwest ELearning Journal*, *2*(1). https://doi.org/10.5399/osu/nwelearn.2.1.5643

Shea, P., Richardson, J., & Swan, K. (2022). Building bridges to advance the community of inquiry framework for online learning. *Educational Psychologist, 57*(3), 148–161. https://doi.org/10.1080/00461520.2022.2089989

Shin, J., Balyan, R., Banawan, M. P., Arner, T., Leite, W. L., & McNamara, D. S. (2025). Analyzing interaction patterns and content dynamics in an online mathematics discussion board. *Interactive Learning Environments, 33*(3), 2151–2174. https://doi.org./10.1080/10494820.2024.2392619

Surahman, E., & Wang, T. (2022). Academic dishonesty and trustworthy assessment in online learning: A systematic literature review. *Journal of Computer Assisted Learning, 38*(6), 1535-1553. https://doi.org/10.1111/jcal.12708

Sweet, S. (2022). Using guided critical reflection to discover deepened and transformative learning in leadership education. *Journal of Research on Leadership Education*, *18*(4), 600–621. https://doi.org/10.1177/19427751221118951

Tawalbeh, M., & Al-husban, N. (2023). EFL students' perspectives on activities designed for asynchronous discussion forums: Transformative practices. *International Journal of Technology in Education, 6*(3), 507–520. https://doi.org/10.46328/ijte.519

Tsai, C., Ku, H., & Campbell, A. (2021). Impacts of course activities on student perceptions of engagement and learning online. *Distance Education*, *42*(1), 106–125. https://doi.org/10.1080/01587919.2020.1869525

Wang, Q., Wen, Y., & Quek, C. (2022). Engaging learners in synchronous online learning. *Education and Information Technologies*, *28*, 4429–4452. https://doi.org/10.1007/s10639-022-11393-x

Wang, Y. (2022). Exploring the relationships among the dimensions of a community of inquiry in an online learning environment. *Distance Education, 43*(3), 353–368. https://doi.org/10.1080/01587919.2022.2088481

Wertz, R. E. H. (2022). Learning presence within the Community of Inquiry framework: An alternative measurement survey for a four-factor model. *Internet and Higher Education, 52*, 100832. https://doi.org/10.1016/J.IHEDUC.2021.100832

Wu, D., & Hiltz, S. (2019). Predicting learning from asynchronous online discussions. *Online Learning*, *8*(2) https://doi.org/10.24059/olj.v8i2.1832

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education, 16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0

Appendix A

Collaborative Discussions Instructions

For this class, we will handle online discussion boards a bit differently. Research is showing that the "post once then comment two to three times" format is not actively engaging students nor is it building collaborative practices. It does not mean discussion boards are not effective; it means the intention and use of them must be relative to students and built to establish bonding experiences (Blackmon, 2012, p. 15).

Here is how this will work. During Week Four of class, you will pick small groups (the number in the group is up to your specific instructor) by interacting with your classmates in the Student/Faculty Lounge. Once you have a group, your group will decide what platform you will use to conduct your discussions. Acceptable platforms used before include Word Docs with comments via your One Drive, Canva, video recording with transcript or closed captioning, podcast with transcript showing names, Padlet, or a new one your group discovers. Your grade will be based upon the interaction and content of your discussion. We want you to show us all you have learned and how it can be incorporated in the realm of education while epitomizing collaborative practices. Specifics for each discussion and rubrics used are up to the individual instructor, so read each one assigned carefully.

References

Blackmon, S. J. (2012). Outcomes of chat and discussion board use in online learning: A research synthesis. *Journal of Educators Online, 9*(2). 1-19.

Appendix B

Instructions:

Provide a response to all of the following prompts:

Why is the concept of instructional design so important to the field of distance education?
What does the text say about the importance of instructional design?
What are your suggestions for encouraging faculty to collaborate with IDs?

This will be a collaborative live discussion. You will be assigned into small groups (2 or 3). Once you have a group, your group will decide what platform you will use to conduct your discussions. Acceptable platforms used before include MS Word with comments, Canva, video recording with transcript or closed captioning, podcast with transcript showing names, or a new one your group discovers. However, Teams has seemed to be the best tool. If you do use Word, make sure it isn't like Threaded Discussion, the thing we are trying to avoid? Your grade will be based upon the interaction and content of your discussion. You will submit the information using this assignment link. We want you to show us how you can use technology to dive deeper into how it can be incorporated in the realm of education while epitomizing collaborative practices. You will have two weeks to get this completed.

Making Generative AI Expectations Visible: Extending the TILT Framework for Transparent Assignment Design

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Abstract
Instructor practices in higher education for setting assignment-level expectations have been meaningfully shaped by the Transparency in Learning and Teaching (TILT) Framework (Winkelmes, 2023a, 2023b) which encourages the development of clear guidance for students around each assignment's purpose, core tasks, and assessment criteria. The TILT Framework has been widely adopted by faculty and instructional support professionals (Winkelmes et al., n.d.) as a methodology that can align instructor expectations with student understanding and effort on a given assignment. The line of applied research contained in this article extends the existing TILT model to provide students with transparent genAI guidance. The authors introduce their TILTai Framework that is inclusive of instructors' intentions surrounding genAI use. They then describe a pilot faculty development model that was implemented using their TILTai Framework (Wiss et al., 2025). The authors introduce a new and preliminarily validated instrument for measuring student perceptions of a particular assignment's transparency related to genAI (the TILTai Scale) and describe a research study conducted across a series of graduate-level courses in which the instrument was piloted. This study also considered the influence that student perceptions of genAI transparency may have on commonly held concerns regarding genAI (Singer-Freeman et al., 2025). Results from the TILTai Scale, perceptions of genAI transparency as measured by the TILTai Scale, their influence on commonly held student concerns, and the efficacy and potential future applications of the TILTai Framework are discussed.

Keywords: TILTai Framework, genAI transparency, generative artificial intelligence, transparent assignment design, scale-based measurement

Wiss, A., Singer-Freeman, K., Pattershall-Geide, J., Dobbeck, K., Heminger, C., Quinlan, S., Volarich, J., Gray, G. Making generative AI expectations visible: Extending the TILT framework for transparent assignment design. *Online Learning, 30*(3), 55-77. https://doi.org/10.24059/olj.v30i3.6398

Background

The role of generative artificial intelligence (genAI) in the teaching and learning process has rapidly become one of academia's most profound opportunities and challenges of the post-pandemic era. In response to the release and widespread adoption of publicly available large language models (LLMs) starting in late 2022, professionals across the education sector have wrestled with this technology's potential influence on student learning and attainment of educational goals and competencies. Several recent surveys have reported that university students' perceptions of genAI vary based on factors such as educational level of the student, topical area of a course, type of course activity being considered, student comfort with genAI tools, course learning objectives, and sequence of the course within the academic program (Chirikov et al., 2026., Watson & Rainie, 2026, Singer-Freeman et al., 2025). Of particular interest to the authors here is the shared finding that student views are strongly influenced by the types of guidance faculty provide regarding their incorporation or prohibition of genAI use for academic work.

Instructor practices in higher education for setting assignment-level expectations have been meaningfully shaped by the Transparency in Learning and Teaching (TILT) model (Winkelmes, 2023a, 2023b, n.d.) which encourages the development of clear guidance for students around each assignment's purpose, core tasks, and assessment criteria. The TILT Framework has been widely adopted by faculty and instructional support professionals as a methodology that can align instructor expectations with student understanding and effort on a given assignment.

In this study, the authors expand the TILT Framework to be inclusive of genAI's potential role in assignment completion and then describe a corresponding faculty development program based on this expanded framework. They also introduce, validate, and pilot a new instrument across several graduate courses to measure student perceptions of how transparently genAI related assignment guidelines were communicated. Finally, the authors explore how transparent expectations of genAI use may address common student concerns about this technology and its role in their coursework.

Review of Literature

As a foundational framework for instructional design, Anderson and Krathwohl (2001) classify learning objectives by intersecting types of knowledge with levels of cognitive complexity. This structure allows educators to scaffold learning progressively throughout a course of study, systematically building from foundational mechanics to the highest order of learning: creating. As students progress, foundational skills acquired at earlier stages support creative and evaluative work in later stages. The widespread availability of genAI tools in higher education challenges instructors to ensure these tools support, rather than disrupt, student development towards scholarly competence and the creation of new knowledge and solutions. Of particular concern to some faculty is the possibility that students will fail to develop foundational skills if they offload that work to genAI. This might result in impaired ability to tackle the creative and evaluative work required in advanced courses and career paths.

Nonetheless, when faculty apply thoughtful design principles to the inclusion of genAI into student assignments, genAI can encourage students to clarify reasoning, explore alternatives, and reflect on learning. One promising approach may be the application of collaborative learning principles to genAI-assisted assignments (Singer-Freeman, 2025; Singer-Freeman et al., 2026) An emerging body of research suggests that poorly designed genAI-assisted learning is associated with an illusion of competence (Barba, 2025) that can result in reductions in critical thinking (Gerlich, 2025) or creativity (Habib et al., 2024). Additionally, even the most thoughtfully designed assignments will only be effective if students follow the guidelines for genAI use and, where required, abstinence. There is some evidence that many students use genAI in ways that are not aligned with the intent of their faculty, leading to "overreliance on AI, diminished metacognitive engagement, and ethical dilemmas related to plagiarism and authorship" (Sanz-Tejeda et al., 2026, p. 1).

A recognized framework which may assist in navigating the integration of genAI is Transparency in Learning and Teaching (TILT). Developed in 2009, the TILT Framework is an evidence-based approach that aims to provide greater transparency in assignment design and instructions to foster higher education learning and equity (Winkelmes, 2023; Winkelmes et al., n.d.). A substantial body of research supports the efficacy of the TILT method to enhance educational equity and heighten metacognitive awareness (Brown, 2025; Brown et al., 2024; Winkelmes, 2023a; Winkelmes et al., 2016). The framework aims to provide clarity for students through three pillars of effective assignment design: the Purpose, the Task, and the Criteria.

The Purpose pillar provides a series of questions that guide instructors to clearly explain the assignment's learning objectives and how the assignment relates more broadly to the objectives of the course. When students read the purpose section of a TILT-influenced assignment, they will emerge with a clear idea of why they should engage in the work. The Task pillar supports faculty as they create a step-by-step outline of what the assignment entails, including recommended task sequence, opportunities for feedback, types of scaffolding, and moments for student reflection (when appropriate). When students read the Task section of a TILT assignment, they should understand clearly how to approach the work. Finally, the Criteria pillar provides metrics for evaluation and grading (ideally, a rubric and exemplary work samples), explicitly detailing how a student can succeed in the assignment.

The application of the TILT model to assignments that incorporate genAI has the potential to promote learning, reduce student anxiety, and increase faculty confidence. Work by Friberg-Fort and Giovagnoli (2026), Brown (2024) and Brown et al. (2025) suggests that the TILT Framework can be used by faculty members considering AI-enhanced assignments to provide "opportunities to connect concepts to real-world applications and to reflect on this educational process" (Brown et al., 2025, p.197). Conversely, both faculty and students have expressed emotional burden and uncertainty around appropriate uses of genAI in academic work (Corbin et al., 2025; Singer-Freeman et al., 2025). Gonsalves (2026) posits that as institutions create increasingly complicated rules around appropriate genAI use, students experience increasing uncertainty about how they should proceed. Along similar lines, Orfanidis (2025) notes that in many cases where instructors establish their own expectations and boundaries for AI use, students may encounter inconsistent policies, ethical perspectives, and enforcement practices across a program. This may place students in the position of having to “interpret not only central policy but its multiple local instantiations, an ongoing act of translation that shifts the work of resolving contradiction onto those least equipped to do so” (Gonsalves, 2026, p.5). She argues that this creates an interpretive overload for students that makes effective academic learning more difficult. Gonsalves suggests that, to reduce this burden, faculty must consider the work that is required of students to understand and comply with rules for genAI use and treat clear communication about genAI use in assignments as an essential component of ethical assessment. She goes on to suggest that guidance should go beyond descriptions of permitted and forbidden uses of genAI to provide stage-based permissions in which the policies are attached directly to the expected workflow students will undertake. Similarly, Corbin et al. (2025) argue for eliminating ambiguity and increasing the clarity of assignment policies and expectations as they relate to student AI use. The TILT Framework’s Task and Criteria pillars offer potentially useful ways to create assignments that will reduce students’ interpretive load by explicitly linking policies to student workflow and grading criteria.

There is evidence that some educationally harmful student behaviors related to the use of genAI could be addressed through increased clarity around the purpose, task, and criteria in genAI-supported work. For example, Cotelli Kureth et al. (2025) found that students who reported incomplete disclosure of genAI use explained their decisions as stemming primarily from either a lack of clarity around the professor’s expectations for disclosure or the belief that full disclosure was not important. These authors increased the completeness and quality of students’ self-reported disclosure of genAI use by making this a part of the assignment grade. It is possible, however, that grading genAI disclosure may have increased false declarations of full disclosure rather than actual disclosure.

An alternate approach to the challenge of academic integrity violations may be improving assignment explanations of purpose and task. Explicitly defining the purpose of an assignment underscores the specific cognitive skills under development, which helps students understand exactly what intellectual growth they compromise by completely outsourcing their thinking to automated tools. Clarifying the structural steps of the task establishes definitive boundaries for permissible technological assistance, thereby reframing genAI as a supportive brainstorming or editing aid rather than an unauthorized shortcut. Supporting this possibility, Du and He (2026) reported that perceptions of fairness, teacher support, and organizational support were associated with increased willingness to disclose genAI use, but perceived uncertainty reduced full disclosure.

Without a coherent genAI policy, students are left to navigate genAI usage on their own, with students becoming increasingly comfortable doing so (Parker et al., 2026), which in turn can create unintentional sabotage of long-term personal development and success and the process of learning how to learn (Yee et al., 2025). Additionally, the use of genAI without clear policy articulation can create or contribute to a murky environment for academic integrity standards in higher education. Recent studies have explored the ways in which assignments, designed to provide guidance on AI usage, disclosure, and documentation, can lead to positive results in student learning (Lipuma et al., 2025). Calls for additional genAI use transparency from academic programs and instructors have been made by voices across the higher education space (Damm & Eaton, 2026), describing the need that “Transparency should be emphasized around acceptable genAI use, with faculty encouraged to clearly communicate expectations in their syllabi" (Lewis Miller et al., 2025, p, 23).

The review of the literature indicated limited scholarship related to scale-based tools to measure genAI transparency. The strongest example is provided by Furze et al. (2024) and their AI Assessment Scale (AIAS). The AIAS is not a validated instrument but rather provides a five-level scale that faculty can use to establish and then communicate the level of acceptable AI use, from "No AI" to "Full AI" use (p. 5-6). Use of this scale was reported to improve integration of genAI in courses and was also reported to help reduce misuse. This scale's intended purpose aligns with the Task dimension of the TILT Framework. The authors were unable to locate a comprehensive tool, framework, or scale that fully addresses all three dimensions of TILT regarding AI use in the literature.

Methods

This study measured student perceptions of genAI transparency, and that transparency's corresponding influence on known student concerns with genAI, after exposure to a set of assignment instructions developed using the newly conceptualized TILTai Framework.

Research Questions

- RQ1: What are students' perceptions of genAI transparency after being given a specific set of assignment instructions that were informed by the TILTai Framework?

- RQ2: What is the relationship between students' levels of perceived genAI transparency and known factors relating to the emotional burden and uncertainty around appropriate uses of genAI in a particular assignment?

- RQ3: What differences in perceived genAI transparency might exist between different types of assignments informed by the TILTai Framework?

Introducing the TILTai Framework

In response to the challenges outlined in the review of literature, the authors have extended the Transparency in Teaching and Learning Framework to be inclusive of genAI considerations. Named the TILTai Framework (Wiss et al., 2025), this framework was designed to supplement overall assignment design and articulation, with a consideration for genAI's allowed and recommended usage (see Figure 1). Like the original TILT Framework, this adaptation utilizes the same three categories of Purpose, Task, and Criteria, but with an explicit focus on genAI within each.

Table 1

The TILTai Framework

TILTai Framework	General TILT Principles
Purpose •Provide clarity on AI’s intended use and how it may support/detract from learning goals •Provide clarity on why AI's use is curtailed or prohibited	**Purpose** •Clearly explain *why* students are doing the assignment •Specifies how it connects to learning goals •Shines a light on real-world applications
Task •Provide specific guidance on use of AI to support application of knowledge and skills •Provide specific guidance on where it should be avoided	**Task** •Spell out *what* students are expected to do. •Where possible provide a workflow for successful completion •Provide formative feedback, scaffolds, and reflective opportunities where appropriate
Criteria •Define how AI use will be judged •Set expectations on if/how AI output should be integrated into my deliverable(s) for this assignment •Set policies on how AI use should be indicated in submitted work	**Criteria** •Make explicit *how* the work will be evaluated, •Consider providing a rubric •Consider providing access to successful exemplars

Note: Author’s original Transparency in Teaching & Learning with genAI considerations and the TILT framework (Wiss et al., 2025, adapted from Winkelmes et al., n.d.

This TILTai Framework utilizes the same pillars as the original TILT model it is built upon. The Purpose pillar focuses on describing why genAI may help or hinder achievement of learning objectives. The Task pillar focuses on the specific ways in which genAI can be used, as well as areas in which it should be avoided. Finally, the Criteria pillar describes how AI use will be assessed and/or judged and provides expectations on citing AI or indicating its usage on the assignment in question.

Pilot Faculty Development Model

The TILTai Framework was used by the authors to create a pilot faculty development program intended to guide participants through the process of creating more transparent assignment-level guidance regarding genAI use within a large school of public health. The pilot program generated high levels of interest, with over 80 full and part-time faculty registrants. Over the course of two one-hour sessions, faculty were introduced to many of the challenges that students encounter with genAI in their coursework, introduced to the principles outlined in the TILTai Framework, and invited to critically evaluate the guidance they were currently providing their students regarding genAI at both the course and individual assignment level.

As an applied culminating activity, participants engaged in a scaffolded workshop activity where they enhanced the directions in an existing assignment to be more inclusive of genAI's role in the Purpose, Task(s), and Criteria for success on that assignment. Each component of the TILTai Framework was demonstrated by workshop facilitators during the workshop activity, where they presented their own examples of TILTai-influenced assignment guidance.

The applied portions of this workshop took place in small group breakout rooms and culminated in a general report-out to all participants in the main session. Faculty participants were encouraged to continue this work after the two-part series and then deploy that assignment with enhanced genAI guidance in the following academic term. This study is anchored in a set of eight separate courses where faculty made these transparency updates to one or more assignments using the TILTai framework.

Initial Creation of the TILTai Scale

The authors note that an early version of the scale was shared as a part of the faculty workshop activity previously described as a general survey tool. Positive participant reaction to the prototype led the authors to engage in a full study to both explore the effects of the TILTai Framework on student perceptions of genAI's role on assignments, and to validate the TILTai Scale as a psychometric instrument that can be used to measure student perceptions of transparency.

Measurement

To measure students' perceptions of transparency related to AI's use on a particular assignment, a new multi-factor instrument was developed utilizing the previously described TILTai principles. This work was informed throughout by foundational work on assignment transparency by Winkelmes et al. (n.d.). Named the TILTai Scale, this instrument consists of 11 items mapped to the three distinct factors in the TILTai Framework, those being: Purpose, Task, and Criteria.

Scale-based items were extrapolated from the TILTai Framework (See Table 1) and its three pillars and treated as discrete factors. For example, the principle "Provide clarity on AI's intended use and how it may support/detract from learning goals" in the Purpose pillar was used to create two separate items in the TILTai Scale ("I understand how AI's intended use on this assignment could support my learning" and "I understand how AI's prohibited use could potentially detract from my learning") with expectations that it would load on the Purpose factor.

Content and Construct Validity

The newly developed TILTai Scale and its individual items were reviewed by a team of five scholarly practitioners who had received previous training on transparent assignment design and were designated as "Master Teachers" by their school's internal fellowship program. The review team provided comments on both item and construct validity. Input from this team was used to finalize the instrument before use in the study.

Additional Non-Scale Based Items

Additionally, the authors wished to understand the relationship between assignment transparency as described by TILTai and emotional burden and uncertainty regarding genAI use in academic work as described by Singer-Freeman et al. (2025). A set of eight Likert items were created based on findings from this work, asking participants to share their perceived levels of uncertainty and discomfort as compared to other assignments they had recently encountered. For example, “Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident my professor will be aware of my intended use(s) of AI.”

Instrumentation

All items in the TILTai Scale utilized a seven-point Likert scale and asked participants to rate their level of agreement with a series of items, where 1 = Strongly Disagree and 7 = Strongly Agree. The newly developed instrument contained a total of eleven items (Table 3).

The instrument was first administered online to students who chose to opt-in to the study. The online survey platform first captured general demographic details, including identifying the course and assignment the student participant was currently involved with. On a new screen, students were then asked to complete the 11-item TILTai Scale. On the following screen, students were asked to respond to the set of eight non-scale-based items. The final screen contained three open-ended and optional qualitative questions that captured additional student perceptions related to genAI’s use in academic coursework.

Procedure

Students were first presented with a set of assignment directions that had been modified using the TILTai Framework. Within one week of receiving the assignment, these same students received an email invitation to participate in a brief study regarding their perceptions of the assignment and its clarity regarding genAI use. Both the email invitation and the online survey tool indicated that participation was fully optional and would have no impact on grading or other evaluation of that student. This study was conducted under GW IRB# NCR203171.

Data Analysis and Results

Participants

Participants ($N = 70$) were students enrolled in one of eight separate master’s level public health and health administration courses. In all courses, the instructor had participated in the previously described TILTai-based faculty development program, and as a result, had offered an assignment that had been redesigned using the TILTai Framework. These assignments were classified into three types for the purposes of this study: Program Planning and Evaluation, Quantitative Skills, and Capstone Project. The number of participants from each course type is located in Table 2.

Exploratory Factor Analysis (EFA)

We began the EFA process with a Kaiser-Meyer-Olkin (KMO) test to determine the suitability of factor analysis. The KMO value of .70 indicated an acceptable sample. Further, the Bartlett’s Test of Sphericity was significant ($p < .001$), indicating significant correlations between the scale items.

Principal axis factoring with an Oblimin rotation identified three factors with eigenvalues greater than one, and which combined explained 74.52% of the variance. Factor 1 had an eigenvalue of 4.61 and explained 41.86% of the variance. Factor 2 had an eigenvalue of 2.27 and explained 20.66% of the variance. Factor 3 had an eigenvalue of 1.32 and explained 11.99% of the variance. Factor loadings are in Table 4. Communalities ranged from .55 to .99, indicating the variance explained by the factors was acceptable.

The items did not load directly on the assumed factors of Purpose, Task, and Criteria as the authors intended when developing these three scales. After review of the factor analysis, it revealed that the items loaded on to three discrete factors that closely aligned with TILT principles.

Items 1 and 2 loaded onto a discrete factor that describes Purpose in the support of learning; we named this factor Purpose–Support Learning. Items 3, 4, and 5 also loaded onto the TILT concept of Purpose, this time measuring Purpose in terms of student understanding of future roles and acceptance of AI's role in the assignment; we named this factor Purpose–Role and Future Success. Finally, items 6 through 11 loaded together onto a single factor related to the TILT principles of both Task and Criteria; we named this factor Task Criteria. These items were combined into subscales for subsequent analysis. All items in the TILTai Scale loaded onto one of the three factors with factor loadings of .64 or greater.

We evaluated the reliability of the TILTai scale and its subscales. The full scale showed good reliability, $\alpha = .86$. Each subscale also showed acceptable-to-high reliability with Purpose–Support Learning, $\alpha = .70$, Purpose–Role and Future Success, $\alpha = .90$, and Task Criteria, $\alpha = .87$.

TILTai Scale Scores

The descriptive statistics for the TILTai scale can be found in Table 3. Participant average scores across all items ranged from slightly agree ($M = 4.93$, Item 10) to agree ($M = 6.01$, Item 7). No significant differences were found between the assignment category and the three TILTai Scale factors of Purpose–Support–Learning ($p = .93$), Purpose–Role–and Future Success ($p = .09$), and Task Criteria ($p = .37$).

Regression Analysis

We next explored the TILTai subscales as predictors of eight items intended to assess known concerns held by students related to use of genAI (Singer-Freeman et al., 2025). These eight items and their descriptive statistics can be found in Table 5. We conducted a series of eight linear regression analyses, where the three TILTai subscales were the predictor variables, and the individual genAI challenge items were the outcome variables. Seven of the eight models were significant, with the only genAI challenges item not significantly predicted by the TILTai subscales being "this assignment makes me interested in one or more specific applications of AI."

The model and predictor statistics can be found in Table 6. General results of note include that the Purpose–Role and Future Success subscale was a significant predictor in all but two of the models, those being for the genAI challenges items "this assignment makes me worry less that other students who use AI will have an unfair advantage," and "this assignment makes me worry less that I will be accused of plagiarism related to AI use." Task Criteria was also a significant predictor in all but two of the models, those being for the genAI challenges items "this assignment makes me interested in one or more specific applications of AI," and "this assignment makes me better understand how AI might be used to support my learning going forward." Finally, the Purpose–Support Learning subscale was not a significant predictor in any of the models.

The strongest relationship was found between the genAI challenges item "compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident when it is acceptable to use AI," R^2=.52, F(3, 59)=21.05, p<.001. Both Purpose–Role and Future Success (β=.60, p<.001) and Task Criteria (β=.22, p=.03) were significant predictors, while Purpose–Support Learning (β=.03, p=.79) was not.

Another strong relationship included the genAI challenges item "compared to other assignments I have completed over the past three semesters, this assignment makes me worry less that other students who use AI will have an unfair advantage," R^2=.42, F(3, 59)=13.94, p<.001. Only Task Criteria was a significant predictor (β=.53, p<.001), while Purpose–Role and Future Success (β=.16, p=.17) and Purpose–Support Learning (β=.09, p=.41) were not.

A third strong relationship included the genAI challenges item "compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident that my efforts will result in the grade I expect on this assignment," R^2=.40, F(3, 59)=13.27, p<.001. Both Task Criteria (β=.26, p=.02) and Purpose–Role and Future Success (β=.51, p<.001) were significant predictors, while Purpose–Support Learning (β=-.03, p=.82) was not.

Table 2

Participants by Course Type

Course Type	N
Program Planning and Evaluation	31
Quantitative Skills	21
Capstone Project	18

Table 3

TILTai Scale Descriptive Statistics

Item #	Item	Mean	SD
1	I understand how AI's intended use on this assignment could support my learning	5.39	1.70
2	I understand how AI's prohibited use could potentially detract from my learning	5.59	1.62
3	I understand how this assignment—including any required or recommended use of AI—can prepare me for future success	5.40	1.51

4	I understand how this assignment—including any required or recommended use of AI—can prepare me to succeed in my future profession.	5.37	1.49
5	I am accepting of AI's recommended role in this assignment.	5.29	1.62
6	I understand what tools and technologies are allowed when completing this assignment.	5.93	1.49
7	I understand what tools and technologies are prohibited when completing this assignment.	6.01	1.25
8	I was provided specific guidance on how I should be using AI to support my work on this assignment.	5.44	1.70
9	It is clear how AI output should be integrated into my deliverable(s) for this assignment.	5.04	1.81
10	It is clear how I should indicate AI's use in my work on this assignment.	4.93	2.04
11	If I choose to use AI on this assignment, I understand how it will be judged.	5.04	1.88

Table 4

TILT-AI Factor Loadings

Factor Name	Item #	Item	Factor 1	Factor 2	Factor 3
Purpose - Support Learning	1	I understand how AI's intended use on this assignment could support my learning	.33	.53	.67
	2	I understand how AI's prohibited use could potentially detract from my learning	.23	.12	.74
Purpose - Role and Future Success	3	I understand how this assignment—including any required or recommended use of AI—can prepare me for future success	.20	.87	.18
	4	I understand how this assignment - including any required or recommended use of AI - can prepare me to succeed in my future profession.	.18	.99	.11
	5	I am accepting of AI's recommended role in this assignment.	.42	.73	.26
Task Criteria	6	I understand what tools and technologies are allowed when completing this assignment.	.64	-.07	.51
	7	I understand what tools and technologies are prohibited when completing this assignment.	.64	.04	.60

	8	I was provided specific guidance on how I should be using AI to support my work on this assignment.	.78	.16	.27
	9	It is clear how AI output should be integrated into my deliverable(s) for this assignment.	.81	.28	.20
	10	It is clear how I should indicate AI's use in my work on this assignment.	.77	.22	.26
	11	If I choose to use AI on this assignment, I understand how it will be judged.	.78	.22	.27

Table 5

Participant Self-Reported GenAI Concerns Descriptive Statistics

Self-Reported Confidence	Mean	SD
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident when it is acceptable to use AI	4.95	1.53
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident my professor will be aware of my intended use(s) of AI	4.90	1.65
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident my professor will approve of my intended use(s) of AI for this assignment	4.84	1.70
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident that my efforts will result in the grade I expect on this assignment	5.03	1.45
Compared to other assignments I have completed over the past three semesters, this assignment makes me worry less that other students who use AI will have an unfair advantage	4.29	1.79
Compared to other assignments I have completed over the past three semesters, this assignment makes me worry less that I will be accused of plagiarism related to AI use	4.38	1.71
Compared to other assignments I have completed over the past three semesters, this assignment makes me interested in one or more specific applications of AI	4.57	1.77
Compared to other assignments I have completed over the past three semesters, this assignment makes me better understand how AI might be used to support my learning going forward	5.19	1.56

Table 6

Multiple Regression Analyses, TILTai Subscales as Predictors of Concern Items

Outcome	Model R^2	Model sig.	Predictor	Standardized β	Predictor sig.
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident when it is acceptable to use AI	.52	<.001	Purpose–Support Learning	.03	.79
			Purpose–Role and Future Success	.60	<.001
			Task Criteria	.22	.03
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident my professor will be aware of my intended use(s) of AI	.37	<.001	Purpose–Support Learning	.14	.27
			Purpose–Role and Future Success	.25	.04
			Task Criteria	.39	.001
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident my professor will approve of my intended use(s) of AI for this assignment	.37	<.001	Purpose–Support Learning	.14	.44
			Purpose–Role and Future Success	.37	.003
			Task Criteria	.31	.008
Compared to other assignments I have completed over the past three semesters, this assignment makes me feel more confident that my efforts will result in the grade I expect on this assignment	.40	<.001	Purpose–Support Learning	-.03	.82
			Purpose–Role and Future Success	.51	<.001
			Task Criteria	.26	.02
Compared to other assignments I have completed over the past three semesters, this assignment makes me worry less that other students who use AI will have an unfair advantage	.42	<.001	Purpose–Support Learning	.09	.41
			Purpose–Role and Future Success	.16	.17
			Task Criteria	.53	<.001
Compared to other assignments I have completed over the past three semesters, this assignment makes me worry less that I will be accused of plagiarism related to AI use	.18	.007	Purpose–Support Learning	-.05	.74
			Purpose–Role and Future Success	.19	.16
			Task Criteria	.35	.01

Compared to other assignments I have completed over the past three semesters, this assignment makes me interested in one or more specific applications of AI	.09	.12	Purpose–Support Learning	-.03	.82
			Purpose–Role and Future Success	.33	.02
			Task Criteria	-.04	.78
Compared to other assignments I have completed over the past three semesters, this assignment makes me better understand how AI might be used to support my learning going forward	.21	.003	Purpose–Support Learning	.08	.57
			Purpose–Role and Future Success	.44	.001
			Task Criteria	-.09	.49

Qualitative Procedures

The qualitative data comprised participant responses to three open-ended survey questions, which asked 1) what students had learned about AI that they could apply to their future work, 2) what additional guidance from the instructor would have helped them understand AI's role in the assignment, and 3) what worries they still held about AI's use. In total, 38 sets of participant responses were analyzed. These responses were analyzed using a categorical coding approach (Maxwell, 2009). This approach was chosen to foreground internal validity and contextual understanding where possible in the data (Huberman & Miles, 2002). The qualitative analysis below was conducted independently of the quantitative results. Participant responses were examined one item at a time and coded using an open coding approach to assign meaningful categories to groupings of participant responses, with related responses grouped before a categorical cluster was assigned to identify patterns (Saldaña, 2011). Throughout, the intent was to base each resulting category on the specific responses and participant voices. From these clusters coalesced relevant patterns of shared participant perspectives and overarching themes presented below (Richards & Morse, 2012).

Qualitative Results

Participant responses converged into three themes related to the three areas the open-ended items addressed: 1) whether and how students learned from the assignment; 2) the adequacy and direction of the guidance received; and 3) the concerns that remained even when expectations were explicit. Within each theme, responses were grouped into specific shared perspectives. The table below outlines these results with participant quotes drawn from the survey responses, and the prose that follows summarizes each theme in turn.

Table 7

Categories of Themes and Shared Participant Perspectives

Theme	Shared perspective	Participant quotes
Learning about AI from the assignment	Where students did learn about AI from the assignment, they described learning about AI as a tool.	“AI is a tool for streamlining tasks. Should be used as an aid to learn and increase productivity. Autonomy should still remain and critical thinking within ourselves. It is inevitable for everyone to use it. Job structuring and demands will change so career outlook I should be concerned of. Will I have a decent paying job in the near future that relates to my field of study, Public health/health informatics” “AI is great at providing basic level research/information (similar to a Wikipedia page) for gaining background knowledge”; “It's a good research tool.” “I learned how to use it to debug code.” “Using AI to organize research and compile ideas.” “I learn AI tools can help to improve my grammar and spelling and research some articles database.” “That AI can help me study for exams and grouping articles into categories or themes.” “Organization of data”; “How to use ideas to help generate own ideas”; “Using AI to help debug code”
Learning about AI from the assignment	Some students perceived that AI was prohibited or they are resistant to using AI.	“Nothing, we were told not to use AI and only databases” “All my classes generally prohibit, so I don't use it” “I don't use AI”; “I do not like using AI, so it is hard for me to find it to be reliable”
Diverging perspectives on guidance	A prevalent group of students felt the guidance was sufficient or nothing more was needed.	“No, all instructions were clear”; “No, it was clear what was and was not acceptable”; “No - it was clear”; “No, this was the most clear guidance on AI that I have received.”
Diverging perspectives on guidance	Some students wanted guidance to be more concrete and clearer demonstrations of AI use.	“Professor should clearly outline tips and tricks for formatting using AI and when it's not appropriate to use AI. Display how academic individuals would appropriately leverage AI in academic work. This helps to set a good example as we know how we could use

		the tool if the instructor themselves can demonstrate their understanding of AI" "There should be live examples to teach how to properly prompt an AI tool before applying it to their work"
Diverging perspectives on guidance	Other students noted potential challenges with implementing further guidance.	"I think maybe specify less of what you can use since there are so many AI opportunities out there. I know it says only Copilot but sometimes people do not listen." "This is difficult considering the rapidly changing capabilities of AI. I think if I was adept at using it, there are probably capabilities to assist with organization that would help. However, due to the (understandable) restrictions regarding its use, I am hesitant and do not have the opportunity to use it for academia"
Student fears and concerns regarding AI	Students feared being wrongfully accused that their own, self-created/honest work would be flagged as AI generated.	"My main concern is that when I paraphrase or summarize the sources in my assignment—even though I'm using my own words and including in-text citations—it still gets flagged as AI-generated during proofreading." "I always have the worry at the back of my head that I will be accused of using AI when I did not, which is why I try to cite so vigorously." "Perhaps an instructor is using an AI detection tool that hallucinates or incorrectly flags an assignment as AI-generated, even when AI was only used as instructed. This raises concerns about the validity of a student's work and the complications surrounding how much AI was used to help draft a paper versus how much reflects the student's actual effort and understanding"
Student fears and concerns regarding AI	Some students expressed deeper concern/harm due to AI use	"Without proper illustration, both students and teachers will be harmed and distrust between the two widens" "I'm always concerned about accuracy of AI results and suggestions. I still worry that using it, even while following the provided guidelines, is a form of cheating"
Student fears and concerns	In group work, students worried that their grade depended	"Since most of it is group work, we have to rely that other students are not overusing AI. ... our grade's reliance on other's contribution is concerning"

regarding AI	on peers whose AI use they could not see/control.	"I can also tell when my group partners in other assignments/classes use AI to write and it is quite frustrating because I am putting in the effort to be a strong writer while others are just copying and pasting"

Learning About AI from the Assignment

Describing what they learned about AI from the assignment, students primarily fell into two categories: those who were resistant to using AI and those who learned about its use as a tool. Regarding the former, some had chosen not to use AI for various broader concerns outside the assignment itself, with one stating, "I do not like using AI, so it is hard for me to find it to be reliable." Other students described learning about its varied use as a tool. One described it as reference material, "great at providing basic level research/information (similar to a Wikipedia page) for gaining background knowledge." Other students noted specific tasks, such as learning to "debug code," to "organize research and compile ideas," or that AI "can help me study for exams and grouping articles into categories or themes."

Diverging Perspectives on Guidance

Students were somewhat divided on the nature and sufficiency of the guidance provided, and their perspectives fell into three categories. Primarily, most students felt nothing further was needed because the TILTai-based guidance was already clear. For example, one student described the assignment guidance as "the most clear guidance on AI that I have received." Another set of students wanted the guidance to be made more concrete and/or demonstrated, asking that the instructor provide "specific examples" to show how the tools should be used, and some wanted clearer expectations about how AI use "should be cited." Finally, yet another smaller set of students expressed that more restrictions could be problematic if implemented, with one student suggesting the instructor "specify less of what you can use" and another predicting that further guidance would be "difficult considering the rapidly changing capabilities of AI."

Student Fears and Concerns Regarding AI

Regardless of the clarity of the guidance provided, some students expressed worries that this clearer guidance may not have directly resolved. Generally, a number of students reported no concerns at all. One concern that recurred in several instances in student comments was a fear of being wrongly accused of using AI inappropriately. For instance, one participant explained that even when they used their own words and included citations, "it still gets flagged as AI-generated during proofreading," and another described trying to "cite so vigorously" out of fear of being accused. Others worried about being "monitored 24/7" or felt that, without demonstration, "distrust between the two widens" between students and teachers. A further possible concern arose specifically in group work, where a student described how "our grade's reliance on other's contribution is concerning" when peers' AI use could not be seen or controlled.

Discussion

The TILTai Framework

This study's population of master's level students who encountered TILTai-influenced assignment guidance showed moderately positive to positive levels regarding overall perception of assignment transparency across all three factors measured by the TILTai Scale. This indicated to the authors that the pilot faculty development program supporting the development of AI guidance using the TILTai Framework was generally successful. In analyzing the results from the TILTai Scale, we observed no significant differences between the assignment types included in this study in terms of perceived transparency of assignment guidance. This suggests a broad applicability of the TILTai Framework to different types of academic coursework and assignment guidance. The authors make the general recommendation that TILTai Framework be considered for inclusion in faculty development programming related to transparent assignment design, as the TILTai Framework was designed to be a natural extension of the successful transparent design principles outlined by TILT (Winkelmes et al., n.d.).

TILTai Scale: Future Use

The TILTai Scale was found to be a preliminarily valid and reliable tool to measure student perceptions of assignment transparency as it relates to genAI use. Educators and researchers alike with interest in examining curriculum design in the context of genAI may find this scale an appropriate tool for measuring student perception of genAI transparency within their own scholarship and institutions.

Influence of TILTai

Regression analysis indicated a wealth of relationships between the three factors measured by the TILTai Scale (Purpose-Support Learning, Purpose-Role and Future Success, and Task Criteria) and the ongoing concerns held by students regarding genAI's role in their academic work. The study's strongest overarching finding was that greater transparency in assignment guidance was associated with lower levels of student concern about specific issues related to the academic use of genAI (see Table 5). This suggests that the TILTai Framework as a foundation for assignment design and faculty development can positively move the needle in terms of documented student fears related to genAI in academic work (Singer-Freeman et al., 2025). These general sentiments were echoed in the qualitative comments from students who highlighted the clarity of the TILTai-based assignment guidance compared to other previous assignments they had encountered.

TILTai-based guidance on an assignment's purpose and its role in their future success had a meaningful impact on students' comfort with acceptable AI use. Similarly, student concerns about unfair academic advantage being provided to users of AI also decreased as transparency of task and criteria increased. Finally, student confidence in meeting instructor expectations and receiving a corresponding grade was positively influenced by higher level of transparency regarding the assignment's purpose, specifically regarding AI's role on the assignment and how it could shape future success. These three pronounced examples from the larger set of significant relationships uncovered by the regression analysis further confirm the benefits of TILTai-influenced assignment guidance in addressing a wide range of commonly held student concerns regarding AI's role on individual assignments.

Continued Tensions: Instructor Transparency and Academic Integrity

Beneath the surface of these positive scale scores emerged a qualitative theme and unsettled tension that, even with more robust assignment guidance, students feared potential accusations of academic integrity violations related to genAI use, even in cases where they are attempting to be good actors operating within the assignment parameters. This provides some further insight into the lowest but still positively scored item in the TILTai Scale being clarity on "how to indicate AI's use." A similar tension arose regarding group work, where students worried that peer use of genAI could affect the quality of the group product and its evaluation. In these respects, students appeared less worried about their own genAI use, focused instead on what they cannot control individually.

Given this context, the authors believe that the TILTai Framework can be a useful component in leading a larger mindset and culture shift in higher education that can help to control the impulse to immediately distrust genAI tools and their use. Transparency at all levels, starting with each individual assignment and radiating out to the institutional level, can help create the conditions for organizational change.

Limitations and Recommendations for Further Research

This study was limited to master's-level students, who likely possessed foundational research and writing skills and/or greater exposure to academic writing prior to the widespread introduction of genAI in the academic space. Future studies focusing on the dimensions of TILTai and commonly held student concerns related to genAI use may wish to widen their aperture to include a broader spectrum of students and degree levels and also consider levels of student experience using genAI tools both inside and outside of academic settings. Along similar lines, the authors also note the modest sample size of 70 graduate-level participants from a single academic program as a limitation and encourage further scholarship using this framework and instrument in a wider range of academic settings.

The authors encountered two specific challenges regarding the population for this study. First, participants came from eight different academic courses and therefore encountered one of eight different sets of TILTai-influenced assignment guidance. While no significant differences were found between the categories of assignment, future studies would benefit from a larger pool of participants or engaging with a single TILTai-influenced assignment. Additionally, approximately half of participants in this study chose not to provide substantive qualitative responses to the open-ended questions, which limited the insights gained from this component of the study.

This study was conducted after the introduction of TILTai-influenced assignment guidance, and future studies would be strengthened by utilizing a pre-post design where measurement of student perceptions of transparency takes place before and then after exposure to that TILTai influenced guidance. Additionally, examination of informal instructor guidance, including in-class discussion and commentary, could be considered for additional study.

The authors also recommend further research into students' perception of control as it relates to student team member behaviors with genAI, the use of computer-based tools for genAI detection, and institutional acceptance of genAI use in academic work. This recommendation is made in the context of students who displayed positive perceptions of transparency at the assignment level but continued to have broader concerns that cannot be addressed by a single assignment and its transparency.

Declarations

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Declaration of AI and AI-Assisted Technologies
During the preparation of this work, the authors used OpenAI's ChatGPT 5.5 Thinking Mode to assist with literature review and organizing literature. After using this tool, the authors reviewed and verified the accuracy, completeness, and originality of all source citations, and take full responsibility for the content of this publication.

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References

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Barba, L. A. (2025). Experience embracing genAI in an engineering computations course: What went wrong and what next. https://doi.org/10.1109/MC.2025.3572654

Brown, E. A., Kronenburg, M., Steeley, A., & Tagbor, D. (2025). A case study using the transparency framework and artificial intelligence to promote effective writing and student success in a writing-intensive course. *Journal of Health Administration Education*, *41*(2), 183–210.

Brown, E. A. (2024, March). Using the transparency framework and artificial intelligence to promote effective writing and student success in a writing-intensive course [Conference presentation]. 2024 ASPPH Annual Meeting for Academic Public Health, Arlington, VA, United States.

Chirikov, I., Smirnov, I., & Kizilcec, R. F. (2026). Generative AI use and misuse call for assessment reform in higher education. *Science*, *392*(6800), 818–820.

Cotelli Kureth, S., Paliot, E., & Zink, S. (2025). Fostering transparency: a critical introduction of generative AI in students' assignments. *Language Learning in Higher Education, 15(1),* 63–85. https://doi.org/10.1515/cercles-2024-0105

Corbin, T., Dawson, P., Nicola-Richmond, K., & Partridge, H. (2025). "Where's the line? It's an absurd line": Towards a framework for acceptable uses of AI in assessment. *Assessment & Evaluation in Higher Education, 50*(5), 705–717. https://doi.org/10.1080/02602938.2025.2456207

Damm, C., & Eaton, L. (2026, March 18). *From prompt to practice: A framework for transparent GenAI use in higher education*. EDUCAUSE Review. https://er.educause.edu/articles/2026/3/from-prompt-to-practice-a-framework-for-transparent-genAI-use-in-higher-education

Du, Y., & He, H. (2026). Enabling and inhibitory pathways of university students' willingness to disclose AI use: A cognition-affect-conation perspective. arXiv preprint. https://arxiv.org/pdf/2604.21733

Friberg-Fort, J. C., & Giovagnoli, D. (2026). Radical transparency as an antidote to unclear expectations for generative AI use. In N. Pritts (Ed.), *Empowering educational development and faculty growth with AI* (pp. 273–288). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3373-4129-3.ch010

Furze, L., Perkins, M., Roe, J., & MacVaugh, J. (2024). The AI Assessment Scale (AIAS) in action: A pilot implementation of GenAI-supported assessment. *Australasian Journal of Educational Technology, 40*(4), 38–55. https://doi.org/10.14742/ajet.9434

Gerlich, M. (2025). AI tools in society: Impacts on cognitive offloading and the future of critical thinking. *Societies, 15*(1), 6. https://doi.org/10.3390/soc15010006

Gonsalves, C. (2026). The transparency trap: Generative AI and the rise of interpretive load. *Review of Education*, 14, e70139. https://doi.org/10.1002/rev3.70139

Habib, S., Vogel, T., Anli, X., & Thorne, E. (2024). How does generative artificial intelligence impact student creativity? *Journal of Creativity*, 34 (1). https://doi.org/10.1016/j.yjoc.2023.100072

Huberman, M., & Miles, M. B. (2002). *The qualitative researcher's companion*. Sage.

Lewis Miller, C., Barth, D., Gay, K., Scherer, F., & Herron, J. (2025). *Faculty development and GenAI playbook: Evidence-based best practices*. Online Learning Consortium. https://onlinelearningconsortium.org/publication/2025/playbook/faculty-development-genAI-playbook/

Lipuma, J., Leon, C. & Meng, Y. (2025). From digital natives to AI-natives: Rethinking assessment and instructional design in the age of autonomous AI tools. *STEM for Success Resources*. 121. https://digitalcommons.njit.edu/stemresources/121

Maxwell, J. A. (2009). Designing a qualitative study. In L. Bickman & D. J. Rog (Eds.), The SAGE handbook of applied social research methods (2nd ed., pp. 214–253). Sage. https://doi.org/10.4135/9781483348858.n7

Orfanidis, C. (2025). Moral diversity in institutional policies governing the student usage of generative AI: An international comparison. *Higher Education Quarterly, 79(4)*, e70051. https://doi.org/10.1111/hequ.70051

Parker, L., Loper, A. J., Carter, C., Hayes, J., & Karakas, A. (2026). Longitudinal insights into AI in education: Usage, ethics, and policy development in higher education. *Computers and Education Open*, 100329.

Richards, L., & Morse, J. M. (2012). *README FIRST for a User' s Guide to Qualitative Methods*. Sage.

Saldaña, J. (2011). *Fundamentals of qualitative research*. Oxford University Press.

Sanz-Tejeda A, Domínguez-Oller JC, Baldaquí-Escandell JM, Gómez-Díaz R and García-Rodríguez A (2026) The impact of generative AI on academic reading and writing: a synthesis of recent evidence (2023–2025). *Front. Educ. 10*:1711718. https://doi.org/10.3389/feduc.2025.1711718

Singer-Freeman, K. E. (2025). Structuring effective learning with GenAI: Lessons from group work. *The National Teaching and Learning Forum*. https://doi.org/10.1002/ntlf.30607

Singer-Freeman, K., E., Verbeke, K., & Barre, B. (2025). Generative AI usage among university students depends on academic level and task. *Higher Learning Research Communications. 15(2),* 1–24. https://doi.org/10.18870/hlrc.v15i2.1616

Singer-Freeman, K. E., Payne, C., & Zimmerman, S. C. (2026). Applying collaborative learning principles to teaching with GenAI: A pre-calculus assignment example. *International Journal of Education in Mathematics, Science and Technology (IJEMST),* 14(3), 971-985. https://doi.org/10.46328/ijemst.5542

Watson, C. E., & Rainie, L. (2026). The AI Challenge: How College Faculty Assess the Present and Future of Higher Education in the Age of AI. American Association of Colleges and Universities. https://www.aacu.org/research/the-ai-challenge

Winkelmes, M.A. (2023a). Introduction: The story of TILT and its emerging uses in high er education. In M.A. Winkelmes, A. Boye, & S. Tapp (Eds.), *Transparent design in higher education teaching and leadership: A guide to implementing the transparency framework institution-wide to improve learning and retention* (pp. 1–14). Routledge. https://doi.org/10.4324/9781003448396-1

Winkelmes, M.A. (2023b). Introduction to transparency in learning and teaching. *Perspectives In Learning, 20*(1). https://csuepress.columbusstate.edu/pil/vol20/iss1/2

Winkelmes, M. A., Bernacki, M., Butler, J., Zochowski, M., Golanics, J., & Harriss Weavil, K. (2016). A teaching intervention that increases underserved college students' success. *Peer Review*, *18*(1/2), 31–36. https://www.proquest.com/docview/1805184428?sourcetype=Scholarly%20Journals

Winkelmes, M. A., Christopher, K., Copeland, D., Gravett, E., LaFleur, J., Palmer, M., … Yong, D. (n.d.). TILT Higher Ed examples and resources. www.TILTHigherEd.org

Wiss, A., Singer-Freeman, K., Thorpe, J. H., Heminger, C., Quinlan, S., & Pattershall-Geide, J. (2025, November 19). Supporting learning-centered usage of GenAI tools: Adapting the Transparency in Learning and Teaching (TILT) framework [Conference presentation]. OLC Accelerate 2025, Orlando, FL, United States.

Yee, K., Uttich, L., Giltner, L., & Bojanowski, A. (2025). Coach for the approach: The educator's new role in the age of AI. UCF Created OER Works.

The Online Learning Consortium Quality Scorecard for K12 Blended Learning

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Abstract
As K12 blended learning continues to expand, a K12-specific framework for evaluating program quality was not found. While rubrics such as Quality Matters and iNACOL address course-level design, no comprehensive scorecard exists for the broader design, leadership, implementation, and administration of K12 blended programs. This study used a four-round Delphi methodology to build expert consensus for adapting the Online Learning Consortium's 2023 Quality Scorecard for Blended Programs, originally developed for higher education, for use in K12 settings. A panel of 20 U.S.-based experts in K12 blended teaching, administration, and research evaluated 65 quality indicators across nine categories, voting on relevance, proposing new indicators, and refining language for a K12 audience using a 6-point Likert scale with consensus defined as $M \geq 5.0$ and 70% panel agreement. The resulting OLC K12 Blended Learning Scorecard organizes quality indicators into eight categories: School District Support, Technology Support, Course Development and Instructional Design, Course Structure, Teaching and Learning, Teacher Support, Student Support, and Evaluation and Assessment. Findings show quality blended learning in K12 settings depends on the combination of organizational leadership, infrastructure, instructional design, pedagogy, and ongoing evaluation, rather than an isolated intervention. This study contributes a practical, research-informed tool to guide K12 educators, administrators, and policymakers in designing, implementing, and evaluating blended learning programs, and offers a foundation for future research on scorecard implementation, blended teacher training, and blended learning program evaluation.

Keywords: Quality K12 education, K12 blended learning, K12 digital learning, quality blended learning, Delphi method, blended learning program evaluation

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K12 education continues to transform with the integration of emerging digital technologies along with the disruption created by the COVID-19 pandemic (Yu et al., 2025a). With that transformation, K12 blended learning continues to increase (Molnar, 2019; Short et al., 2021). While hybrid or blended learning was used prior by early adopters, the pandemic forced many to an online and blended educational environment, which quickly showed a gap in the understanding of best practices (Johnson et al. 2023; Henríquez & Hilliger, 2024; Newfield, 2025). As digital educators, we need to respond to this knowledge gap as well as the research on parental demand for school choice. For example, two different studies show that 60% of parents switched their child's(children's) school or are considering a change (Ed Choice, 2026; National School Choice Awareness Foundation, 2025). One recent survey revealed that 49% of parents would prefer their child learn from home at least one day a week. While 10% of those want full-time homeschooling, the remaining 39% of parents desire their child to learn at home one to four days a week, with the remaining days attending school on-campus. In another parent survey, 64% of parents indicated that if they were looking for a new school for their child, would enroll him or her in a hybrid school (McShane, 2024). The increased parent demand for school choice is not about rejecting education but about recognizing students have different needs, different schedules, and different learning styles; because of this, blended learning is even more important to the success of K12 education.

Background and Rationale

Horn and Staker (2011) were convinced early on that blended learning could revolutionize K–12 education by offering the following:

- A more consistent and personalized pedagogy that lets students learn at their own pace, use preferred learning modalities, and receive frequent and timely feedback on their performance for a far higher quality learning experience.

- Productive new school models that require fewer, more specialized teachers and use space more efficiently. (p. 6)

Just four years later, Horn and Staker (2015) found schools were indeed adopting blended learning because of personalizing student learning, increasing student access, and needing to control costs.

K12 blended learning is a formal education program in which a student learns at least in part both through online learning and face-to-face components (Horn & Staker, 2011). Key characteristics include the integration of online and offline learning environments, the use of technology to facilitate learning, and the empowerment of students to take ownership of their educational journey. This model supports differentiated instruction and can cater to diverse learning styles and needs, making it particularly effective in K12 settings where student engagement and adaptability are crucial.

Staker and Horn (2012) suggested four different models of blended learning: the Rotation, Flex, Self-Blend (now called À La Carte model), and Enriched Virtual models. In a Rotation model, students move between teacher-directed learning activities, including at least one online activity and is most used in elementary schools (McCabe & Francis, 2020). Their Flex model utilizes foundational online content that is individually customized, with students moving on a flexible schedule among the learning modalities but still includes a teacher on-site.

In the Self-Blend model, students supplement their on-campus experience by taking one or more courses entirely online. The Enriched Virtual model offers the majority of coursework to be completed at home but still requires students to visit the campus for face-to-face learning.

The literature continues to support blended learning effectiveness. For example, one meta-analysis of 84 studies showed significant positive effects on K12 student performance especially in cognitive domains (Li & Wang, 2022). Means et al. (2014) found, "on average, students in conditions that included significant amounts of learning online performed better than students receiving face-to-face instruction," and went on to state that, "the subset of the studies employing blended learning approaches was entirely responsible for the observed online advantage" (p. 20). Another systematic literature review of 1355 studies found blended learning was more effective than both online learning and traditional learning (Topping et al., 2022). In their meta-analysis of 133 studies, Yu et al. (2025b) also found blended learning was more effective than online learning.

The literature has shown that while K12 blended learning continues to expand, the research has not kept the same pace (Barbour et al., 2026). While both Quality Matters (Kennedy et al., 2018) and iNACOL (Voelker et al., 2019) offer rubrics for use in K12 education, there was not a more recent rubric or best practices found that focused on the overall design, leadership, implementation, and administration of blended learning in K12 education (Barbour et al., 2014; Linton, 2016). In addition, Short et al. (2021) suggested additional research is needed for administrative, school-wide, and district-level practices of blended learning. While there have been several systematic and meta-analyses performed, clearly identified quality practices for K12 blended learning were not found, as existing research focuses on teaching, course design, effectiveness of student learning (Li & Wang, 2022; Poirier et al., 2019; Topping et al, 2022; Yu et al., 2025b), and student perceptions and satisfaction (Diep et al., 2017). Because the literature continues to reveal challenges—such as teacher training and continuous professional development, infrastructure gaps and inconsistent implementation quality (Angawi & Tasir, 2024)—a K12 blended learning quality scorecard may be a useful resource for both researchers and practitioners.

Purpose and Research Question

The purpose of this Delphi study was to determine if experts in K12 blended programs believe the existing quality indicators identified in the Online Learning Consortium's Quality Scorecard for Blended Programs in 2023 were essential for K12 blended academic programs, if existing indicators need modification, and if additional indicators are necessary. For this study, K12 blended learning is "a formal education program in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace" (Horn & Staker, 2011, p. 5). Blended learning combines traditional face-to-face instruction with digital learning experiences, allowing for a more personalized and flexible approach to education. This study sought to investigate quality indicators within K12 blended learning environments and to contribute to the growing field in order to help policymakers and educators in the development and evaluation of blended learning programs.

The following research question guided this study:

> What do experts in K12 blended programs believe if the existing quality indicators identified in the Online Learning Consortium's Quality Scorecard for Blended Programs in 2023 are essential for K12 blended academic programs, if existing quality indicators need modification, and if additional quality indicators are necessary to create a K12 Blended Program Quality Scorecard?

Research Design and Methodology

In order to establish consensus, a Delphi method was used to develop consensus on the modification of the Online Learning Consortium's (OLC) 2023 Quality Scorecard for Blended Programs (Higher Education) for use as a scorecard for K12 blended/hybrid academic programs. First used by the Rand Corporation in the 1950s for forecasting (Dalkey & Helmer, 1963), Delphi methodology is an iterative, anonymous process using multiple surveys with an expert panel and is best used when consensus is needed from experts for complex or uncertain topics (Jorm, 2025).

The Delphi method is best suited for this study because its structural features are specifically designed to counteract biases that may compromise other group decision-making approaches such as Nominal Group Technique. Expert consensus achieved through the Delphi process is considered more reliable and objective than the opinion of a single expert because it maximizes the benefits of engaging a group of knowledgeable individuals (Khodyakov, 2023). This reliability stems largely from the anonymity of the expert panel members in order to discourage member dominance, group conformity, or "groupthink," commonly observed in face-to-face group meetings (Nasa et al., 2021). Finally, the iterative, feedback-driven structure of the method allows expert opinion to converge in a controlled, evidence-informed way rather than through social pressure. Controlled feedback meaningfully shapes how panelists revise their judgments between rounds, and this reassessment often results in a convergence of opinions across multiple rounds (Barrios et al., 2021), giving researchers a transparent, traceable record of how and why consensus was reached.

Consensus Level

Across systematic reviews of Delphi studies, consensus is largely defined as percentage agreement in published Delphi studies with cut-off values most commonly set at 70%, 75%, or 80% (Schifano & Niederberger, 2025). For this study, consensus level was established as a M=5 points and above with 70% of the expert panel being in agreement using a 6-point Likert scale:

1 point=Absolutely Not Essential

2 points=Not Essential

3 points=Slightly Not Essential

4 points=Slightly Essential

5 points=Essential

6 points=Absolutely Essential.

For example, if the panel agreed an indicator reaches the minimum level of consensus (M=5.0 or above using a Likert scale of 1-6 and 70% panel agreement), the quality indicator was removed from the next survey round and recorded as gaining consensus to be part of the new OLC K12 Blended Learning Scorecard. If consensus level was not reached after survey two rounds, the quality indicator was removed from consideration.

Delphi Expert Panel

The composition of a Delphi expert panel is critical as the quality of consensus reached depends entirely on the expertise and engagement of the participants. The panel's depth of knowledge and practical experience with the subject matter, along with their willingness to remain engaged through multiple rounds of data collection, directly influence the validity and reliability of study findings (Belton et al., 2019; Jorm, 2025; Niederberger & Spranger, 2020; Schmalz et al., 2020). The quality of Delphi panel results depends on the expertise of invited panelists and their willingness and ability to articulate their perspectives using the Delphi approach (Khodyakov et al., 2023).

Content validity may be strengthened by careful selection of the expert panel so that its composition is as representative as possible (Hasson et al., 2000). Selecting participants who combined recognized expertise with a collaborative disposition therefore helped ensure both the rigor of the input gathered and the completion rate needed to sustain a credible consensus-building process across all rounds. High attrition between rounds is a well-documented threat to Delphi studies and attrition across rounds is commonplace in Delphi research (Haynes & Shelton, 2018). For this reason, selection criteria for this panel prioritized two qualities: demonstrated expertise with the topic under investigation, and a genuine interest in collaborating with fellow panelists toward a shared outcome (Shelton & Creghan, 2015).

Purposeful sampling was used with the Online Learning Consortium assisting the researcher in identifying qualified experts throughout the US that work in K12 blended learning or scholarly researchers with peer-reviewed publications in K12 blended learning and who were willing to be part of the Delphi study. Forty-eight experts were identified and invited to join the study. The Delphi expert panel consisted of 20 US experts in K12 blended teaching and learning with five or more years of experience; thirteen members of the expert panel had more than 10 years of experience in K12 blended learning with only one member have the minimum of 5 years. Of the 20, 18 members completed the first survey round. Panel members must have completed the prior survey round in order provide data for the subsequent survey round.

Description of Delphi Rounds

For this study, four survey rounds were used to complete the study. At the beginning of each survey round, the researcher communicated clarifying information on what data was being presented and what votes were needed from the expert panel. A summary of results was presented before each survey round to assist with decision making.

Survey Round One

Using Survey Monkey for online data collection, the first survey provided the expert panelists the OLC 2023 Blended Quality Scorecard statements of quality to be voted on by each expert panel member for relevance and application to K12 education. Sixty-five blended learning quality indicators in nine categories (Institutional Support, Technology Support, Course Development/Instructional Design, Course Structure, Teaching and Learning, Learner Support, and Evaluation and Assessment) were presented (Appendix A, Table 1). In addition, for each quality indicator, panel members were given the opportunity to suggest edits to the indicator phrasing and to recommend additional quality indicators to be voted on by the expert panel in the next survey round. The survey concluded with asking the expert panel how many years of experience they have in K12 Blended Learning.

Survey Round Two

The second round survey presented the indicators (8) for panel voting that did not achieve consensus and 23 suggestions for new quality indicators in each of the eight categories (Appendix A, Table 2). For the eight indicators still needing consensus, the Mean (M) and Standard Deviation (SD) were provided to the panel to show overall percentage of agreement.

Next, the panelists were asked if there were any additional quality indicators that needed to be included for voting. Finally, the following three survey questions explored responses as suggested by the panel in Survey Round One:

- Are more specific statements needed for blended learning since many of the indicators could also apply to online learning?
- Should Hyflex mode be considered?
- Should a quality indicator be developed that points to the skills (i.e.., navigating online tools, navigating multimodal assets like videos, prompt engineering, personal motivation, asynchronous communication, video conferencing) one learns by completing an online/blended/hyflex course for it to add to the student's skillset in a different way than in a face-to-face class?

Panelists provided their opinion on each of the questions included in the data results.

Survey Round Three

The third round survey presented 40 quality indicators that had reached consensus but had suggested edits and rephrasing. In addition, the panel was asked to review 16 quality indicators for consensus suggested in Survey Round One. Three additional quality indicators were suggested by panel in Survey Round Two and needed voting for consensus (Appendix A, Table 3).

The following three survey questions explored responses as suggested by the panel in Survey Round Two:

- Should the word "course" be replaced with the word "class" throughout the scorecard?
- Should the Faculty Support category be changed to Teacher Support Category?
- Should the following Institutional Support quality indicator be deleted as it appears to be duplicated in Course Development category: *Blended courses/programs are systematically reviewed based on published quality standards and continuously improved to optimize the learning experience and ensure achievement of learning outcomes*?

Survey Round Four

The final round survey presented three questions regarding overall phrasing for the quality indicators and four indicators needing a final vote in phrasing. The three clarifying questions addressed the following suggested changes that would affect all quality indicators since the scorecard is for K12 users:

- Should the word “learner” be replaced with the word “student”?
- Should the word “institution” be replaced with the word(s) “school (or district)?
- Should the words “instructor or faculty” be replaced with “teacher or teachers?.

Panelists were encouraged to examine the provided cumulative results from the previous three survey rounds for decision making.

Results

Survey Round One

The first round survey resulted in only 57 of the 65 quality indicators presented reaching consensus. Eight quality indicators did not reach consensus and were returned for a re-vote; four indicators in Course Development/Instructional Design, three in Learner Support and one in Evaluation and Assessment achieved less than the required level of consensus (M=5.00). In addition, panelists suggested an additional 23 quality indicators to be considered in Survey Round Two. The panel also suggested edits for 40 quality indicators. Finally, three suggestions were made that required panel responses to be answered in Survey Round Two:

- Are more specific statements needed for blended learning since many of the indicators could also apply to online learning?

- Should Hyflex mode be considered?

- Should a quality indicator be developed that points to the skills (i.e.., navigating online tools, navigating multimodal assets like videos, prompt engineering, personal motivation, asynchronous communication, video conferencing) one learns by completing an online/blended/hyflex course for it to add to the student’s skillset in a different way than in a face-to-face class?

Survey Round Two

Of the eight indicators presented again for voting on consensus, three achieved consensus. The remaining five indicators were removed from panel consideration because of low stability of responses. Of the 23 new suggestions for quality indicators, 17 did not achieve consensus in Round Two but were presented again to the panelist’ voting in Survey Round Three. The six indicators achieving consensus were in the following categories: Institutional Support, Technology Support, Teaching and Learning, Faculty Support, and Learner Support.

Of the 40 quality indicators with suggested edits and rephrasing, 12 achieved response consensus and were removed from the next survey and included in the final OLC K12 Quality Scorecard. An additional nine indicators achieved response consensus but also received additional suggested edits so those indicators were returned to the panel for voting in Survey Round Three. The remaining 19 quality indicators were returned with the most popular responses to be voted on again for panel agreement.

The expert panel was asked if there were any additional quality indicators that needed to be included for voting; they provided three (Appendix A, Table 3). Finally, the following questions were asked in Survey Round One that needed expert panel response. Results are provided with the question.

- Are more specific statements needed for blended learning since many of the indicators could also apply to online learning?

While three panel members' responses agreed, the other six responses believed it was not necessary since the modalities are similar and "good teaching and learning design" should be the primary focus no matter what the modality.

- Should Hyflex mode be considered?

Two panel members' responses agreed and six did not believe Hyflex mode should be used for Blended Learning terminology. Some suggested Hyflex is a term more for higher education.

- Should a quality indicator be developed that points to the skills (i.e.., navigating online tools, navigating multimodal assets like videos, prompt engineering, personal motivation, asynchronous communication, video conferencing) one learns by completing an online/blended/Hyflex course for it to add to the student's skill set in a different way than in a face-to-face class?

Five panel members' responses agreed it was a good recommendation but it should not be included in this scorecard. One response was undecided.

Survey Round Three

The third round survey presented 40 indicators with suggested edits and rephrasing. In addition, 16 suggested indicators were voted on for consensus; four indicators reached consensus. The remaining 12 indicators were not returned for a re-vote and were not included in the scorecard.

The following three survey questions explored responses as suggested by the panel in Survey Round Two:

- Should the word "course" be replaced with the word "class" throughout the scorecard?

The majority of the expert panel did not agree (53.85%) the word "class" should replace the word "course."

- Should the Faculty Support category be changed to Teacher Support Category?

The expert panel agreed (84.62%) the "Faculty Support" category should be changed to "Teacher Support" category.

- Should the following Institutional Support quality indicator be deleted as it appears to be duplicated in the Course Development category: *Blended courses/programs are systematically reviewed based on published quality standards and continuously improved to optimize the learning experience and ensure achievement of learning outcomes*?

The expert panel agreed (71.43%) the quality indicator was duplicated and should be deleted.

Survey Round Four

The final round survey presented three questions regarding overall phrasing for the quality indicators and four indicators needing a final vote in phrasing. The three clarifying questions addressed the following suggested changes that would affect all quality indicators since the scorecard is for K12 users:

- Should the word “learner” be replaced with the word “student”?

The majority of the expert panel agreed (76.93%) “student” should replace “learner” where applicable throughout the scorecard.

- Should the word “institution” be replaced with the word(s) “school (or district)?

The majority of the expert panel agreed (69.23%) “school (or district)” should replace “institution” where applicable throughout the scorecard.

- Should the words “instructor or faculty” be replaced with “teacher or teachers?

The majority of the expert panel agreed (61.54%) “teacher or teachers” should replace “instructor or faculty” where applicable throughout the scorecard.

Consensus was achieved for all four quality indicator edits and rephrasing. The final study results are provided in Appendix A, Table 4.

Discussion

This section presents findings organized across the eight categories of quality indicators that center on quality K12 blended learning: School District Support, Technology Support, Course Development and Instructional Design, Course Structure, Teaching and Learning, Teacher Support, Student Support, and Evaluation and Assessment. Each category synthesizes relevant literature to establish quality indicators grounded in empirical research. As a whole, these quality indicators show successful blended learning implementation requires a focus on quality for organizational, pedagogical, student support, and evaluation practices.

School District Support

The School District Support category demonstrates the important role of leadership, policy, and provision of resources, including providing adapted physical space and time for teachers to plan blended learning activities. Leadership must ensure the blended learning initiative aligns with the school district mission and vision. Effective blended learning programs must be grounded in a clearly articulated vision shared with all stakeholders, including parents, students, and staff. Without this buy-in and alignment, schools may struggle if the blended learning program does not reflect organizational goals.

The literature indicates engaged leadership and administrative support are foundational for quality K12 blended learning (Baca et al., 2019; Kömür, 2023; Newfield, 2025; Reardon, 2010); without it, teachers struggle to succeed in or even embrace blended learning. In fact, Hanney et al. (2023) found teachers need principals and districts to not only provide technology and resources but to be advocates for their success. Moreover, Henríquez and Hilliger (2024) urged key stakeholders such as leaders, teachers, and parents should be involved in the implementation of blended learning for both teacher and student success. In addition, they recommend leadership should define roles, responsibility, and accountability.

Successful blended learning requires adequate resources such as personnel, budget, professional development for teachers, and modified physical classroom space. The quality indicator focused on physical space was a new result; however, the literature does support it. In fact, Sarmento et al. (2018) provide clear guidelines for how classrooms should be designed: space for community and collaboration, space to create assignments, space for teacher and student engagement and all with good technology support and comfortable seating. In addition, Pierce (2015) recommends similar guidelines and includes reconfigurable furniture and wireless Internet to assist with student collaboration.

Technology Support

The Technology Support category provides standards on the technology systems that impact blended learning and recommends benchmarking the technology infrastructure (i.e., the learning management system (LMS), data security, and support for teachers and staff and students). In fact, researchers assert the technology supporting blended learning initiatives must be prioritized as mission critical and should be carefully evaluated because technology failure can often be a barrier for teacher adoption (Al-Busaidi, 2012; Hanney et al., 2023; Min & Yu, 2023; Newfield, 2025). Along with this prioritization should be a focus on supporting pedagogy that supports learning and student engagement (COSN, 2025). In many instances, K12 technology departments must focus on the infrastructure but not necessarily those tools that truly impact teaching and learning outside the traditional classroom. Johnson et al. (2023) recommends technology infrastructure should be examined for both teachers and students with school districts being prepared to help students at home with technology needs and Internet access. As George (2025) points out, "educational technology's value lies not in devices, platforms, or digital content themselves but in how these tools serve pedagogical goals and promote equitable learning opportunities" (p. 59).

Data privacy and security is a continued concern for administrators supporting K12 blended learning with increased cyberattacks. Chanenson et al.'s (2023) study with IT personnel revealed technology administrators believe they do not have the necessary resources to address the ongoing battle with data breaches. If data security is addressed with an invasive technology that records student activity, then privacy can be a concern (Darling-Aduana, 2026). At the same time, digital equity must also be examined beyond just providing the technology tools; resources and training are needed to support equitable student experiences (Darling-Aduana, 2026).

Course Development and Instructional Design

The Course Development and Instructional Design category provides an overview of a systematic process for developing materials for blended courses, pointing to clear course objectives and student outcome alignment and the use of online course standards such as OLC's *Course Review Scorecard*, *Quality Matters,* or the *National Standards for Quality Online Teaching*. This includes best practices identified in the literature such a standards-based instructional design guided by learning objectives and student outcomes (Garrison & Vaughn, 2008, Quiroz et al., 2016; Shand & Glassett Farrelly, 2016) with teachers using intentional design for student interaction and collaboration (McCabe, & Francis, 2020).

Additional research supports evidence-based pedagogy and course design (Johnson et al., 2023) and design models such as ADDIE and ASSURE (Valverde-Berrocoso & Fernández-Sánchez, 2020) for creating age-appropriate blended course materials that should be reviewed for learning outcome achievement and relevance through a quality control process (Huett et al., 2011; Huett & Huett, 2012). Specific to blended course design should be requirements for ensuring best practices for inclusion and providing accessible and universally designed course materials (Basham et al., 2016; McCabe & Francis, 2020).

Course Structure

The Course Structure category reiterates that a systematic course development process supports creating quality blended course materials. Basic tenets such as providing identified learning goals, clear information for both parents and students on the schedule and assessment activities, as well as expectations for behavior and engagement, are included and were identified in the research literature early on. These tenets align with the National Standards for Online Course Quality, first released by the North American Council for Online Learning in 2007 and refined by iNACOL in 2011 (building on the Southern Regional Education Board's earlier Quality Online Course Standards). Adelstein and Barbours (2016) content validity study confirmed the elements such as course content clarity, instructional design, assessment practices, and course management/communication are grounded in the broader K-12 online and blended learning research literature.

Creating a successful learning community has long been recognized as a foundational best practice for supporting student success in online learning environments (Palloff & Pratt, 1999, 2005; Vaughn et al., 2013; Villanueva, 2021). Based on Garrison et al.'s (2000) Community of Inquiry framework, a successful blended learning community can influence effective learning occurs through social presence, cognitive presence, and teaching presence. Although originally developed for online courses in higher education, recent research shows the framework is equally applicable to K12 blended teaching and learning to support student success (Harrell & Wendt, 2019; Villanueva et al., 2024).

Teaching and Learning

The Teaching and Learning category, while only five indicators, summarizes the most effective tips for teaching in a blended environment. The literature shows best practices include a focus on student engagement (Wang & Hofkens, 2019; Wang et al., 2017), teacher presence and interaction (Graham, 2013; Liao et al., 2023; Stevens & Rice, 2016) and managing a seamless experience with both online and blended modalities (Kömür et al., 2023; Cheng et al., 2023; Short et al., 2021). In their study on online and blended teaching competencies, Pulham and Graham noted (2018) teachers need assistance with pacing, curriculum, and scheduling. Anthony (2019) suggests teachers should be more flexible and responsive to better engage students. Moreover, Archambault and Kennedy (2018) found teachers must be able to engage students with limited face-to-face contact while still making sure students master content.

Teacher Support

The Teacher Support category provides best practices for preparing and supporting teachers navigating the blended learning classroom. Training and assistance for technology assistance (An et al., 2021; Bergdahl & Bond, 2022), course development (Huett, 2018), and classroom management and online pedagogy (An et al., 2021; Jackson et al., 2021) are highly recommended throughout the literature as necessary for quality teacher preparation and ongoing support. For example, based on their study of blended learning student satisfaction, Tovine et al. (2019) recommended ongoing effective professional development is needed for instructors teaching blended learning courses, especially those that are new to the process. Johnson et al. (2023) asserted effective professional development must ongoing, include opportunities for practice, feedback, and reflection, effectively model blended pedagogies, and address both technological skills and pedagogical integration.

While Jackson et al. (2021) and Drexler (2018) called for training to focus personalizing learning, others, based on their research, assert overall training for the blended environment is crucial to student success (Baca et al.,2019; Dawson & Dana, 2018; Hathaway & Mehdi, 2020; Huett, 2018; Lockee et al., 2020; Moore et al., 2017; Newman, 2025; Short et al., 2021; Sustanto, & Atabik; 2025; Tao, 2024). In addition, blended learning teachers need administrative support (Baca et al., 2019; Newman, 2025) and expectations provided for communication and feedback as well as support for working with all students (including disabled and underserved groups). Whiteside et al. (2019) recommends districts provide micro-communities to support continuous dialog on blended teaching, while Henríquez and Hilliger (2024) urge leadership to provide a fostering and supportive environment and suggest peer mentoring and hands-on activities to best prepare blended teachers, as was noted by Moore et al. (2017). Fox (2024) also found school leaders play an important role by creating open communication and opportunities for collaboration, which are necessary for teacher trust.

Student Support

The Student Support category gathers indicators that focus on providing clear communication to students and families before they enter the program and during their coursework. In addition, various support services are recommended such as technical support, tutorials, AI literacy, access to library and research resources, and assurances students with disabilities have equal access, which are all supported by literature. For example, as a result of their student satisfaction with blended learning study, Tovine et al. (2019) and Siko et al. (2026) suggest schools should develop or revise processes so students can experience onboarding to the blended learning environment; Siko et al. (2026) also point out readiness instruments need improvement for predicting students who may struggle and need intervention.

Henríquez and Hilliger (2024) recommend students need support to improve and use digital skills safely in the blended environment, while Siko et al. (2026) urge district policy to protect class scheduling and provide information dashboards for parents. Azukas et al.'s (2026) recent research on student support services such as tutoring, academic coaching, counseling services, librarianship, and digitally mediated co-curricular opportunities suggests found emerging evidence that these auxiliary supports contribute to student engagement, persistence, and well-being, despite a relatively limited research base.

Evaluation and Assessment

The Evaluation and Assessment category outlines processes and data analysis needed to improve K12 blended learning programs. Programs should be reviewed regularly with standards such as state guidelines or industry standards such as the OLC K12 Blended Learning Scorecard. In addition, data is needed on achievement of learning outcomes, course material reviews for effectiveness and accessibility, and student and parent satisfaction with support services. Smith and Stahl (2016) urge the review of course materials for WCAG and ADA compliance and UDL guidance. In addition, the process for assessing stakeholder satisfaction (student, teacher, staff, and school or district) with blended learning programs is well supported in the literature (Henríquez & Hilliger, 2024). Although the literature most commonly shows evaluation has been typically focused on course content (Barbour et al., 2016), and state standards vary widely (Barbour et al., 2014), a more holistic approach is needed to determine quality and effectiveness.

Future Research

The purpose of this Delphi study was the development of a quality scorecard as a guide for the development and administration of K12 blended learning programs. The Online Learning

Consortium's Blended Learning Scorecard, developed for higher education, was the foundation but was ultimately modified for this K12 research. Further research should be done with the implementation and evaluation of a blended learning program against the scorecard quality standards. In addition, it is recommended the K12 Blended Learning Scorecard be implemented into teacher preparation programs as an overview of blended teaching and course design. Additionally, more research is needed in specific strategies for personalized learning in the K12 blended classroom. Finally, as recommended by Halverson et al. (2023), additional research on the efficacy of blended learning is needed to inform leaders, faculty and policymakers.

Conclusion

The future of K12 blended learning will be shaped by data-driven improvement and emerging trends in educational technology. As schools collect and analyze data on student engagement and outcomes, they can refine instructional strategies and personalize learning experiences. Trends such as adaptive learning, artificial intelligence, and competency-based education offer new opportunities for enhancing blended learning quality and digital equity for students. Because of this, data-driven decision making, ongoing feedback from all stakeholders, and continuous professional development will remain indispensable to improve the quality of K12 blended programs.

The OLC K12 Blended Learning Scorecard offers a quality framework and essential guidance for educators and administrators to scale blended learning models and maintain excellence. There should be thoughtful integration of all of the quality indicators in order to meet students where they are in the 21st century**.** We, as a society, are asking students to prepare for a world where they will need to fluidly collaborate both in-person and virtually, where they'll need to be self-directed learners, and where they'll need to navigate digital environments with confidence and discernment. This research offers a thorough, evidence-based, resource to design and implement blended learning that can serve K12 education. The OLC K12 Blended Learning Scorecard can be downloaded here:

https://onlinelearningconsortium.org/quality/scorecards/program-level/.

Declarations

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Ethics Statement

This study was conducted in accordance with recognized ethical standards. Informed consent was obtained from all participants, and data were collected and reported with respect for confidentiality and anonymity. The study (all four surveys) was reviewed and approved by the Institutional Review Board of Lamar University, Approval No IRB-FY25-197.

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AI Use Statement

Generative artificial intelligence (AI) was used in the preparation of this manuscript for locating literature sources. The AI tool (Claude) was not used to generate, analyze, or interpret research data, nor to create original scholarly content. All content was reviewed, verified, and approved by the author, who takes full responsibility for the accuracy and integrity of the work.

Conflicts of Interest Statement

While the author was paid a nominal consulting fee for guiding the research study, the author declares no conflicts of interest related to the research, authorship, or publication of this article.

References

Adelstein, D., & Barbour, M. (2016). Building better courses: Examining the construct validity of the iNACOL National Standards for Quality Online Courses. *Journal of Online Learning Research, 2*(1), 41–73. https://doi.org/10.70725/019085jzqdar

Al-Busaidi, K. A. (2012). Learners' perspective on critical factors to LMS success in blended learning: An empirical investigation. *Communications of the Association for Information Systems*, *30*. https://doi.org/10.17705/1CAIS.03002

An, Y., Kaplan-Rakowski, R., Yang, J., Conan, J., Kinard, W., & Daughrity, L. (2021). Examining K-12 teachers' feelings, experiences, and perspectives regarding online teaching during the early stage of the COVID-19 pandemic. *Educational Technology Research and Development, 69*(5), 2589–2613. https://doi.org/10.1007/s11423-021-10008-5

Angawi, M., & Tasir, Z. (2024). Blended learning research: A systematic review and identification of future research gaps. *International Journal of Academic Research in Progressive Education and Development, 13*(3). https://doi.org/10.6007/ijarped/v13-i3/22216

Archambault, L. & Kennedy, K. (2018). Teacher preparation for K-12 online and blended learning. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of research on K–12 online and blended learning* (2nd ed., pp. 221–245). Carnegie Mellon University, ETC Press.

Anthony, E. (2019). Blended learning: How traditional best teaching practices impact blended elementary classrooms. *Journal of Online Learning Research*, *5*(1), 25-48. https://doi.org/10.70725/310262fgtpwl

Azukas, M. E., Garrett Dikkers, A., & Viano, S. (2026). Proximal and auxiliary support systems in K–12 digital learning. *Journal of Online Learning Research, 12*(1), 73–96. https://doi.org/10.70725/898687otxwsq

Baca, A., Creghan, C., & Maninger, R. M. (2019). Teacher perceptions of the effectiveness of a blended learning program at a public charter middle school (5th–8th Grade) in a large city in Texas. *Journal of Multidisciplinary Graduate Research, 4*(1). https://jmgr-ojs-shsu.tdl.org/jmgr/article/view/3

Barbour, M. K., Borup, J., & DeBruler, K. (2026). Mind the (digital) gap: Building a practitioner-centered research agenda for K–12 online and blended learning. *Journal of Online Learning Research, 12*(1), 1–13. https://doi.org/10.70725/988738sldkrs

Barbour, M. K., Clark, T., DeBruler, K., & Bruno, J. A. (2014). *Evaluation and approval constructs for online and blended courses and providers.* Michigan Virtual University. /research/publications/michigan-virtual-report-examines-online-learning-policies-and-practices/

Barrios, M., Guilera, G., Nuño, L., & Gómez-Benito, J. (2021). Consensus in the Delphi Method: What makes a decision change? *Technological Forecasting and Social Change, 163*, 120484. https://doi.org/10.1016/j.techfore.2020.120484

Basham, J. D., Smith, S. J., & Satter, A. L. (2016). Universal Design for Learning. *Journal of Special Education Technology, 31*(3), 147–155. https://doi.org/10.1177/0162643416660836

Belton, I., MacDonald, A., Wright, G., & Hamlin, I. (2019). Improving the practical application of the Delphi method in group-based judgment: A six-step prescription for a well-founded and defensible process. *Technological Forecasting and Social Change, 147*, 72–82. https://doi.org/10.1016/j.techfore.2019.07.002–Bergdahl, N., & Bond, M. (2021). Negotiating (dis-)engagement in K-12 blended learning. *Education and Information Technologies, 27*(2), 2635–2660. https://doi.org/10.1007/s10639-021-10714-w

Chanenson, J., Sloane, B., Rajan, N., Morril, A., Chee, J., Danny Yuxing Huang, D., & Chetty, M. (2023). Uncovering privacy and security challenges in K-12 schools. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. ACM, Hamburg Germany, 1–28.

Cheng, C., Kirby, C. K., Fu, J., Kelly, S., & Vandepol, N. (2023). Instructor challenges, strategies, and satisfaction in blended courses: A case study. *TechTrends*. https://doi.org/10.1007/s11528-023-00884-4

Consortium for School Networking[COSN]. (2025). Driving K-12 innovation. https://www.cosn.org/wp-content/uploads/2025/02/2025_CoSN-Driving-K12-Innovation-Report-V15.pdf

Dalkey, N., & Helmer, O. (1963). An experimental application of the DELPHI Method to the use of experts. *Management Science, 9*(3), 458–467. https://doi.org/10.1287/mnsc.9.3.458

Darling-Aduana, J., Heath, M. K., Steward, A. Viano, S., Asim, S., Garcia, A., Langran, E., Heinrich, C., & Woodley, X. (2025). Digital ethics and equity in K-12 blended and online Learning. In D.A. Christakis & L. Hale (Eds.) *Handbook of children and screens*. Springer. https://doi.org/10.1007/978-3-031-69362-5

Dawson, K., & Dana, N. F. (2018b). Professional development for K–12 online teachers. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of research on K–12 online and blended learning* (2nd ed., pp. 247–260). Carnegie Mellon University, ETC Press.

Diep, A.-N., Zhu, C., Struyven, K., & Blieck, Y. (2017). Who or what contributes to student satisfaction in different blended learning modalities? *British Journal of Educational Technology, 48*(2), 473-489. https://doi.org/10.1111/bjet.12431

Drexler, W. (2018). Personal learning environments in K–12. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of research on K–12 online and blended learning* (2nd ed., pp. 151–162). Carnegie Mellon University, ETC Press.

EdChoice. (2026). *School moves survey: School switching in America* [Report]. https://www.edchoice.org

Fox, E. (2024). Novice K-12 online teacher support. *Journal of Online Learning Research, 10*(1), 15–48. https://doi.org/10.70725/327969pefoha

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. Jossey-Bass/Wiley.

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

George, A. (2025). *Digital equity in blended learning: Closing achievement gaps in underserved communities*. Eduschool Academic Research and Publishers. https://doi.org/10.5281/ZENODO.17707403

Graham, C. R. (2013). Emerging practice and research in blended learning. In M. G. Moore (Ed.), *Handbook of distance education* (3rd ed., pp. 333–350). Routledge.

Halverson, L. R., Spring, K. J., Huyett, S., Henrie, C. R., & Graham, C. R. (2023). Blended learning research in higher education and K–12 settings. In J. M. Spector, B. B. Lockee, & M. D. Childress (Eds.), *Learning, design, and technology* (pp. 3107–3135). Springer International Publishing. https://doi.org/10.1007/978-3-319-17461-7_31

Hanny, C. N., Arnesen, K. T., Guo, Q., Hansen, J., & Graham, C. R. (2023). Barriers and enablers to K–12 blended teaching. *Journal of Research on Technology in Education. 55*(4), 568–589. https://doi.org/https://doi.org/10.1080/15391523.2021.1991865

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

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, *32*(4), 1008–1015.

Hathaway, D. & Mehdi, T. (2020). Exploring teachers' perceptions of quality K-12 blended and online learning. In D. Schmidt-Crawford (Ed.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 693-700). Association for the Advancement of Computing in Education (AACE).

Haynes, C. A., & Shelton, K. (2018). Delphi Method in a digital age. In *Advances in Library and Information Science* (pp. 132–151). IGI Global. https://doi.org/10.4018/978-1-5225-5164-5.ch009

Henríquez, V., & Hilliger, I. (2024). Blended learning in rural K-12 education: Stakeholder dynamics and recommendations. *Journal of Computer Assisted Learning, 40*(4), 1463–1480. https://doi.org/10.1111/jcal.12963

Horn, M., B., & Staker, H. (2011). The rise of K–12 blended learning. *Social Innovations Journal*, (6). https://socialinnovationsjournal.com/index.php/sij/article/view/7985

Horn, M. B., & Staker, H. (2015). *Blended: Using disruptive innovation to improve schools*. Jossey Bass.

Huett, J. B., & Huett, K. C. (2012). *Designing engaging virtual courses for K-12 students*. In P. Resta (Ed.), Proceedings of Society for Information Technology & Teacher Education International Conference 2012 (pp. 432-440). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Huett, K. C. (2018). Designing K–12 student-centered blended learning environment. *Journal of Online Learning, 4*(3)*,* 295–326. https://doi.org/10.70725/976239xsvsvi

Huett, K. C., Huett, J. B., & Ringlaben, R. (2011). From bricks to clicks: Building quality K–12 online classes through an innovative course review project. *Online Journal of Distance Learning Administration, 14*(4). http://www.westga.edu/~distance/ojdla/winter144/huett_huett_ringlaben.htm

Jackson, B. L., Jones, W. M., Schad, M., & Strand, D. (2021). Assessing K12 online teachers' knowledge of online student identities. *Journal of Online Learning Research, 7*(1), 35–36. https://doi.org/0.70725/063959cahlyf

Johnson, C. C., Walton, J. B., Strickler, L., & Elliott, J. B. (2023). Online teaching in K–12 education in the United States: A systematic review. *Review of Educational Research, 93*(3), 353–411. https://doi.org/10.3102/00346543221105550

Jorm, A. (2025). *Expert consensus in science*. Palgrave Macmillan. https://doi.org/10.1007/978-981-97-9222-1

Kennedy K., Tomaselli K., Stimson R. (2018). *National standards for quality online courses (K–12) and QM K–12 secondary and K–12 publisher rubric revision: Literature review*. Quality Matters. https://www.qualitymatters.org/sites/default/files/research-docs-pdfs/National-Standards-for-Quality-Online-Courses-Lit-Review-122818.pdf

Khodyakov, D., Grant, S., Kroger, J., & Bauman, M. (2023). *RAND methodological guidance for conducting and critically appraising Delphi panels*. RAND Corporation. https://www.rand.org/pubs/tools/TLA3082-1.html.

Kömür, İ. A., Kılınç, H., & Okur, M. R. (2023). The rotation model in blended learning. *Asian Journal of Distance Education, 18*(2), 63–74.

Li, S., & Wang, W. (2022). Effect of blended learning on student performance in K–12 settings: A meta-analysis. *Journal of Computer Assisted Learning*, *38*(5), 1254–1272. https://doi.org/10.1111/jcal.12696

Liao, H., Zhang, Q., Yang, L., & Fei, Y. (2023). Investigating relationships among regulated learning, teaching presence and student engagement in blended learning: An experience sampling analysis. *Education and Information Technologies, 28*, 12997–13025. https://doi.org/10.1007/s10639-023-11717-5

Linton, J. (2016). Electronic learning communities as a support for building relationships with students in a statewide virtual high school. *Journal of Online Learning Research, 2*(4), 419–445. https://doi.org/10.70725/292002tclusy

McCabe, C., & Francis, R. W. (2020). Effective instruction in blended learning environments. In T. I. Asino (Ed.) *Learning in the digital age*. https://open.library.okstate.edu/learninginthedigitalage/chapter/effective-instruction-in-blended-learning-environments/

McShane, M. Q. (2024). *What do parents want? Information, choices, constraints*. Ed Choice. https://files.eric.ed.gov/fulltext/ED662411.pdf

Means, B., Bakia, M., & Murphy, R. (2014). *Learning online: What research tells us about whether, when and how.* Routledge.

Min, W., & Yu, Z. (2023). A systematic review of critical success factors in blended learning. *Education Sciences*, *13*(5), 469. https://doi.org/10.3390/educsci13050469

Molnar, A., Miron, G., Elgeberi, N., Barbour, M. K., Huerta, L., Shafer, S. R., & Rice, J. K. (2019). *Virtual schools in the US 2019*. National Education Policy Center. https://files.eric.ed.gov/fulltext/ED595244.pdf

Moore, M., Robinson, H., Sheffield, A. & Phillips, A. (2017). Mastering the blend: A professional development program for K–12 teachers. *Journal of Online Learning Research, 3*(2), 145–173. https://doi.org/10.70725/544886mqrfos

National School Choice Awareness Foundation. (2025). *January 2025 survey*. https://schoolchoiceawareness.org/january-2025-survey/

Nasa, P., Jain, R., & Juneja, D. (2021). Delphi methodology in healthcare research: How to decide its appropriateness. *World Journal of Methodology*, *11*(4), 116–129. https://doi.org/10.5662/wjm.v11.i4.116

Newfield, T. (2025). Barriers to implementing blended learning in K–12 education: A quantitative analysis. *International Journal of Educational Leadership Preparation*, *20*(1), 158–184.

Niederberger, M., & Spranger, J. (2020). Delphi technique in health sciences: A map. *Frontiers in Public Health, 8*, Article 457. https://doi.org/10.3389/fpubh.2020.00457

Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace*. Jossey-Bass.

Palloff, R.M., & Pratt, K. (2005). *Collaborating online: Learning together in community*. Jossey-Bass.

Peirce, D. (2015, August 25). 3 ways mobile technology is transforming learning spaces. *THE Journal*. https://thejournal.com/articles/2015/08/25/3-ways-mobile-technology-is-transforming-learning-spaces.aspx

Poirier, M., Law, J. M., & Veispak, A. (2019). A spotlight on lack of evidence supporting the integration of blended learning in K–12 education. *International Journal of Mobile and Blended Learning, 11*(4), 1–14. https://doi.org/10.4018/ijmbl.2019100101

Pulham, E. B., & Graham, C. R. (2018). Comparing K–12 online and blended teaching competencies: A literature review. *Distance Education, 39*(3), 411–432. http://doi.org/10.1080/01587919.2018.1476840

Quiroz, R. E., Ritter, N. L., Li, Y., Newton, R. C., Palkar, T., Texas A&M University, & United States. (2016). Standards based design: Teaching K–12 educators to build quality online courses. *Journal of Online Learning Research*, *2*(2), 123–144.

Reardon, M. R. (2010). Instructional leadership and blended learning. In Y. Inoue (Ed.), *Cases on online and blended learning technologies in higher education: Concepts and practices* (pp. 44–62). IGI Global. https://doi.org/10.4018/978-1-60566-880-2.ch003

Sarmento, T. S., Gomes, A. S., & Moreira, F. (2018). Classroom adaptations for blended learning practices. In F. J. García-Peñalvo (Ed.), *Proceedings of 6th International Conference Technological Ecosystems for Enhancing Multiculturality* (TEEM'18), Salamanca, Spain, October 2018). ACM. https://doi.org/10.1145/3284179.328429

Shand, K., & Glassett Farrelly, S. (2018). The art of blending: Benefits and challenges of a blended course for preservice teachers. *Journal of Educators Online, 15*(1). https://www.thejeo.com/archive/2018_15_1/shand_farrelly

Schmalz, U., Spinler, S., & Ringbeck, J. (2021). Lessons learned from a two-round Delphi-based scenario study. *MethodsX, 8*, Article 101179. https://doi.org/10.1016/j.mex.2020.101179

Schifano, J., & Niederberger, M. (2025). How Delphi studies in the health sciences find consensus: A scoping review. *Systematic Reviews*, *14*, Article 7. https://doi.org/10.1186/s13643-024-02738-3

Shelton, K., & Creghan, K. A. (2015). Demystifying the Delphi Method. In V. C. Wang (Ed.). *Handbook of research on scholarly publishing and research methods* (pp. 375-395). IGI-Global Publishing. https://doi.org/10.4018/978-1-4666-7409-7.ch019

Short, C. R., Graham, C. R., & Sabey, E. (2021). K-12 blended teaching skills and abilities: An analysis of blended teaching artifacts. *Journal of Online Learning Research*, *7*(1), 5–33. https://doi.org/10.70725/456263phwuix

Siko, J., Barbour, M., Wilson, V. & Adelstein, D. (2026). Assessing and improving digital learning readiness: A review and roadmap for future research. *Journal of Online Learning Research, 12*(1), 151–168. https://doi.org/10.70725/291317sfcqzq

Smith, S., & Stahl, W. (2016). Determining the accessibility of K–12 digital materials: Tools for educators. *Journal of Special Education Leadership, 29*, 70–79.

Staker, H., & Horn, M. B. (2012). *Classifying K–12 blended learning*. Innosight Institute. https://www.christenseninstitute.org/wp-content/uploads/2013/04/Classifying-K-12-blended-learning.pdf

Stevens, M., & Rice, M. (2016). Inquiring into presence as support for student learning in a blended learning classroom. *Journal of Online Learning Research, 2*(4), 447–473. https://doi.org/10.70725/492597rcbgmr

Sustanto, R., & Atabik, S. P. (2025). The impact of blended learning models on student achievement and engagement in secondary education: A systematic review. *International Journal of Multidisciplinary Research and Analysis, 8*(7), 3982–3993. https://doi.org/10.5281/zenodo.15879106

Tao, Y., Yu, L, Luo, L. & Zhang, H. (2024) Effect of blended teaching on college students' EFL acquisition. *Frontiers in Education, 9,* 1264573. https://doi.org/10.3389/feduc.2024.1264573

Topping, K. J., Walter Douglas, Robertson, D., & North Lanarkshire Council. (2022). Effectiveness of online and blended learning from schools: A systematic review. *Review of Education*. https://doi.org/10.1002/rev3.3353

Tovine, G., Fleetwood, A., Shepherd, A., Tapoler, C. J., Hartshorne, R., & Pesce, R. (2019). Investigating student perceptions and the effectiveness of K–12 blended learning communities. In T. L. Heafner, R. Hartshorne, & R. Thripp (Eds.), *Handbook of research on emerging practices and methods for K–12 online and blended learning* (500–522). IGI Global. https://doi.org/10.4018/978-1-5225-8009-6.ch024

Valverde-Berrocoso, J., & Fernández-Sánchez, M. R. (2020). Instructional design in blended learning: Theoretical foundations and guidelines for practice. In A. Martín-García (Ed.) *Blended learning: Convergence between technology and pedagogy* (pp. 113–140). Springer. https://doi.org/10.1007/978-3-030-45781-5_6

Valverde-Berrocoso, J., & Fernández-Sánchez, M. R. (2020). Instructional design in blended learning: Theoretical foundations and guidelines for practice. In *Lecture Notes in Networks and Systems* (pp. 113–140). Springer International Publishing. https://doi.org/10.1007/978-3-030-45781-5_6

Vaughan, N. D., Cleveland-Innes, M., & Garrison, D. R. (2013). *Teaching in blended learning environments: Creating and sustaining communities of inquiry*. Athabasca University Press.

Villaneuva, J. A. R. (2021). Teaching presence in K–12 blended learning classes under the alternative delivery mode. *International Journal on Open and Distance E-Learning, 7*(1). https://ijodel.upou.edu.ph/ijodel/article/view/33

Villanueva, J.A.R., Redmond, P., Galligan, L., & Eacersall, D. (2024). Investigating blended learning interactions in Philippine schools through the community of inquiry framework. *Asia Pacific Education Review, 25*, 813–828. https://doi.org/10.1007/s12564-023-09826-4

Voelker, C., Gemin, B., Quality Matters, Virtual Learning Leadership Alliance, Powell, A., Oliver, W., Archambault, L., Borup, J., Boyarko, M., Cavanaugh, C., Copeland, R., Day, J., DeRosa-Davis, T., Deschaine, M., Graham, C., Hanson, E., Hernandez, B., Imbrunone, M., Jensen, J., . . . Quality Matters. (2019). *National Standards for Quality Online Teaching* (3rd ed). https://www.nsqol.org/wp-content/uploads/2019/02/National-Standards-for-Quality-Online-Teaching.pdf

Wang, M.-T., & Hofkens, T. L. (2019). Beyond classroom academics: A school-wide and multi-contextual perspective on student engagement in school. *Adolescent Research Review, 5*, 419–433. https://doi.org/10.1007/s40894-019-00115-z

Wang, M.-T., Fredricks, J., Ye, F., Hofkens, T., & Linn, J. S. (2017). Conceptualization and assessment of adolescents' engagement and disengagement in school. *European Journal of Psychological Assessment, 35*(4), 592–606. https://doi.org/10.1027/1015-5759/a000431

Whiteside, A. L., Dikkers, A. G., & Baker III, F. W. (2019). Moving beyond trial and error: Exploring case studies of professional development models in K-12 blended learning. In T. L. Heafner, R. Hartshorne, & R. Thripp (Eds.), *Handbook of research on emerging practices and methods for K–12 online and blended learning* (pp. 248–270). IGI Global. https://doi.org/10.4018/978-1-5225-8009-6.ch012

Yu, Q., Yu, K., & Wang, J. (2025a). Unraveling the impact of blended learning vs. online learning on learners' performance: Perspective of self-determination theory. *Behavioral Sciences, 15*(9), 1263. https://doi.org/10.3390/bs15091263

Yu, Q., Yu, K., Li, B., & Wang, Q. (2025b). Effectiveness of blended learning on students' learning performance: A meta-analysis. *Journal of Research on Technology in Education, 57*(3), 499–520. https://doi.org/10.1080/15391523.2023.2264984

Appendix

Table 1

Round One Survey - Quality Indicators Presented to Expert Panel for Consensus

OLC 2025 Blended Learning Scorecard (for Higher Education)

Institutional/Administration Support Quality Standards

1. The institution has a governance structure to enable systematic and continuous improvement of blended learning courses/programs.
2. The institution has a governance structure to enable clear, timely, and effective decision making related to blended learning courses/programs.
3. Blended learning courses/programs are reviewed for continuing relevance and compliance with accreditation standards and improved and updated accordingly.
4. The institution has defined the strategic value of blended learning to its stakeholders (learners, faculty, parents, administration, staff, etc.).
5. The organizational structure of the blended learning program supports the institution's mission, values, and strategic plan.
6. The institution has a process for assessing needs and allocating resources to support effective administration of blended learning courses/programs.
7. The institution allocates sufficient technical, financial and learner support resources to effectively administer blended courses/programs.
8. The institution has policy and guidelines that confirm a learner who registers in a blended course or blended learning program is the same learner who participates in and completes the course or program and receives academic credit. This is done by verifying the identity of a learner by using methods such as (a) a secure login and pass code, (b) proctored examinations, or (c) other technologies and practices that are effective in verifying learner identification.
9. The institution provides resources and assistance to faculty to secure permissions for all course materials (Creative Commons, Copyright, Fair Use, Public Domain, etc.).

Technology Support Quality Standards

1. The course delivery technology is considered a mission critical enterprise system and supported as such.
2. Whether the institution maintains local data centers (servers), and/or contracts for outsourced, hosted services or cloud services, those systems are administered in compliance with established data management practices such as the Information Technology Service Management (ITSM) standards, which include appropriate power protection, backup solutions, disaster recovery plans, etc.
3. The technology systems related to the delivery of blended learning courses/programs are highly reliable and operable.
4. A documented technology plan that includes electronic security measures (e.g., password protection, encryption, secure online or proctored exams if applicable) is in place and operationalized.
5. The institution has a well-supported infrastructure (e.g., Learning Management System; multimedia development tools) for creating and maintaining blended education courses/programs.

6. Faculty, staff, and learners are supported in the development and use of new technologies and skills applicable to blended learning.

Course Development and Instructional Design Quality Standards

1. Blended courses/programs are designed with alignment between learning objectives, course materials, learning activities and assessments to ensure that learners achieve measurable learning outcomes.
2. Quality standards to guide course design, development, delivery and evaluation of blended instruction are published and followed.
3. A course development process has been established and utilized to ensure that courses are utilizing consistent course elements (navigation, technology, etc.) across all of the courses in the program.
4. Blended courses are designed to incorporate face-to-face and online experiences in complementary ways to optimize engagement and achievement of learning outcomes.
5. Blended courses/programs are systematically reviewed based on published quality standards and continuously improved to optimize the learning experience and ensure achievement of learning outcomes.
6. Blended courses/programs are designed to support diversity, equity, and inclusion within the learning environment.
7. Learner-centered instruction (i.e., engagement, immersion and personal responsibility) is considered during the course design and development process.
8. Blended course design promotes interaction and engagement among faculty and learners.
9. Course workloads are reviewed to ensure it is appropriate for designated credit allocation.
10. A systematic process is established and followed for evaluating the effectiveness of current and emerging technologies to support the achievement of learning outcomes and delivering course content.
11. Course technology is used intentionally to support achievement of learning outcomes and unnecessary use of technology is minimized.
12. Blended courses are American Disabilities Act (ADA) compliant and adhere to Web Content Accessibility Guidelines (WCAGs).
13. Faculty play a central role in blended course/program design and development.

Course Structure Quality Standards

1. The blended course includes a syllabus outlining course objectives, learning outcomes, evaluation methods, books and supplies, technical and proctoring requirements, and other related course information, making course requirements and course schedule transparent.
2. All learners enrolled in a blended course, regardless of location, have access to the library/learning resources needed to be successful.
3. Expectations for assignments, participation, grade policy and faculty communication and feedback are clearly described in the course syllabus.
4. Links to technical, learner services and disability support resources are easily accessible in the course.
5. Rules or standards for appropriate learner behavior, both online and face-to-face, are provided within the course or syllabus.

6. Instructional materials are easily accessible to the learner, easy to use, with an ability to be accessed by multiple operating systems, applications and devices such as tablets.
7. The blended course utilizes strategies to support inclusion and sense of belonging for learners.
8. The course structure is clear, intuitive and easy to navigate.

Teaching and Learning Quality Standards

1. Learner-to-Learner and Faculty-to-Learner interaction are essential characteristics and are encouraged and facilitated in either face-to-face or online portions of a course.
2. Instructor feedback on learner assignments and questions is constructive and provided in a timely manner.
3. Instructors use evidence-based practices to create an engaged, learning-focused presence across all modalities of the course.
4. Faculty teach the course as one cohesive whole, using specific strategies to create an engaged, learning-focused presence in both modalities of the course.

Faculty Support Quality Standards

1. Technical assistance is provided for faculty before and during blended course development and teaching.
2. Faculty have access to training, assistance and support for course development and effective teaching with technology in a variety of modalities.
3. Faculty receive guidance for assessing Fair Use and identifying and responding to plagiarism.
4. Faculty are provided on-going professional development related to blended teaching and learning.
5. Expectations for faculty engagement (e.g., response time, contact information, etc.) are established and adhered to.
6. Faculty are provided administrative and technological support for ensuring that course materials are ADA compliant.
7. Faculty are provided information and resources on accessibility standards for blended learning.
8. Faculty support and resources are provided to promote application of blended teaching and learning best practices.

Learner Support Quality Standards

1. Before starting a blended learning program, learners are advised about the minimum technology skills, equipment and software needed to participate successfully in the program.
2. Students can access program information, including admission requirements, tuition and fees, books and supplies, technical and proctoring requirements, and student support services.
3. Throughout the duration of the course/program, learners have access to training and information they will need to secure required materials through electronic databases, interlibrary loans, government archives, news services, and other sources (such as OER).
4. Learners have access to appropriate technical assistance and technical support staff.

1. Support personnel are available with extended hours to address learner questions and problems of a technical nature.
2. Learners are provided with information regarding required course materials in print and/or digital format, such as ISBN numbers for textbooks, publisher content, and delivery modes prior to course enrollment.
3. The institution provides guidance/tutorials for learners in the use of all forms of technologies used for course delivery.

Evaluation and Assessment Quality Standards

1. The program is systematically assessed using specific established standards (i.e., accreditor guidelines and/or other recognized agency such as the OLC Scorecard.)
2. A variety of data (academic and administrative information) are used to regularly evaluate program effectiveness in order to facilitate continuous improvement.
3. Intended learning outcomes at the course and program level are reviewed regularly to ensure alignment, clarity, utility, appropriateness, and effectiveness.
4. A process is in place and followed for the comprehensive assessment of support services for faculty and learners.
5. A systematic process is in place and followed for the assessment of learner retention in blended courses and programs.
6. Program demonstrates compliance with accessibility standards.
7. Course evaluations collect learner feedback on the effectiveness of the instructor and the educational experience.
8. Blended courses are held to the same standards as any modality of face-to-face or online courses.
9. Blended courses/programs are evaluated and continuously improved to support diversity, equity and inclusion within the learning environment.
10. A process is in place and followed for the assessment of learners, faculty, staff, and institutional satisfaction with the blended learning program(s).

Table 2

Round One Survey Results – New Suggested Quality Indicators

Category	Suggestion for New Quality Indicator
Institutional Support	Physical learning spaces designed for hybrid classrooms and common spaces are equipped to support both independent and collaborative work aligned with blended practices.
	Teachers are provided with protected time to collaboratively plan cohesive lessons that span in-person and online instruction.
Technology Support	Teachers and administrators can easily track student progress, attendance, and participation across both modalities.
	The school ensures that every student has consistent access to appropriate devices and internet at school and home.

Course Development and Instructional Design	The program includes checks to prevent cognitive overload and ensures that workload is balanced and manageable for each age group. Curriculum in both the online and in-person components is tightly aligned to state academic standards and learning progressions. The program embeds Social-Emotional Learning (SEL) competencies (e.g., self-regulation, empathy, relationship skills) within both face-to-face and online environments.
Course Structure	Clearly defined norms for attendance, participation, and behavior in both settings are communicated.
Teaching and Learning Support	Learning is seamless and interconnected across modalities, not fragmented or duplicative. Instruction is intentionally adapted to leverage the strengths of each modality (e.g., project- based learning in person, personalized practice online).
Faculty Support	Professional learning is not one-time but embedded and responsive to teacher needs and emerging technology. Teachers receive ongoing training on best practices in blended instruction, including classroom management in hybrid contexts, formative assessment, and learner engagement.
Learner Support	Regular communication occurs with families to explain the blended learning approach and address any concerns. Guidance is provided on how to support learners in safe use of technology (digital citizenship), including the use of GenAI. Students receive instruction tailored to their grade level on safe, ethical, and responsible use of technology in digital learning environments. Structures are in place for frequent, two-way communication between teachers/schools and families using accessible tools (email, apps, phone calls, etc.). Comprehensive, scaffolded orientations are provided for both students and caregivers that introduce learning platforms, expectations, schedules, and support services. The program builds student metacognition and organizational skills to foster independence and responsibility in a hybrid (blended) setting. Blended programs include built-in supports for learners like translation tools for non-English learners and captioning, screen readers, and individualized accommodations for students with disabilities.

Evaluation and Assessment Category	Changes made to the program/course and their impact to inform future improvements are documented.
	Ongoing feedback loops from stakeholders systems are in place for students, parents, and teachers to provide input on blended program effectiveness and make iterative improvements.
	The program routinely reviews learning materials to ensure they are accessible (ADA compliant) and culturally responsive for all learners.
	Real-Time data dashboards for academic and engagement are monitored for continuous improvement.

Table 3

Round Two–Additional Suggested Indicators in Round Two

Additional Suggested Indicators
Institutional Support
All stakeholders understand how to access supports, both online and in person.
Course Development/Instructional Design
Instructional designers work with teachers in class module development.
Faculty Support
Teachers have training/certification in online teaching and learning methods.

Table 4

Final Results by Category

OLC K12 Blended Learning Scorecard Final Results	
School District Support	
IS1	The school (or district) has a structured process to guide, support, and evaluate the effectiveness of blended learning courses/programs.
IS2	The school (or district) has a structured process in place to ensure clear, timely, and effective decision-making related to blended learning courses/programs.
IS4	The school (or district) has defined and articulated the value of blended learning with its stakeholders (students, teachers, parents, administration, staff, etc.).
IS5	The organizational structure of the blended learning program supports the school’s (or district’s) mission, values, and strategic plan.
IS6	The school (or district) has a process for assessing needs and allocating resources to support effective administration of blended learning courses/programs.
IS7	The school (or district) allocates sufficient technical, financial and student support resources to effectively administer blended courses/programs.

IS8	The school (or district) has policy and guidelines that confirm a student who is enrolled in a blended course or blended learning program is the same student who participates in and completes the course or program and receives academic credit.
IS9	The school or district ensures that all instructional materials used in blended learning courses comply with copyright, Creative Commons, public domain, and fair use guidelines. Support is provided to curriculum developers and instructional staff to secure appropriate permissions.
IS-A	Physical learning spaces designed for blended classrooms and common spaces are equipped to support both independent and collaborative work aligned with blended practices.
IS-B	Teachers are provided with protected time to collaboratively plan cohesive lessons that span in-person and online instruction.
Technology Support	
TS1	The learning management system and/or virtual classroom technologies used for blended learning are considered to be critical system(s) and supported as such.
TS2	Whether the school (or district) maintains local data centers (servers) and/or contracts for outsourced, hosted services or cloud services, those systems are administered in compliance with established data management practices such as the Information Technology Service Management (ITSM) standards.
TS3	The technology systems related to the delivery of blended learning courses/programs are highly reliable and operable.
TS4	The school (or district) maintains a technology and security plan that includes age-appropriate electronic safety measures, such as secure login systems, encryption, and compliant with FERPA (and if relevant, laws such as COPPA, CIPA, etc.) and ensures these practices are implemented in blended learning environments.
TS5	The school (or district) has a well-supported infrastructure for creating and maintaining blended education courses/programs.
TS6	The school (or district) provides ongoing support and training to teachers, staff, and students in the use of technology tools and strategies that enhance blended learning.
TS-A	Teachers and administrators can easily track student progress, attendance, and participation across both modalities.
TS-B	The school ensures that every student has consistent access to appropriate devices and internet at school and home.
Course Development and Instructional Design	
CD1	Blended courses/programs are designed with alignment between learning objectives, course materials, learning activities and assessments to ensure that students achieve measurable learning outcomes.

CD 2	The school (or district) identifies and follows quality standards to guide the design, delivery, and evaluation of blended instruction.
CD3	Blended learning courses are developed (or reviewed) using a school (or district) approved process that promotes consistency in navigation, technology tools, and instructional design across courses.
CD4	Blended courses are intentionally designed to combine face-to-face and online learning experiences in ways that support student engagement and achievement of learning outcomes.
CD5	Blended learning courses are regularly reviewed using school (or district) approved quality standards and updated to enhance student engagement and support learning goals.
CD6	Blended courses/programs are designed to be inclusive of all students and their learning needs.
CD7	Blended learning course design and development incorporates student-centered instruction and student engagement.
CD8	Blended course design promotes meaningful interaction and engagement between teachers and students.
CD9	Blended learning tasks and assignments are designed to be developmentally appropriate and manageable for students within the expected instructional timeframe.
CD10	A systematic process is established and followed for evaluating the effectiveness of current and emerging technologies to support learning and achievement of learning outcomes.
CD12	Blended courses are American Disabilities Act (ADA) compliant and adhere to Web Content Accessibility Guidelines (WCAGs).
CD13	Teachers and instructional staff contribute to the design and development of blended learning experiences in collaboration with school (or district) curriculum and technology teams.
CD-B	Curriculum in both the online and in-person components is tightly aligned to state academic standards and learning progressions (as applicable).
Course Structure	
CS1	Blended learning courses provide students and families with clear information about learning goals, expectations, materials, evaluation methods, and the course schedule.
CS2	All students enrolled in a blended learning course have access to the library, digital tools, and learning resources they need to succeed, whether learning in-person or online.
CS3	Expectations for assignments, participation, grading, and teacher communication and feedback are clearly communicated to students and families in blended learning courses.

CS4	Students and families have easy access to technology help, academic support, and services for students with disabilities through the blended learning environment.
CS5	Expectations for student behavior, both online and in the classroom, are clearly communicated within the blended learning environment.
CS6	Instructional materials are easily accessible to the student, easy to use, with an ability to be accessed by multiple operating systems, applications and devices.
CS7	Teachers use strategies in blended learning to build a respectful, welcoming environment that supports meaningful participation for all students.
CS8	The structure of the blended learning course is clear, intuitive, and easy for students to navigate.
CS-A	Clearly defined norms for attendance, participation, and behavior in both settings are communicated.
Teaching and Learning	
TL1	Student-to-student and teacher-to-student interactions are intentionally built into blended learning through structured activities that support collaboration and connection.
TL2	Feedback on student work is clear, supportive, and delivered in a timely way across both online and face-to-face activities.
TL3	Teachers use evidence-based practices to create an engaged, learning-focused presence across all modalities of the course.
TL4	Teachers approach blended learning as one cohesive experience, using specific strategies to maintain an engaging and learning-focused presence both online and in-person.
TL-A	Learning is seamless and interconnected across modalities, not fragmented or duplicative.
Teacher Support	
FS1	The school (or district) provides timely technical assistance to teachers before and during the development and delivery of blended learning courses.
FS2	Teachers have access to training, assistance, and support for course development and effective teaching with technology across a variety of modalities.
FS3	Teachers receive guidance in assessing, identifying and responding to plagiarism, copyright compliance, and academic integrity - including effective and ethical use of artificial intelligence (AI).
FS4	Teachers receive ongoing professional development in blended teaching and learning.
FS5	Expectations for teacher engagement (e.g., response time to students and families, availability, and communication protocols) are clearly established, communicated, and consistently followed.
FS6	Teachers are provided administrative and technological support for ensuring that course materials are ADA compliant.

FS7	Teachers are provided with information and resources on accessibility standards to ensure that all students can effectively engage in blended learning environments.
FS8	Teachers are provided support and resources to implement best practices in blended teaching and learning.
FS-B	Teachers receive ongoing training on best practices in blended instruction, including classroom management in blended contexts, formative assessment, and student engagement.
Student Support	
LS1	Before starting a blended learning program, students) are advised about the minimum technology skills, equipment and software needed to participate successfully in the program.
LS3	During the course or program, students will be guided on how to find the information and materials they need using online tools like library databases, digital archives, news websites, and free educational resources (OER).
LS4	Students have access to appropriate technical assistance and technical support staff.
LS7	The school (or district) provides guidance/tutorials for students on the use of all forms of technologies used for course delivery.
LS-C	Students receive instruction tailored to their grade level on AI literacy and safe, ethical, and responsible use of technology in digital learning environments.
LS-D	Structures are in place for frequent, two-way communication between teachers/schools and families using accessible tools (email, apps, phone calls, etc.).
LS-E	Comprehensive, 3lded orientations are provided for both students and caregivers that introduce learning platforms, expectations, schedules, and support services.
LS-G	Blended programs include built-in supports for students like translation tools for non-English students and captioning, screen readers, and individualized accommodations for students with disabilities.
Evaluation and Assessment	
EA1	The program is regularly reviewed using established standards, such as state guidelines or expectations from recognized educational organizations.
EA2	A variety of data (academic and administrative data) are used to regularly evaluate program effectiveness in order to facilitate continuous improvement.
EA3	Intended learning outcomes at the course and grade level are reviewed regularly to ensure alignment, clarity, utility, appropriateness, and effectiveness.
EA4	A clear process is established and implemented to regularly evaluate support services provided to both teachers and students.
EA5	A systematic process is in place and followed for the assessment of student retention in blended courses and programs.

EA6	Program demonstrates compliance with accessibility standards (i.e., WCAG and ADA).
EA7	Course evaluations collect student feedback on the effectiveness of the teacher and the educational experience.
EA8	Blended courses are held to the same standards as any modality of face-to-face or online courses.
EA10	A process is in place and followed for the assessment of students, teachers, staff, and school (or district) satisfaction with the blended learning program(s).
EA-B	Ongoing feedback loops from all stakeholders are in place to provide input on blended program effectiveness and for continuous improvement of the program.

Online STEM Education Before COVID-19: An Integrative Review and Thematic Framework for Higher Education

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Abstract
Scholarship on online STEM education in higher education has been dispersed across disciplinary and educational research communities. This integrative literature review synthesized studies published from 2011 through early 2020 to establish a historical baseline for online STEM teaching and learning before the COVID-19 pandemic. Searches were conducted in EBSCO, ERIC, and Web of Science using terms related to STEM education, online and distance learning, and higher education. The final body of literature comprised 33 studies published across 31 scholarly outlets. Inductive thematic synthesis produced eight categories: (1) Online STEM Learner Support; (2) Integrated Online STEM Education; (3) Online STEM Course Quality, Design, and Learner Success; (4) Strategies for Improving Online Learner Engagement in STEM; (5) Communication in Online STEM Environments; (6) Equity and Inclusion for Underrepresented Learners in Online STEM; (7) Online STEM Education and Workforce Development; and (8) Online STEM Faculty Preparation. Across asynchronous, synchronous, combined-online, and selected blended contexts, the reviewed literature linked learner experiences and outcomes more closely to the integration of instructional design, interaction, facilitation, authenticity, assessment, learner support, access, and equity than to modality alone. These dimensions operated interdependently across the eight themes. The review also revealed uneven methodological scale and theoretical grounding across the literature. By synthesizing this body of research, the review provides a thematic framework for interpreting pandemic-era and post-pandemic developments and advancing more rigorous, theoretically grounded, and equity-centered research in online STEM education.

Keywords: Online STEM education; online learning; higher education; integrative literature review; equity in STEM; faculty development

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Introduction

Since its emergence through the National Science Foundation (NSF) in the 1990s and its increased visibility in the early 2000s, STEM education has become a familiar and influential term in higher education. Yet conceptual ambiguity and inconsistency persist in how STEM is defined and enacted (Breiner et al., 2012; Honey et al., 2014). Even the NSF has treated STEM as four distinct disciplines rather than as an integrative framework. Breiner et al. (2012) found that many faculty interpret STEM primarily in siloed disciplinary terms, while others misidentify the acronym altogether. Sanders (2009) described this proliferation of competing definitions as *STEMmania*, warning that without conceptual clarity, meaningful reform remains difficult to achieve.

Although *STEM* is often used to denote the individual disciplines of science, technology, engineering, and mathematics, many scholars argue that *STEM education* implies purposeful connections across those disciplines (Breiner et al., 2012; English, 2016; Gibbons, 1979; Honey et al., 2014; Kysilka, 1998; Sgro et al., 2020). In practice, however, U.S. educational systems remain largely organized around discrete subject areas. A common critique is that STEM is not taught in the integrated way it is practiced in professional contexts (Schwartz & Lederman, 2002). Courses are typically offered in isolation, reinforcing the perception that disciplines are independent rather than overlapping and mutually dependent, despite the interdisciplinary demands of STEM careers.

Sanders (2009) argues for the use of the term *integrative STEM education* to reflect the reality of professional STEM practice, defining it as “teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects” (p. 21). He characterizes integrative STEM as a constructivist pedagogy of purposeful design and inquiry, engaging learners in authentic problem solving as a response to persistent weaknesses in STEM preparation and participation. Longstanding critiques underscore that these challenges are not new and remain closely tied to broader struggles over educational reform and entrenched disciplinary structures (Gibbons, 1979; Kysilka, 1998; Sanders, 2009). Sanders further cautions that unless conventional assumptions about STEM preparation and instructional contexts are fundamentally challenged, meaningful reform is unlikely to occur.

More than three decades later, the knowledge gap articulated by Gibbons (1979) persists. Honey et al. (2014) reaffirmed that despite strong arguments for STEM integration, there remains limited research on how integration should be enacted or whether it improves learning, retention, or other valued outcomes. These unresolved challenges are further compounded when STEM teaching and learning move online, where disciplinary complexity intersects with additional demands related to technology, course design, learner support, and faculty readiness.

At the same time, online education has been steadily expanding. Early efforts to support science education online emphasized content delivery over inquiry and collaboration, limiting opportunities for authentic engagement (Davis & Snyder, 2012). By fall 2017, more than 6.6 million postsecondary learners, approximately one-third of total enrollment, had taken at least one distance education course, with 15.7% enrolled exclusively online (National Center for Education Statistics, 2018; Seaman et al., 2018). Online enrollments increased for fourteen consecutive years, while campus-based enrollments declined by more than one million between

2012 and 2016. Despite this growth, little national data documented the participation and experiences of STEM majors in online programs, leaving an important gap in understanding how STEM is taught and learned online.

Because online learning has been defined in varied and sometimes contradictory ways, clear modality distinctions are important (Singh & Thurman, 2019). Online education encompasses several distinct instructional modalities. Formal institutional reporting definitions classify a course as fully online when 100% of direct instruction is delivered online, whether asynchronously, synchronously, or through a combination of both. In contrast, hybrid courses combine online instruction with required face-to-face direct instruction, while HyFlex courses allow learners to participate through face-to-face, synchronous online, or asynchronous online options (State University of New York [SUNY], 2025). These modalities are related but not interchangeable because they structure time, place, participation, and instructional interaction differently.

Modality should also be distinguished from course formats, pacing structures, technologies, and pedagogical approaches, such as self-paced learning, MOOCs, simulations, adaptive learning, and competency-based education, each of which may be implemented within more than one instructional modality. In this review, online STEM education functions as an analytic umbrella for scholarship in which online teaching, learning, instructional design, learner support, or faculty development was a substantive focus rather than merely a background technology or categorical variable. The included literature represents asynchronous, synchronous, combined-online, and some blended or mixed-modality contexts. Consistent with the integrative purpose of the review, these studies were retained when their online dimensions contributed meaningfully to understanding online STEM teaching and learning in higher education.

Across these modalities, effective online teaching and learning depend on the intentional design and facilitation of learner–content engagement; reciprocal learner–instructor interaction; purposeful independent learning activities; structured learner–learner interaction; and assessment and feedback. These opportunities make learners’ thinking and learning visible and open to feedback from instructors and peers through activities that require reflection, application, explanation, questioning, analysis, synthesis, self-assessment, and peer evaluation. Online learning is therefore not simply the delivery of content through technology; it requires coherent instructional design that aligns course content, interaction, engagement, feedback, assessment, and learner support with intended learning outcomes.

The Community of Inquiry framework locates meaningful online learning in the interdependence of social, teaching, and cognitive presence (Garrison et al., 2000). Anderson’s (2011) model similarly emphasizes interactions among learners, instructors, and content while recognizing both collaborative, community-based learning and independent study. Picciano (2017) extends these foundations by emphasizing that pedagogical purpose, rather than technology alone, should guide the integration of content, interaction, reflection, collaboration, assessment, and independent learning.

These pedagogical demands are particularly consequential in STEM fields, where laboratory experiences, quantitative and procedural reasoning, collaborative problem solving, and disciplinary communication may require substantial adaptation for online environments. They also make faculty preparation and institutional support central to the quality and inclusiveness of online STEM education. However, even prominent pre-COVID STEM reform initiatives that centered faculty development and learner-centered pedagogy did not explicitly address preparation for online teaching or use online professional development as a scalable means of preparing STEM faculty (Elrod, 2010).

National policy reports and statistical briefs further underscore the urgency of a number of issues. The National Academies of Sciences, Engineering, and Medicine (NASEM, 2020) identified persistent barriers to the participation of women in STEM and recommended evidence-based practices for broadening access. Longitudinal data similarly reveal high rates of attrition among learners who initially pursue STEM majors, particularly those from underrepresented groups (Chen, 2013). More recently, the NSF's National Center for Science and Engineering Statistics (2023) documented that women, racial and ethnic minorities, and persons with disabilities remain significantly underrepresented across STEM education and workforce pipelines. Together, these developments positioned STEM and online education as converging priorities for U.S. higher education policy and practice on the eve of the COVID-19 pandemic.

Prior reviews have established broad patterns in online teaching and learning in higher education but have not synthesized the multidisciplinary literature on online STEM education as a distinct body of scholarship. Wallace (2003) found extensive attention to social interaction, community, and online presence but comparatively little research connecting these constructs to subject-specific interactions and learning. Subsequent reviews identified recurring concerns related to course design, instructor–learner interaction, learning community, instructor preparation and support, learner engagement, and institutional conditions (Martin et al., 2020; Sun & Chen, 2016). Martin et al. (2020), for example, mapped 619 studies published from 2009 through 2018 across 12 online-learning and educational-research journals but did not include discipline-specific journals. More recently, van Dorresteijn et al. (2025) synthesized 47 reviews and meta-analyses across course, learner, instructor, and institutional levels, further demonstrating the maturity and breadth of the online higher education review literature. However, these syntheses examined online higher education broadly, general conditions for effectiveness, or field-wide research themes rather than integrating how online STEM teaching and learning had been studied across disciplines and pedagogical concerns during the pre-COVID period. The present review addresses this gap by synthesizing that historically bounded and widely dispersed literature as a distinct field of inquiry.

Online Education and the COVID-19 Era

The COVID-19 pandemic profoundly altered higher education in spring 2020, as an estimated 4,200 institutions serving more than 25 million learners shifted courses online with little preparation (Entangled Solutions & Alexander, 2020). Surveys indicated that nearly all U.S. colleges moved the majority of face-to-face instruction into remote formats within weeks, with many investing rapidly in new digital tools to support continuity (Lederman, 2020). National higher education organizations underscored the unprecedented scale of disruption and the need for coordinated institutional and federal responses (American Council on Education, 2020). Unlike purposefully designed online education, which typically involves extended faculty preparation, instructional design support, and iterative course development, emergency remote teaching was implemented under crisis conditions with little opportunity for planning or choice, raising widespread concerns about readiness, engagement, attrition, equity, and instructional quality. This distinction is consequential for interpreting the literature because pandemic-era scholarship often encompassed both conventional online education and emergency remote teaching despite their conceptual and historical differences (Doo et al., 2023).

The pandemic also changed the scale and emphasis of online learning research. In a systematic review of 191 studies published from February 2020 through April 2022, Doo et al. (2023) found that attention shifted from the pre-pandemic concentration on learners toward courses and instructors, with substantially greater emphasis on course design and technology, while engagement remained prominent. The authors characterized technology acceptance and learners' and instructors' perceptions of online learning as newly emerging topics within the pandemic-era literature. These questions, however, were not new to online education research. Rather, they resurfaced in a rapidly expanding body of scholarship that often treated online education as a newly encountered phenomenon and revisited longstanding questions about modality, quality, effectiveness, and perceptions with limited connection to decades of prior research. While valuable for documenting institutional and instructional responses to crisis, much of this work was descriptive, context-specific, and disconnected from the well-established scholarship on online teaching and learning. The emergency pivot consequently redirected substantial research attention away from the pre-pandemic emphasis on learners and toward technology, immediate implementation challenges, and the experiences of instructors suddenly required to teach online. This review therefore focuses on studies published from 2011 through early 2020 to identify what was known about online STEM education before that disruption and to establish a historical baseline against which pandemic-era and post-pandemic developments can be interpreted.

Purpose and Significance of the Review

Although prior reviews have synthesized broad themes, effective practices, and pandemic-era developments in online higher education, the multidisciplinary literature on online STEM teaching and learning has not been integrated as a distinct pre-COVID body of scholarship. This review therefore examines scholarship published from 2011 through early 2020, a period in which online education matured alongside STEM's rise as a national priority. It asks: What does the pre-COVID literature collectively reveal about online STEM teaching and learning in higher education?

Using an integrative review methodology, the study identifies recurring patterns, relationships, inconsistencies, and gaps across the literature and synthesizes them into eight thematic categories. The resulting framework encompasses instructional design, learner support, communication, engagement, interdisciplinary integration, equity and inclusion, workforce preparation, and faculty preparation across disciplines and instructional modalities.

By isolating scholarship developed before the emergency shift of 2020, the review makes three contributions. First, it establishes a historical baseline against which pandemic-era and post-pandemic research can be interpreted. Second, it brings coherence to a literature dispersed across disciplinary and educational publication venues. Third, the eight thematic categories provide an integrative framework for organizing future research and identifying persistent gaps in theory, methodological scale, and equity-centered design.

Methodology

This study employed an integrative literature review methodology (Whittemore & Knafl, 2005), selected for its capacity to synthesize heterogeneous empirical, applied, and conceptual scholarship across multiple research traditions. This approach was well suited to the multidisciplinary field of online STEM education and to the review's purpose of identifying patterns, relationships, inconsistencies, and gaps across a varied body of literature.

Searches were conducted in Education Research Complete (EBSCO), the Education Resources Information Center (ERIC), and Web of Science. Searches combined the following terms: STEM education AND online education AND higher education; integrated STEM AND online learning AND higher education; and STEM education AND (online learning OR e-learning OR distance learning) AND (higher education OR college OR university). The searches covered scholarship published from 2010 through early 2020 and returned more than 200 records. The earliest included study was published in 2011. Search results were reviewed for topical relevance, and potentially eligible publications were examined in full text.

The author conducted the database searches, full-text eligibility review, coding, and thematic synthesis during spring 2020. Decisions were documented in structured review matrices throughout the process. The review included English-language scholarly publications in which online STEM teaching, learning, instructional design, learner support, or faculty development was a substantive focus.

For this review, online STEM education functioned as an analytic umbrella encompassing studies in which the online dimension contributed meaningfully to understanding STEM teaching and learning in higher education. Eligible studies could examine asynchronous, synchronous, combined-online, blended, or mixed-modality contexts, as well as online STEM-related professional development. Conceptual and design-oriented scholarship was also eligible when it directly informed how online STEM teaching and learning could be designed, supported, or understood.

Studies were excluded if they focused on K–12 education; informal or otherwise non-scholarly publications; virtual or immersive technologies as the primary object of study; professional development not explicitly connected to STEM teaching and learning; or contexts lacking clear implications for online STEM instruction in higher education. Studies in which online learning functioned solely as a background context, delivery mechanism, or categorical variable rather than a meaningful component of the analysis were also excluded.

The initial review yielded a provisional corpus of 38 publications. As the review was refined, the full texts were reassessed against the eligibility criteria. Five publications were excluded because they focused on K–12 populations, general STEM education or policy, or technology-supported contexts in which online STEM teaching and learning in higher education was not a substantive focus. The final analytic corpus comprised 33 studies.

The included studies were documented in structured review matrices and compared by publication venue, study type and design, instructional modality, target population, substantive focus, and contribution to understanding online STEM education. Studies were classified as either core pedagogical studies, which empirically examined online STEM teaching and learning processes, or contextual/supporting studies, which addressed curriculum design, faculty preparation, program evaluation, or conceptual frameworks directly shaping online STEM education.

The 33 studies were coded using an inductive thematic analysis process. Through iterative reading and constant comparison, patterns in research focus, instructional context, theoretical framing, and analytic emphasis were identified and refined. For purposes of analytic presentation, each study was assigned to the thematic category representing its primary contribution, while relationships across categories were considered during synthesis. The categories were refined through repeated cycles of comparison across studies, with analytic decisions documented and revisited throughout the process rather than established in advance. The interpretation considered the nature and scale of the evidence, methodological design, theoretical grounding, and contribution of each study to the developing body of knowledge on online STEM education.

Findings

This review synthesized 33 studies of online STEM teaching and learning in higher education published between 2011 and early 2020. The studies appeared across 31 scholarly outlets and comprised 30 peer-reviewed journal articles, two peer-reviewed conference papers published in scholarly proceedings, and one formal working paper issued by an established university research center. Sixteen studies appeared in STEM-focused or discipline-specific STEM outlets, and 17 appeared in broader education venues, including distance and online education, higher education, pedagogy, and education policy. Three appeared in journals devoted specifically to online or distance education. These publication counts are used descriptively to characterize the dispersion of the reviewed scholarship across disciplinary and educational research communities.

Table 1

*Analytic Distribution of Scholarly Outlets in the Review (*N *= 33 studies; 31 scholarly outlets)*

Analytic Outlet Category	Sub-Category	Scholarly Outlets (*n*)	Studies (*n*)
STEM-Focused Scholarly Outlets	Interdisciplinary STEM Education	4	4

Analytic Outlet Category	Sub-Category	Scholarly Outlets (*n*)	Studies (*n*)
STEM Discipline – Focused Scholarly Outlets	Science Education	2	2
	Technology (Educational Technology)	3	3
	Technology (Computing Education)	5	5
	Engineering Education	1	1
	Mathematics Education	1	1
	Subtotal: STEM & STEM Discipline Focus	**16 Outlets**	**16 Studies**
Non-STEM Education Outlets	Distance / Online Education	3	3
	Education (General)	2	2
	English / Language Education	1	1
	Higher Education	6	7
	Pedagogy / College Teaching	2	3
	Education Policy & Practice	1	1
	Subtotal: Non-STEM Focus	**15 Outlets**	**17 Studies**
	TOTAL	**31 Outlets**	**33 Studies**

The analysis resulted in eight thematic categories that structure the synthesis of findings: (1) Online STEM Learner Support; (2) Integrated Online STEM Education; (3) Online STEM Course Quality, Design, and Learner Success; (4) Strategies for Improving Online Learner Engagement in STEM; (5) Communication in Online STEM Environments; (6) Equity and Inclusion for Underrepresented Learners in Online STEM; (7) Online STEM Education and Workforce Development; and (8) Online STEM Faculty Preparation. The following sections synthesize findings within each category. Studies were assigned to the category representing their primary contribution, although several findings intersect across themes.

1. Online STEM Learner Support

Learner support is widely recognized as a critical factor in academic success, persistence, and retention in STEM education. Retention theory emphasizes the importance of institutional and social supports (Tinto, 2012), national data document persistent STEM attrition patterns (Chen, 2013), and the Community of Inquiry framework highlights the importance of social presence and support in online environments (Garrison et al., 2000). Research on STEM persistence further underscores the need to examine how learner supports are enacted in online settings, particularly for underrepresented groups (Seymour & Hunter, 2019). Five of the 33 studies in this review addressed online STEM learner support.

Several studies examined academic supports for underprepared, disadvantaged, or underrepresented learners enrolled in high-risk online STEM courses. Spaniol-Mathews et al. (2016) found asynchronous supplemental instruction effective for improving performance and persistence among online STEM learners. Similarly, Rennar-Potacco and Orellana (2018) and Rennar-Potacco et al. (2019) reported that synchronous videoconferencing-based tutoring produced retention outcomes comparable to in-person support for academically underprepared learners.

Other research highlighted the needs of adult and disadvantaged learners. Butcher et al. (2019) evaluated an online “maths for science” access module combining asynchronous skill development with individualized phone tutoring and found it effective in preparing disadvantaged adult learners for subsequent study in science.

The perspective of tutors was also examined. Campbell et al. (2019) identified challenges associated with synchronous online tuition, including technological barriers to interaction and mismatched expectations, with learners often anticipating direct instruction rather than facilitated learning.

These studies identify two complementary functions of learner support in online STEM: strengthening performance and persistence within high-risk courses and preparing learners for further STEM study. The studies were concentrated in high-risk course and widening-participation contexts, and several addressed the needs of disadvantaged, underrepresented, and nontraditional learners or sought to reduce barriers to participation in academic support. Across the studies, support included structured supplemental instruction, synchronous tutoring, preparatory modules, and individualized assistance addressing academic skills and non-academic conditions affecting participation. The tutor-focused evidence further indicates that technological barriers and mismatched expectations about learner and facilitator roles can constrain synchronous support. Collectively, the findings position learner support as an integral component of online STEM course design, particularly in high-risk and widening-participation contexts. Because the evidence was drawn from varied but largely context-specific studies, it does not establish the scalability or sustained effects of these approaches across STEM disciplines and institutions (see Table 2).

Table 2

Online STEM Learner Support

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Spaniol-Mathews et al. (2016)	Empirical, quantitative (randomized controlled trial)	Online supplemental instruction (synch. with asynch. supports)	Learners (undergraduate STEM)	Core Pedagogical
Rennar-Potacco & Orellana (2018)	Evidence-based practice, case study	Synch. online video	Learners (undergraduate STEM)	Core Pedagogical

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Rennar-Potacco et al. (2019)	Empirical, quantitative (quasi-experimental, nonequivalent posttest-only design)	Synch. online video	Learners (undergraduate STEM; high-risk courses)	Core Pedagogical
Butcher et al. (2019)	Empirical, mixed methods (institutional case study)	Asynch. online & one-on-one phone calls	Learners (adult, nontraditional)	Core Pedagogical
Campbell et al. (2019)	Empirical, qualitative (thematic analysis; grounded theory–informed)	Synch. online video	Instructors (STEM tutors)	Core Pedagogical

Note. Targeted modality refers to the instructional modality explicitly examined or addressed in each study. Asynch. = asynchronous; Synch. = synchronous.

2. Integrated Online STEM Education

Integrated STEM approaches are increasingly viewed as essential for preparing learners for real-world problem solving; however, their application in online environments introduces additional instructional and conceptual complexities (English, 2016; Honey et al., 2014). Four of the 33 studies in this review addressed integrated STEM education in online higher-education contexts. Collectively, these studies offer primarily contextual, design-oriented, and conceptual insights into how integrated STEM learning can be structured and supported online, with limited empirical attention to enacted teaching and learning across contexts.

Two studies addressed learner-facing curriculum and learning design. Reid and Wilkes (2016) conducted an applied empirical study mapping quantitative skills across STEM curricula delivered through multiple instructional modes. Their analysis demonstrated how curriculum mapping can identify gaps and redundancies in where quantitative skills are taught, practiced, and assessed and support more coherent integrated STEM curricula. Hossain et al. (2018) employed design-based research to study an Open edX MOOC integrating experimentation, modeling, and data analysis through asynchronous, cloud-based biology laboratories. Their findings showed that inquiry-based, lab-centered science learning can be designed and scaled in online environments, supporting authentic scientific practices.

Two additional studies addressed instructor-focused design considerations and conceptual frameworks for integrated STEM education. Geiger et al. (2018) described and evaluated the interdisciplinary process used to develop an online mathematical-modeling module for preservice educators. The evaluation was generally positive but also identified the need for more meaningful involvement of preservice educators and other stakeholders in the design process. Yang and Baldwin (2020) synthesized prior research on integrated STEM learning to identify technology-use strategies that support learning, including the use of authentic problem contexts, web-based inquiry environments, immersive and interactive technologies, and approaches that position learners as active creators of knowledge. They also highlighted persistent challenges, such as disciplinary boundaries, uneven instructor expertise, and the cognitive demands of cross-disciplinary integration, which are especially relevant in online settings.

Together, these studies position integrated online STEM primarily as a curriculum and design challenge rather than as a well-established instructional model. Across empirical and conceptual work spanning mixed-modality and asynchronous settings, curriculum mapping, interdisciplinary module development, and technology-supported problem solving offered different mechanisms for coordinating disciplinary knowledge and authentic inquiry. The literature also identifies challenges related to disciplinary boundaries, uneven instructor expertise, and the cognitive demands of integration. Because the evidence was largely design-oriented, case-based, or conceptual, it does not establish comparative outcomes or how integrated STEM operates across disciplines and online modalities (see Table 3).

Table 3

Integrated Online STEM Education

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Reid & Wilkes (2016)	Empirical, quantitative (curriculum mapping study)	Mixed modalities (& F2F)	Learners (higher education STEM; Australia)	Contextual/ Supporting
Hossain et al. (2018)	Empirical, design-based research (iterative)	Asynchronous online (MOOC; cloud-based labs & simulations)	Learners (higher education STEM)	Contextual/ Supporting
Geiger et al. (2018)	Evidence-based practice (design-based case study)	Asynchronous online	Instructors (preservice educators)	Contextual/ Supporting
Yang & Baldwin (2020)	Conceptual synthesis (integrative literature review)	Conceptual (includes online & technology-mediated contexts)	Instructors (integrated STEM education)	Contextual/ Supporting

Note. Targeted modality refers to the instructional modality explicitly examined or addressed in each study. Contextual/supporting studies contribute design, curricular, or conceptual insights without empirically examining enacted online STEM teaching and learning processes.

3. Online STEM Course Quality, Design, and Learner Success

Course quality and instructional design are consistently identified in the online learning literature as central to learner success and satisfaction. Foundational frameworks position design as a core element of teaching presence (Garrison et al., 2000), large-scale syntheses demonstrate positive effects of well-designed online and blended instruction (Means et al., 2013), and engagement research emphasizes the role of intentional design in persistence (Meyer, 2014). Six of the 33 studies in this review examined how course structures, evaluation practices, and design features were conceptualized and studied in online STEM contexts, with particular attention to asynchronous environments.

Several studies focused on evaluation practices and predictors of success in online STEM courses. Downs (2014), in a multi-case evaluation of three online graduate STEM programs, identified limitations in reliance on informal feedback, inconsistent use of satisfaction surveys, and outcome measures that sometimes disadvantaged online learners. Hachey et al. (2015) found that prior online course outcomes, or the absence of online experience, were associated with success in subsequent online STEM courses, indicating that early online learning experiences may be consequential. Similarly, Wladis et al. (2014) reported higher success rates in online STEM major courses than in elective courses, suggesting that enrollment characteristics played a greater role than course content.

Other studies examined learner perceptions of online STEM course quality. Ramlo (2017) identified three learner perspectives in physics courses: a preference for face-to-face instruction; conditional acceptance of online learning; and resistance based on perceived limits to authentic, hands-on activity. These findings highlighted authenticity as a central factor shaping perceptions of online STEM course quality and contrasted with institutional narratives emphasizing strong demand for online STEM offerings, suggesting possible misalignment between administrative assumptions and learner experiences.

Design-oriented studies further underscored the role of instructional features and technological supports. Chen et al. (2018) identified design elements learners perceived as beneficial, including active learning strategies, interactive engagement, and robust assessment practices, and highlighted the role of Universal Design for Learning (UDL) to enhance accessibility and inclusivity, particularly for learners with disabilities and other underrepresented groups. In a MOOC field experiment, DeBoer et al. (2019) found that low-cost at-home lab kits improved exam scores and self-efficacy relative to controls, suggesting a feasible approach for supporting problem-centered, experiential learning at scale.

These studies identify three interrelated dimensions of quality in online STEM education: institutional evaluation practices, learner histories and perceptions, and instructional design for active, authentic, and accessible learning. Quality was therefore not a property of modality alone; it reflected how courses and programs were evaluated, how prior online experience and enrollment contexts were associated with learner success, and whether instructional features supported engagement, accessibility, assessment, and hands-on STEM activity. At the same time, divergent learner perceptions and uneven evaluation practices indicate that institutional narratives emphasizing demand for online STEM offerings may not align with learners' experiences of quality. Because most evidence came from individual courses or institutional settings, the findings do not establish how these dimensions operate across STEM disciplines and programs (see Table 4).

Table 4

Online STEM Course Quality, Design, and Learner Success

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Downs (2014)	Empirical, qualitative (multi-case program evaluation)	Asynchronous online	Learners (graduate STEM)	Core Pedagogical
Hachey et al. (2015)	Empirical, quantitative (predictive analysis)	Asynchronous online	Learners (community college STEM)	Core Pedagogical
Wladis et al. (2014)	Empirical, quantitative (course-level analysis)	Asynchronous online	Learners (online STEM course enrollees)	Core Pedagogical
Ramlo (2017)	Empirical, qualitative (Q methodology)	Asynchronous online	Learners (first-year undergraduate physics)	Core Pedagogical
Chen et al. (2018)	Empirical, quantitative (exploratory survey)	Asynchronous online	Learners (online STEM course)	Core Pedagogical
DeBoer et al. (2019)	Empirical, quantitative (randomized controlled trial)	Asynchronous online	Learners (engineering MOOC participants)	Core Pedagogical

4. Strategies for Improving Online Learner Engagement in STEM

Learner engagement and community-building are widely recognized as essential to persistence, satisfaction, and success in online learning. Engagement is central to the Community of Inquiry framework (Garrison et al., 2000), is understood as multidimensional (Dixson, 2015), and has been associated with specific instructional strategies in online courses (Martin & Bolliger, 2018). Two of the 33 studies in this review addressed strategies for improving engagement in online STEM contexts, representing asynchronous and blended instructional models.

One study examined engagement through instructional structure and delivery. Johnston (2018) conducted an experimental study of a blended, flipped model across seven core undergraduate engineering courses in a low-resource setting. Findings indicated equivalent levels of reported engagement and satisfaction and comparable overall performance relative to traditional instruction. However, assignment to the blended format was also associated with greater withdrawal or disengagement, particularly among lower-achieving learners. The findings suggest that blended, flipped approaches may offer cost-effective alternatives in resource-constrained contexts while indicating that some learners may require additional scaffolding when adapting to the format.

A second study foregrounded community-building as an engagement strategy. Hutton and Robson (2019) reported a case study of a preparatory website designed for distance learners in a summer science program. Evaluation findings indicated that non-academic interaction with peer mentors and opportunities for low-stakes self-disclosure were central to community formation. Learners reported valuing social contact and peer connections as much as, or more than, academic development in sustaining engagement.

Together, these studies identify two complementary dimensions of engagement in online STEM education: participation structured through course design and active-learning opportunities, and belonging cultivated through peer connection and low-stakes social interaction. The findings suggest that engagement was supported not only by participatory and social opportunities but also by the scaffolding and contextual conditions surrounding learners' participation. Because the studies examined different populations, purposes, modalities, and research designs, the evidence does not establish the relative effectiveness or transferability of either approach across online STEM settings (see Table 5).

Table 5

Strategies for Improving Online Learner Engagement in STEM

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Johnston (2018)	Empirical, quantitative (experimental study with supplementary qualitative interviews)	Blended (F2F & asynchronous online)	Learners (undergraduate engineering, Mongolia)	Core Pedagogical
Hutton & Robson (2019)	Empirical, qualitative (case study)	Asynchronous online	Learners (incoming undergraduate science)	Core Pedagogical

Note. F2F = face-to-face, referring to traditional in-person classroom-based instructional modalities.

5. Communication in Online STEM Environments

Communication is central to STEM learning because it supports disciplinary reasoning, collaboration, and participation in academic and professional communities (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018; National Research Council [NRC], 2012). In online environments, purposeful communication, instructor presence, and structured interaction also support belonging and collaborative knowledge-building (Garrison et al., 2000; Swan et al., 2000). Three of the 33 studies in this review examined communication in online STEM environments, focusing on language development, teamwork, and professional communication.

One study addressed language development. Arno-Macià and Rueda-Ramos (2011) presented a qualitative case study of *Quantum LEAP*, an online autonomous learning environment integrating English for Academic Purposes (EAP) with interdisciplinary science, technology, and society content. Their findings challenged assumptions that EAP instruction is limited to language development, showing how language learning can support interdisciplinary STEM engagement and critical reflection.

A second study examined communication for collaboration and teamwork. Fiore et al. (2012) introduced *uCollaborator,* a prototype framework designed to support geographically distributed engineering and technology teams through integrated synchronous and asynchronous communication, shared visualization, and collaborative decision-making. As a proof-of-concept, the study illustrated how communication tools can support team-based problem solving in online STEM contexts.

The third study focused on professional communication. Baim (2016) reported a qualitative course-intervention case study designed to support undergraduate STEM learners' transition from informal social media practices to academically and professionally appropriate communication through self-paced modules and peer-driven wiki activities, highlighting the role of structured online scaffolding and peer interaction in supporting professional communication development.

These studies identify three interrelated functions of communication in online STEM education: supporting disciplinary reflection through language, coordinating collaborative problem solving, and developing professional discourse practices. Across the three studies, communication supported teamwork, made disciplinary thinking visible for reflection and coordination, and developed professional discourse practices relevant to distributed STEM collaboration. Because the evidence consisted of two case studies and a proof-of-concept, it does not establish the effects of these communication designs on learning, teamwork, or transfer to professional practice across settings (see Table 6).

Table 6

Communication in Online STEM Environments

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Arno-Macià & Rueda-Ramos (2011)	Empirical, qualitative (case study)	Asynchronous online (self-paced learning materials)	Learners (engineering)	Core Pedagogical
Fiore et al. (2012)	Empirical, design-based (proof-of-concept)	Synchronous & asynchronous online collaboration	Learners & Instructors (STEM project teams)	Core Pedagogical
Baim (2016)	Empirical, qualitative (course-intervention case study)	Asynchronous online	Learners (undergraduate STEM)	Core Pedagogical

6. Equity and Inclusion for Underrepresented Learners in Online STEM

Equity and inclusion remain critical challenges in STEM education, with persistent gaps in access, participation, and outcomes across gender, race, disability, and other learner characteristics. National reports and meta-analyses document systemic barriers faced by women and learners of color (Corbett & Hill, 2015; Hill et al., 2010), while research on stereotype threat and structural inequities highlights mechanisms that undermine persistence (Rozek et al., 2019; Vakil et al., 2016). More recent evidence underscores the urgency of these concerns: NASEM (2020) identified enduring barriers to women's participation in STEM, and the NSF (2023) reported continued underrepresentation of women, racial and ethnic minorities, and persons with disabilities across STEM education and workforce pipelines. Online education offers new possibilities for broadening access, but it also raises questions about whether inequities are mitigated or reproduced. Eight of the 33 studies in this review addressed equity and inclusion in online STEM education. The studies primarily examined asynchronous online environments, while also including comparative, blended, and online-supported instructional contexts. None focused primarily on online faculty preparation or examined institutional policy or systemic reform.

Several studies examined outcomes and enrollment patterns in online STEM environments. Bosch et al. (2019) found that underrepresented learners in an online introductory science course began with lower exam scores but showed comparable improvement over the semester, suggesting both gaps in prior preparation and the potential for online environments to support similar learning gains. Wladis, Conway, et al. (2015) reported that older learners performed better online, while women performed worse than expected relative to face-to-face settings; importantly, gaps for Black and Hispanic learners did not widen online. A second study by Wladis, Hachey, et al. (2015) analyzed enrollment trends, showing underrepresentation of Black and Hispanic men in online STEM courses, overrepresentation of women, and strong links between nontraditional risk factors and online enrollment, with patterns differing by institutional sector.

Other research focused on learners with disabilities and nontraditional needs. Graves et al. (2011) found that learners with learning disabilities (LD) and attention-deficit/hyperactivity disorder (ADHD) reported benefits associated with asynchronous online access, including improved clarity, organization, convenience, and opportunities for self-accommodation. Maldonado and Pearson (2013) described the TECH-FIT project, which combined online resources with faculty development to adapt STEM curricula for women and art/design learners and became institutionalized within its program context as a model for broadening participation.

Several studies examined technology-enabled supports and online interventions aimed at expanding participation. Krishnamurthi and Richter (2013) suggested that low-cost mobile technologies could increase access and interaction for women and underrepresented learners, particularly in resource-limited contexts. Sanga et al. (2013) found that e-learning was associated with improved access, flexibility, and collaboration opportunities for women, although broader socio-cultural and policy changes were required for sustained equity. Similarly, Dawson et al. (2015) described *CareerWISE*, a fully self-paced online resilience training program that provided scalable psychosocial support for women in STEM and offered an alternative to traditional mentoring.

These equity-focused studies distinguish expanded access to online STEM education from equitable participation and outcomes within STEM pathways. Flexible delivery, accessible asynchronous design, mentoring, resilience training, and technology-enabled supports were associated with expanded access and support for some underrepresented and nontraditional STEM learners. At the same time, patterns of participation and benefit remained uneven across gender, race and ethnicity, age, disability, prior preparation, and institutional context. The collective evidence therefore positions online STEM education as a potential site for targeted equity-oriented intervention, but not as an automatic remedy for structural inequities across STEM education and workforce pathways (see Table 7).

Table 7

Equity and Inclusion for Underrepresented Learners in Online STEM

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Bosch et al. (2019)	Empirical, quantitative (correlational analysis)	Asynchronous online	Learners (underrepresented undergraduate STEM)	Contextual / Supporting

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Wladis, Conway, et al. (2015)	Empirical, quantitative (exploratory correlational analysis)	Asynchronous online	Learners (community college STEM)	Core Pedagogical
Wladis, Hachey, et al. (2015)	Empirical, quantitative (secondary data analysis)	Online vs. F2F (comparative; modality not disaggregated)	Learners (community college STEM majors)	Core Pedagogical
Graves et al. (2011)	Empirical, qualitative (semi-structured interviews)	Asynchronous online	Learners (postsecondary STEM learners with LD and/or ADHD)	Core Pedagogical
Maldonado & Pearson (2013)	Descriptive (program design case study)	Blended (asynchronous online resources supporting F2F instruction)	Learners (undergraduate women in STEM)	Contextual / Supporting
Krishnamurthi & Richter (2013)	Practitioner-oriented, descriptive (conference paper)	Asynchronous mobile learning	Learners (underrepresented and nontraditional in STEM)	Contextual / Supporting
Sanga et al. (2013)	Empirical, mixed methods (survey and interviews)	Asynchronous online (supplemental to F2F)	Learners (women in higher education STEM, Tanzania)	Contextual / Supporting
Dawson et al. (2015)	Descriptive (program evaluation case study)	Asynchronous online (self-paced mentoring and resilience training)	Learners (undergraduate women in STEM)	Contextual / Supporting

7. Online STEM Education and Workforce Development

Concerns about STEM workforce capacity and projected shortages have long been documented in national reports and policy initiatives, which emphasize the need for improved preparation, persistence, and participation across diverse learner populations (Carnevale et al., 2011; National Science Board, 2018; National Science Foundation [NSF], 2023). These reports consistently highlight inequities in STEM pathways, particularly for learners from groups historically underrepresented in STEM. Together, these conditions frame the question of whether and how online STEM education may expand access to workforce preparation and advanced credentials for learners who might otherwise have limited access to conventional pathways.

Two of the 33 studies directly addressed STEM workforce development in online higher education contexts. Both examined asynchronous online environments: one involved a contextualized workforce-training intervention, and the other examined a large-scale online graduate degree program delivered through Udacity's MOOC infrastructure. Mohammadi et al. (2019) examined an online Contextualized Teaching and Learning (CTL) intervention that used experiential learning to connect skills development with real-world occupational training. Using a nonrandomized comparison-group design, they found that learners in the CTL condition achieved higher credentialing rates and demonstrated learning gains across multiple measures relative to a comparison group. Nontraditional and historically underrepresented learners, including older adults, women, and learners from racial and ethnic minority groups, were overrepresented in the CTL condition. Although the study design does not fully disentangle intervention effects from group composition, the findings indicate that online CTL environments are associated with positive workforce-oriented outcomes for diverse populations.

Goodman et al. (2019) investigated whether online delivery can expand access to higher education by examining the Georgia Institute of Technology's Online Master of Science in Computer Science (OMSCS), developed with Udacity and AT&T. Using a regression discontinuity design, the authors found that online access substantially increased overall enrollment, attracting mid-career learners who would likely not have enrolled in the traditional on-campus program. Because OMSCS was offered by a highly ranked department at a fraction of the cost of its in-person equivalent, the findings provide rigorous evidence of previously unmet demand for affordable graduate STEM education. Their estimates suggest that the program could increase the annual production of U.S. computer science master's degrees by approximately 7%, underscoring the broader potential of low-cost online graduate STEM programs to expand access and degree attainment.

These studies identify two complementary workforce functions for online STEM education: creating alternative pathways into occupational training and expanding access to advanced credentials for learners unable or unlikely to enter conventional programs. Contextualized experiential learning and a low-cost, large-scale online graduate degree program illustrate how distinct pedagogical and program models can broaden access to workforce-oriented education for nontraditional and mid-career learners. The collective evidence is strongest for expanded access and, in one study, credentialing and near-term learning outcomes; the studies do not establish whether expanded access translated into equitable persistence or longer-term workforce outcomes (see Table 8).

Table 8

Online STEM Education and Workforce Development

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Mohammadi et al. (2019)	Empirical, quantitative (nonrandomized comparison-group design)	Asynchronous online	Learners (adult, nontraditional STEM workforce trainees)	Core Pedagogical
Goodman et al. (2019)	Empirical, quantitative (descriptive and quasi-experimental causal inference)	Asynchronous online (large-scale graduate degree program)	Learners (graduate-level, mid-career STEM professionals)	Contextual/ Supporting

8. Online STEM Faculty Preparation

The preparation and ongoing professional development of STEM faculty are widely recognized as critical to improving teaching quality, learner engagement, and persistence in STEM education (Derting et al., 2016; Ebert-May et al., 2011; Henderson et al., 2011; NRC, 2012). Three of the 33 studies in this review addressed STEM faculty preparation, including one focused on preservice educators; all three examined online, asynchronous professional development environments.

Davis and Snyder (2012) investigated the Science Education Online (SEO) graduate-level program and found that its online courses met university quality standards while providing inquiry-based learning opportunities. Participants reported that purposeful learner–faculty and peer discussion positively influenced their own teaching practices. Christe (2015) designed an asynchronous workshop focused on learner persistence and retention in STEM, introducing evidence on learner–faculty rapport and classroom climate (including the Wilson–Ryan Rapport Scale) to prompt reflection and buy-in. Although not all faculty were persuaded, the case suggested that evidence-informed framing can strengthen commitment to persistence-oriented teaching practices. Wu et al. (2019) tested an online training intervention to scaffold design-thinking competence for collaborative STEM learning design among preservice educators, finding that different scaffolding modes shaped collaborative design discussions, underscoring the importance of instructional design choices in faculty preparation for interdisciplinary STEM teaching.

These studies identify three functions of online faculty preparation: supporting inquiry-oriented pedagogy, prompting reflection on learner–faculty rapport and persistence, and scaffolding collaborative design competence for interdisciplinary STEM learning. The evidence, however, is drawn from a small number of context-specific studies and does not establish whether the documented professional-learning outcomes translated into sustained changes in teaching practice or were associated with learner outcomes (see Table 9).

Table 9

Online STEM Faculty Preparation

Authors	Type of Study	Targeted Modality	Target Population	Analytic Classification
Davis & Snyder (2012)	Empirical, quantitative (quasi-experimental)	Asynchronous online	Instructors (graduate-level science educators)	Core Pedagogical
Christe (2015)	Empirical, qualitative (case study)	Asynchronous online (self-paced)	Instructors (STEM faculty)	Core Pedagogical
Wu et al. (2019)	Empirical, quantitative (experimental design)	Asynchronous online	Instructors (pre-service STEM teacher candidates)	Core Pedagogical

Across asynchronous, synchronous, combined-online, and selected blended contexts, the reviewed literature linked learner experiences and outcomes to intentional course design, interaction, facilitation, authenticity, assessment, learner support, and access. The themes were interdependent: learner support intersected with engagement and persistence; communication with collaboration and disciplinary participation; faculty preparation with design and facilitation; and equity considerations across these dimensions.

At the same time, the evidence base was uneven. Experimental and quasi-experimental studies provided stronger evidence concerning learner outcomes and course design, while large-scale studies provided broader evidence concerning program access and workforce pathways; much of the literature, however, remained small-scale, descriptive, case-based, or lightly theorized. Attention to underrepresented learners was more visible than attention to institutional policy, systemic reform, or faculty capacity. Taken together, the pre-COVID literature portrays online STEM education as a set of interrelated design, teaching, interaction, and support practices situated within disciplinary, pedagogical, institutional, and equity contexts.

Discussion

The eight themes show that the central concerns represented in the reviewed literature were not isolated problems but interdependent dimensions of online STEM teaching and learning. Applying established online-learning principles within STEM disciplines required attention to laboratory activity, quantitative and procedural reasoning, authentic problem solving, and disciplinary communication. These disciplinary demands help explain why course design, learner support, engagement, communication, equity, and faculty preparation repeatedly intersected across the reviewed studies.

The publication pattern among the included studies also helps explain why online STEM scholarship has remained difficult to recognize as a coherent body of research. Only three of the 33 studies appeared in journals devoted specifically to online or distance education, while the remainder were dispersed across STEM-specific, disciplinary, and broader education venues. These counts describe the composition of the reviewed literature rather than establish a longitudinal publication trend. Nevertheless, the pattern is consistent with Wallace's (2003) observation that online-learning research had done comparatively little to connect general online constructs with subject-specific teaching and learning. It also complements Martin et al.'s (2020) broad review of online-learning research, which did not include discipline-specific journals. Together, these comparisons position the present review at the intersection of STEM education scholarship and the broader online-learning literature.

Across the themes, intentional design and facilitation appeared more consequential than any single delivery format. In asynchronous environments, active learning, assessment, accessibility, authentic laboratory activity, learner support, and community-building were associated with learner experiences and outcomes. Synchronous and combined-online studies showed how real-time interaction could extend tutoring and collaboration, while also introducing technological barriers and differing expectations about instructor and learner roles. The blended studies contributed evidence about active learning, instructional structure, and access in particular contexts, underscoring the importance of interpreting findings in relation to the modality and setting examined. Across modalities, the findings reinforce established online-learning frameworks that position interaction, teaching presence, community, and coherent instructional design as mutually supporting conditions for learning (Anderson, 2011; Garrison et al., 2000; Picciano, 2017; Sun & Chen, 2016).

The findings also complicate the assumption that expanded online access necessarily produces equity. Flexible and accessible asynchronous design, mentoring, resilience-oriented support, contextualized learning, and lower-cost degree pathways were associated with expanded access and support for underrepresented, nontraditional, and mid-career learners. At the same time, differences in prior preparation, enrollment patterns, institutional structures, and broader sociocultural conditions continued to shape participation and outcomes. Equity in online STEM education therefore requires more than making courses or programs available; it requires intentional attention to accessibility, belonging, learner support, assessment, and the institutional conditions through which learners enter and progress through STEM pathways.

Faculty preparation was a comparatively small part of the reviewed literature, but its significance extends across the themes. The included studies suggest that online professional development can support inquiry-oriented pedagogy, purposeful interaction, learner–faculty rapport, persistence-focused practice, and collaborative STEM learning design. This limited attention is especially consequential when viewed alongside Elrod's (2010) account of *Project Kaleidoscope 2.0,* a national cross-disciplinary initiative that placed learner-centered pedagogy, faculty development, and leadership for sustained reform at the center of STEM improvement.

Yet the initiative did not address preparation for online teaching or consider online professional development as a scalable means of preparing STEM faculty. This contrast suggests that online education and STEM reform were developing largely as parallel rather than integrated agendas, leaving unresolved how faculty would be prepared to teach effectively in online STEM environments.

The strength of the evidence varied considerably across the 33 studies. Experimental and quasi-experimental studies provided stronger evidence concerning learner outcomes and course design, while large-scale studies provided broader evidence concerning program access and workforce pathways; much of the literature, however, remained small-scale, descriptive, case-based, or lightly theorized. This unevenness limits comparison across disciplines, modalities, learner populations, and institutional settings and constrains cumulative knowledge building. Bringing these dispersed studies together nevertheless clarifies how online STEM questions developed across research communities that were not always in direct conversation. The eight-theme framework also provides a structured basis for examining whether later research extends, reframes, or overlooks this earlier knowledge base.

Limitations

This review has several limitations that shape the scope of its findings. First, the search was restricted to three databases: EBSCO, ERIC, and Web of Science, and to English-language scholarly publications. These boundaries may have excluded relevant studies indexed elsewhere, published in other languages, or disseminated through grey literature such as dissertations. In addition, discipline-specific studies that did not use STEM-related terminology may not have been identified through the search strategy.

Second, much of the evidence base was small-scale, descriptive, case-based, or lightly theorized, with relatively few longitudinal or multi-institutional studies. These characteristics limit the transferability of individual findings and the extent to which broader patterns in online STEM teaching and learning can be compared across disciplines, learner populations, and institutional settings.

Finally, each study was assigned to the thematic category representing its primary contribution for purposes of analytic presentation. Because many studies addressed interrelated dimensions of online STEM teaching and learning, their findings often crossed thematic boundaries. The categories should therefore be understood as an organizing framework for synthesis rather than as mutually exclusive divisions within the literature.

Future Research

Future research on online STEM education should build on the thematic framework and pre-COVID baseline established in this review. Five cross-cutting priorities emerge.

First, stronger theoretical grounding is needed. Future studies should use established online learning, persistence, motivation, adult learning, sociocultural, and identity-oriented frameworks to guide research design and interpretation rather than applying theory only after findings have been generated. Relevant traditions include persistence and motivation theory (Bandura, 1977; Bean, 1982; Tinto, 1975), adult learning theory (Knowles, 1973), established online learning models such as the Community of Inquiry (Garrison et al., 2000; Shea & Bidjerano, 2010), and sociocultural and identity-oriented perspectives (Brown et al., 1989; Luehmann, 2007; Wenger, 1998). Such perspectives may help explain how disciplinary culture, interaction, belonging, self-efficacy, resilience, epistemic beliefs, pedagogical conceptions, and professional identity shape teaching, learning, and participation in online STEM environments.

Second, more diverse and rigorous research designs are needed in online STEM research. Multi-institutional, longitudinal, experimental, and mixed-methods studies could strengthen understanding of how instructional design, learner support, faculty preparation, and program structures influence learning, persistence, and workforce pathways across disciplines and institutional contexts. Studies should clearly define the instructional modalities examined and use terminology consistently, distinguishing among asynchronous, synchronous, combined-online, blended or hybrid, and other relevant contexts. Where appropriate, researchers should investigate modality-specific and cross-modality patterns.

Third, equity should be examined as a cross-cutting dimension of online STEM education rather than confined to studies focused specifically on underrepresented populations. Research should consider how accessibility, prior preparation, interaction, assessment, belonging, course design, faculty preparation, and institutional policy shape participation and outcomes for diverse learners in online STEM environments. Social justice, critical, feminist, culturally responsive, and accessibility-oriented perspectives can help researchers examine how power, agency, inclusion, and relationality operate in digitally mediated learning environments (Freire, 1970; Gay, 2000; Kumi-Yeboah & Amponsah, 2023; Woodley et al., 2017).

Fourth, research should examine how artificial intelligence is reshaping online STEM teaching and learning. AI-enabled tools may influence instructional design, feedback, learner support, assessment, accessibility, simulation, and disciplinary problem solving, while raising questions about accuracy, bias, data privacy, academic integrity, learner agency, ethical use, and the changing roles of faculty and instructional designers. Research should examine these developments across specific STEM disciplines and learner populations, including how AI is integrated into learning platforms and institutional policy, how it affects preparation for AI-mediated STEM work, and whether it reduces or reproduces existing inequities.

Finally, the pre-COVID literature synthesized here provides a lens for examining how online STEM scholarship changed during and after the pandemic. Comparative reviews could identify which established concerns and practices were extended, reframed, or overlooked and which longstanding questions resurfaced without connection to the earlier knowledge base.

Conclusion

This integrative review synthesized 33 studies to establish a historical baseline of online STEM teaching and learning in higher education before the COVID-19 pandemic. The eight thematic categories bring coherence to scholarship published across STEM-specific, disciplinary, and broader education venues and show that online STEM education is best understood as a set of interrelated design, teaching, interaction, and support practices. Across the reviewed literature, learner experiences and outcomes reflected how instructional design, facilitation, authenticity, communication, assessment, learner support, access, and equity were addressed within particular disciplinary and institutional contexts.

The synthesis also reveals persistent gaps in theoretical grounding, methodological scale, faculty preparation, institutional capacity, and the integration of equity across online STEM teaching and learning. These gaps limit cumulative knowledge building across disciplines and institutional contexts.

The pre-COVID boundary should therefore be understood not as an endpoint, but as a lens for interpreting subsequent developments. The thematic framework provides a basis for examining whether pandemic-era and post-pandemic scholarship extends, reframes, or overlooks the earlier knowledge base. As online and hybrid learning remain integral to higher education, building on this foundation through more rigorous, theoretically grounded, and equity-centered research can strengthen online STEM education by advancing workforce pathways that are more accessible, effective, and equitable; strengthening institutional capacity and faculty practice; and better supporting the success of diverse online learners.

Ethics Statement

According to the guidelines of the State University of New York at Albany, this type of research did not require formal ethics approval.

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AI Use Statement

Generative artificial intelligence (AI) was used in the preparation and revisions of this manuscript for grammar, style refinement, and APA 7th edition reference formatting using OpenAI ChatGPT models GPT-5.2 and GPT-5.6. The AI tool was not used to generate, analyze, or interpret research data, nor to create original scholarly content. All content was reviewed, revised, verified, and approved by the author, who takes full responsibility for the accuracy and integrity of the work.

Conflicts of Interest Statement

The author declares no conflicts of interest related to the research, authorship, or publication of this article.

References

American Council on Education. (2020, April 9). *Higher education fourth supplemental letter to Senate Majority Leader McConnell and Minority Leader Schumer* [Letter]. https://www.acenet.edu/Documents/Letter-Senate-Higher-Ed-Supplemental-Request-040920.pdf

Anderson, T. (Ed.). (2011). The theory and practice of online learning (2nd ed.). AU Press.

Arno-Macià, E., & Rueda-Ramos, C. (2011). Promoting reflection on science, technology, and society among engineering students through an EAP online learning environment. *Journal of English for Academic Purposes*, *10*(1), 19–31. https://doi.org/10.1016/j.jeap.2010.12.004

Baim, S. A. (2016). Building professional social media communications skills: A STEM-originated course with university-wide student appeal. *Journal on Excellence in College Teaching*, *27*(2), 155–182. https://eric.ed.gov/?id=EJ1104014

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bean, J. P. (1982). Student attrition, intentions, and confidence: Interaction effects in a path model. *Research in Higher Education*, *17*(4), 291–320. https://doi.org/10.1007/BF00977899

Bosch, N., Huang, E., Angrave, L., & Perry, M. (2019). Modeling improvement for underrepresented minorities in online STEM education. In *Proceedings of the 27th Conference on User Modeling, Adaptation and Personalization (UMAP '19),* Association for Computing Machinery (ACM) (pp. 327–335). https://doi.org/10.1145/3320435.3320463

Breiner, J. M., Harkness, M., Johnson, C. C., & Koehler, C. M. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. *School Science and Mathematics*, *112*(1), 3–11. https://doi.org/10.1111/j.1949-8594.2011.00109.x

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

Butcher, J., Clarke, A., Wood, C., McPherson, E., & Fowle, W. (2019). How does a STEM access module prepare adult learners to succeed in undergraduate science? *Journal of Further and Higher Education, 43*(9), 1271–1283. https://eric.ed.gov/?id=EJ1228873

Campbell, A., Gallen, A. M., Jones, M. H., & Walshe, A. (2019). The perceptions of STEM tutors on the role of tutorials in distance learning. *Open Learning: The Journal of Open, Distance and e-Learning*, *34*(1), 89–102. https://doi.org/10.1080/02680513.2018.1544488

Carnevale, A. P., Smith, N., & Melton, M. (2011). *STEM: Science, technology, engineering, mathematics*. Georgetown University Center on Education and the Workforce. https://cew.georgetown.edu/wp-content/uploads/2014/11/stem-complete.pdf

Chen, B., Bastedo, K., & Howard, W. (2018). Exploring design elements for online STEM courses: Active learning, engagement & assessment design. *Online Learning*, *22*(2), 59–75. https://doi.org/10.24059/olj.v22i2.1369

Chen, X. (2013). *STEM attrition: College students' paths into and out of STEM fields* (NCES 2014-001). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/pubs2014/2014001rev.pdf

Christe, B. (2015). Implementation of an asynchronous workshop for STEM educators designed to enhance professor-student rapport. *Journal on Excellence in College Teaching, 26*(4), 9–28. https://eric.ed.gov/?id=EJ1082710

Corbett, C. & Hill, C. (2015). *Solving the equation: The variables for women's success in engineering and computing.* American Association of University Women (AAUW), Washington, D.C. https://eric.ed.gov/?id=ED580805

Davis, K. S., & Snyder, W. (2012). Fostering science education in an online environment: Are we there yet? *Journal of College Science Teaching*, *42*(2), 24–31. https://eric.ed.gov/?id=EJ999485

Dawson, A. E., Bernstein, B. L., & Bekki, J. M. (2015). Providing the psychosocial benefits of mentoring to women in STEM: CareerWISE as an online solution. *New Directions for Higher Education*, *2015*(171), 53–62. https://doi.org/10.1002/he.20142

DeBoer, J., Haney, C., Atiq, S. Z., Smith, C., & Cox, D. (2019). Hands-on engagement online: Using a randomized control trial to estimate the impact of an at-home lab kit on student attitudes and achievement in a MOOC. *European Journal of Engineering Education*, *44*(1–2), 234–252. https://eric.ed.gov/?id=EJ1203328

Derting, T. L., Ebert-May, D., Henkel, T. P., Maher, J. M., Arnold, B., & Passmore, H. A. (2016). Assessing faculty professional development in STEM higher education: Sustainability of outcomes. *Science Advances*, *2*(3), e1501422. https://doi.org/10.1126/sciadv.1501422

Dixson, M. D. (2015). Measuring student engagement in the online course: The online student engagement scale (OSE). *Online Learning*, *19*(4). https://doi.org/10.24059/olj.v19i4.561

Doo, M. Y., Zhu, M., & Bonk, C. J. (2023). A systematic review of the research topics in online learning during COVID-19: Documenting the sudden shift. *Online Learning, 27*(1), 15–45. https://doi.org/10.24059/olj.v27i1.3405

Downs, H. A. (2014). Evaluation in STEM online graduate degree programs in agricultural sciences and engineering. *Journal of Case Studies in Education*, *5*, 1–18. https://files.eric.ed.gov/fulltext/EJ1060613.pdf

Ebert-May, D., Derting, T., Hodder, J., Momsen, J., Long, T., & Jardeleza, S. (2011). What we say is not what we do: Effective evaluation of faculty professional development programs. *BioScience*, *61*(7), 550–558. https://doi.org/10.1525/bio.2011.61.7.9

Elrod, S. (2010). Project Kaleidoscope 2.0: Leadership for twenty-first century STEM education. *Liberal Education, 96*(4), 24–33. https://eric.ed.gov/?id=EJ923879

English, L. D. (2016). STEM education K–12: Perspectives on integration. *International Journal of STEM Education, 3,* Article 3. https://doi.org/10.1186/s40594-016-0036-1

Entangled Solutions, & Alexander, B. (2020, April 27). *COVID-19: Higher education resource center*. Entangled Solutions. https://www.entangled.solutions/coronavirus-he

Fiore, S. M., Rodriguez, W. E., & Carstens, D. S. (2012). uCollaborator: Framework for STEM project collaboration among geographically-dispersed student/faculty teams. *Journal of STEM Education: Innovations and Research*, *13*(2), 84–92. https://eric.ed.gov/?id=EJ978729

Freire, P. (1970). *Pedagogy of the oppressed*. Herder & Herder.

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

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press.

Geiger, V., Mulligan, J., Date-Huxtable, L., Ahlip, R., Jones, D., May, E. J., Rylands, L. J., & Wright, I. (2018). An interdisciplinary approach to designing online learning: Fostering pre-service mathematics teachers' capabilities in mathematical modelling. *ZDM Mathematics Education*, *50*(2), 217–232. https://doi.org/10.1007/s11858-018-0920-x

Gibbons, J. A. (1979). Curriculum integration. *Curriculum Inquiry, 9*(4), 321–332. https://eric.ed.gov/?id=EJ216032

Goodman, J., Melkers, J., & Pallais, A. (2019). Can online delivery increase access to education? *Journal of Labor Economics, 37*(1), 1–34. https://doi.org/10.1086/698895

Graves, L., Asunda, P. A., Plant, S. J., & Goad, C. (2011). Asynchronous online access as an accommodation on students with learning disabilities and/or attention-deficit hyperactivity disorders in postsecondary STEM courses. *Journal of Postsecondary Education and Disability, 24*(4), 317–330. https://eric.ed.gov/?id=EJ966132

Hachey, A. C., Wladis, C., & Conway, K. M. (2015). Prior online course experience and GPA as predictors of subsequent online STEM course outcomes. *The Internet and Higher Education, 25*, 11–17. https://doi.org/10.1016/j.iheduc.2014.10.003

Henderson, C., Beach, A., & Finkelstein, N. (2011). Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature. *Journal of Research in Science Teaching*, *48*(8), 952–984. https://doi.org/10.1002/tea.20439

Hill, C., Corbett, C., & St. Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics.* American Association of University Women. https://www.aauw.org/app/uploads/2020/03/why-so-few-research.pdf

Honey, M., Pearson, G., & Schweingruber, H. (2014). *STEM integration in K–12 education: Status, prospects, and an agenda for research.* National Academies Press. https://doi.org/10.17226/18612

Hossain, Z., Bumbacher, E., Brauneis, A., Diaz, M., Saltarelli, A., Blikstein, P., & Riedel-Kruse, I. H. (2018). Design guidelines and empirical case study for scaling authentic inquiry-based science learning via open online courses and interactive biology cloud labs. *International Journal of Artificial Intelligence in Education*, *28*(4), 478–507. https://doi.org/10.1007/s40593-017-0150-3

Hutton, C., & Robson, J. (2019). Breaking barriers, building community: Improving student engagement with preparation for studying online multidisciplinary science by distance learning—A case study. *New Directions in the Teaching of Physical Sciences, 14*(1). https://doi.org/10.29311/ndtps.v0i14.3217

Johnston, J. (2018). *The effects of blended online learning in higher education STEM courses: Experimental evidence from Mongolia* (CEPA Working Paper No. 18–11). Stanford Center for Education Policy Analysis. https://cepa.stanford.edu/content/effects-blended-online-learning-higher-education-stem-courses-experimental-evidence-mongolia

Knowles, M. S. (1973). *The adult learner: A neglected species.* Gulf Publishing. https://eric.ed.gov/?id=ED084368

Krishnamurthi, M., & Richter, S. (2013, March). Promoting STEM education through mobile teaching and learning. Paper presented at the International Association for Development of the Information Society (IADIS*) International Conference on Mobile Learning,* Lisbon, Portugal. https://eric.ed.gov/?id=ED562382

Kumi-Yeboah, A., & Amponsah, S. (2023). An exploratory study of instructors' perceptions on inclusion of culturally responsive pedagogy in online education. *British Journal of Educational Technology*, *54*(4), 878–897. https://doi.org/10.1111/bjet.13299

Kysilka, M. L. (1998). Understanding integrated curriculum. *The Curriculum Journal, 9*(2), 197–209. https://doi.org/10.1080/0958517970090206

Lederman, D. (2020, April 27). Presidents' biggest COVID-19 worries? Low-income students and colleges' financial strain. *Inside Higher Ed.* https://www.insidehighered.com/news/survey/presidents-biggest-covid-19-worries-low-income-students-and-colleges-financial-strain

Luehmann, A. L. (2007). Identity development as a lens to science teacher preparation. *Science Education,* 91(5), 822–839. https://doi.org/10.1002/sce.20209

Maldonado, E., & Pearson, K. R. (2013). Building STEAM in design-related technology. *Journal of Educational Technology Systems*, *42*(2), 133–140. https://doi.org/10.2190/ET.42.2.e

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, *22*(1), 205–222. https://doi.org/10.24059/olj.v22i1.1092

Martin, F., Sun, T., & Westine, C. D. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. *Computers & Education, 159,* Article 104009. https://doi.org/10.1016/j.compedu.2020.104009

Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record: The Voice of Scholarship in Education*, *115*(3), 1–47. https://doi.org/10.1177/016146811311500307

Meyer, K. A. (2014). *Student engagement in online learning: What works and why* (ASHE Higher Education Report, 40). Wiley. https://doi.org/10.1002/aehe.20018

Mohammadi, A., Grosskopf, K., & Killingsworth, J. (2019). Workforce development through online experiential learning for STEM education. *Adult Learning*, *31*(1), 27–35. https://doi.org/10.1177/1045159519854547

National Academies of Sciences, Engineering, and Medicine. (NASEM, 2018). *Graduate STEM education for the 21st century*. The National Academies Press. https://doi.org/10.17226/25038

National Academies of Sciences, Engineering, and Medicine. (NASEM, 2020). *Promising practices for addressing the underrepresentation of women in science, engineering, and medicine: Opening doors.* The National Academies Press. https://doi.org/10.17226/25585

National Center for Education Statistics. (2018). *Fast facts: Distance learning*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/fastfacts/display.asp?id=80

National Research Council. (NRC, 2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Committee on a Conceptual Framework for New K-12 Science Education Standards, Board on Science Education, Division of Behavioral and Social Sciences and Education. The National Academies Press. https://www.nationalacademies.org/read/13165

National Science Board. (2018). *Science and engineering indicators 2018.* National Science Foundation. https://www.nsf.gov/statistics/2018/nsb20181/assets/nsb20181.pdf

National Science Foundation, National Center for Science and Engineering Statistics. (NSF, 2023). *Diversity and STEM: Women, minorities, and persons with disabilities 2023* (NSF 23–315). https://www.nsf.gov/reports/statistics/diversity-stem-women-minorities-persons-disabilities-2023

Picciano, A. G. (2017). Theories and frameworks for online education: Seeking an integrated model. *Online Learning, 21*(3), 166–190. https://doi.org/10.24059/olj.v21i3.1225

Ramlo, S. (2017). Student views regarding online freshmen physics courses. *Research in Science & Technological Education*, *35*(4), 461–476. https://doi.org/10.1080/02635143.2017.1353961

Reid, J., & Wilkes, J. (2016). Developing and applying quantitative skills maps for STEM curricula, with a focus on different modes of learning. *International Journal of Mathematical Education in Science and Technology*, *47*(6), 837–852. https://doi.org/10.1080/0020739X.2016.1144814

Rennar-Potacco, D., & Orellana, A. (2018). Academically supporting STEM students from a distance through videoconferencing: Lessons learned. *American Journal of Distance Education*, *32*(2), 131–149. https://doi.org/10.1080/08923647.2018.1446121

Rennar-Potacco, D., Orellana, A., Chen, P., & Salazar, A. (2019). Rethinking academic support: Improving the academic outcomes of students in high-risk STEM courses with synchronous videoconferencing. *Journal of College Student Retention: Research, Theory & Practice, 20*(4), 455–474. https://eric.ed.gov/?id=EJ1201691

Rozek, C. S., Ramirez, G., Fine, R. D., & Beilock, S. L. (2019). Reducing socioeconomic disparities in the STEM pipeline through student emotion regulation. *Proceedings of the*

National Academy of Sciences, *116*(5), 1553–1558. https://doi.org/10.1073/pnas.1808589116

Sanders, M. (2009). STEM, STEM education, STEMmania. *The Technology Teacher*, *68*(4), 20–26. https://eric.ed.gov/?id=EJ821633

Sanga, C., Magesa, M. M., Chingonikaya, E., & Kayunze, K. A. (2013). Can e-learning promote participation of female students in STEM disciplines in higher learning institutions of Tanzania? *International Journal of Education and Development Using Information and Communication Technology, 9*(3), 86–102. https://eric.ed.gov/?id=EJ1071373

Schwartz, R. S., & Lederman, N. G. (2002). "It's the nature of the beast": The influence of knowledge and intentions on learning and teaching nature of science. *Journal of Research in Science Teaching, 39*(3), 205–236. https://doi.org/10.1002/tea.10021

Seaman, J. E., Allen, I. E., & Seaman, J. (2018). *Grade increase: Tracking distance education in the United States*. Babson Survey Research Group. https://onlinelearningsurvey.com/reports/gradeincrease.pdf

Seymour, E., & Hunter, A.-B. (Eds.). (2019). *Talking about leaving revisited: Persistence, relocation, and loss in undergraduate STEM education.* Springer. https://doi.org/10.1007/978-3-030-25304-2

Sgro, C. M., Bobowski, T., & Oliveira, A. W. (2020). Current praxis and conceptualization of STEM education: A call for greater clarity in integrated curriculum development. In V. L. Akerson & G. A. Buck (Eds.), *Critical questions in STEM education* (Vol. 51, pp. 185–210). Springer. https://doi.org/10.1007/978-3-030-57646-2_11

Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of a communities of inquiry in online and blended learning environments. *Computers & Education, 55*(4), 1721–1731. https://doi.org/10.1016/j.compedu.2010.07.017

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988–2018). *American Journal of Distance Education, 33*(4), 289–306. https://doi.org/10.1080/08923647.2019.1663082

Spaniol-Mathews, P., Letourneau, L. E., & Rice, E. (2016). The impact of online supplemental instruction on academic performance and persistence in undergraduate STEM courses. *Supplemental Instruction Journal*, *2*(1), 19–32. https://eric.ed.gov/?id=ED600833

State University of New York [SUNY]. (2025). *Online learning data definitions*. https://online.suny.edu/wp-content/uploads/2025/06/Online-Learning-Definitions-June-2025.pdf

Sun, A., & Chen, X. (2016). Online education and its effective practice: A research review. *Journal of Information Technology Education: Research, 15,* 157–190. https://doi.org/10.28945/3502

Swan, K., Shea, P., Fredericksen, E., Pickett, A., Pelz, W., & Maher, G. (2000). Building knowledge-building communities: Consistency, contact, and communication in the virtual classroom. *Journal of Educational Computing Research, 23*(4), 359–383. https://doi.org/10.2190/W4G6-HY52-57P1-PPNE

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, *45*(1), 89–125. https://doi.org/10.3102/00346543045001089

Tinto, V. (2012). *Completing college: Rethinking institutional action.* University of Chicago Press.

Vakil, S., McKinney de Royston, M., Suad Nasir, N., & Kirshner, B. (2016). Rethinking race and power in design-based research: Reflections from the field. *Cognition and Instruction*, *34*(3), 194–209. https://doi.org/10.1080/07370008.2016.1169817

van Dorresteijn, C., Fajardo-Tovar, D., Pareja Roblin, N., Cornelissen, F., Meij, M., Voogt, J., & Volman, M. (2025). What factors contribute to effective online higher education? A meta-review. *Technology, Knowledge and Learning, 30*, 171–202. https://doi.org/10.1007/s10758-024-09750-5

Wallace, R. M. (2003). Online learning in higher education: A review of research on interactions among teachers and students. *Education, Communication & Information*, *3*(2), 241–280. https://doi.org/10.1080/14636310303143

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge University Press. https://doi.org/10.1017/CBO9780511803932

Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, *52*(5), 546–553. https://doi.org/10.1111/j.1365-2648.2005.03621.x

Wladis, C., Conway, K. M., & Hachey, A. C. (2015). The online STEM classroom—Who succeeds? An exploration of the impact of ethnicity, gender, and non-traditional student characteristics in the community college context. *Community College Review*, *43*(2), 142–164. https://doi.org/10.1177/0091552115571729

Wladis, C., Hachey, A. C., & Conway, K. M. (2014). An investigation of course-level factors as predictors of online STEM course outcomes. *Computers & Education*, *77*, 145–150. https://doi.org/10.1016/j.compedu.2014.04.015

Wladis, C., Hachey, A. C., & Conway, K. M. (2015). The representation of minority, female, and non-traditional STEM majors in the online environment at community colleges: A nationally representative study. *Community College Review*, *43*(1), 89–114. https://doi.org/10.1177/0091552114555904

Woodley, X., Hernández, C., Parra, J., & Negash, B. (2017). Celebrating difference: Best practices in culturally responsive teaching online. *TechTrends*, *61*(5), 470–478. https://doi.org/10.1007/s11528-017-0207-z

Wu, B., Hu, Y., & Wang, M. (2019). Scaffolding design thinking in online STEM preservice teacher training. *British Journal of Educational Technology, 50*(5), 2271–2287. https://doi.org/10.1111/bjet.12873

Yang, D., & Baldwin, S. J. (2020). Using technology to support student learning in an integrated STEM learning environment. *International Journal of Technology in Education and Science (IJTES), 4*(1), 1–11. https://ijtes.net/index.php/ijtes/article/view/1592