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Editorial Volume 51 Issue 3

Martha Cleveland-Innes, Editor-in-Chief

Welcome to Volume 51, Issue 3 Canadian Journal of Learning and Technology (CJLT).

This issue provides direction for instructional designers, instructors, policymakers, and leaders of education spaces and systems. Each case is carefully described, and data are detailed and interpreted. Current issues of artificial intelligence and beyond, such as Universal Design for Learning, flipped classrooms, group interaction, and digital literacy, are represented here.

Through the cases, contexts, and findings, this research highlights the evolving intersection of pedagogy, technology, and learner diversity in contemporary education. Across varied contexts of postsecondary course design, teacher preparation, classroom strategies, and emerging technologies, one consistent theme emerges: learning environments must be intentionally designed to support inclusivity, engagement, and ethical practice while leveraging technology in meaningful ways.

The first study introduces a three-layer framework for online course development, combining Universal Design for Learning principles with academic integrity and Indigenous perspectives to create flexible, ethical, and culturally responsive learning spaces. Complementing this, the second study examines teacher education programs' approaches to digital competence, revealing a reliance on stand-alone technology courses and calling for deeper integration of digital skills across curricula to prepare future educators for technology-rich classrooms.

Instructional strategies also take centre stage. The third article demonstrates how process writing paired with flipped learning significantly enhances students' writing performance and higher-order thinking skills, underscoring the value of active, iterative learning. Similarly, the fourth study explores breakout rooms in online graduate courses, identifying both the benefits of collaborative activities and the challenges of unequal participation, offering recommendations for clearer instructions and innovative tools to strengthen virtual teamwork.

The final pair of articles address the rapid emergence of generative artificial intelligence (GenAI) in higher education. One study documents undergraduate students' evolving perceptions of GenAI as a cognitive partner across the learning cycle, while also noting concerns related to accuracy, integrity, and self-regulation. The other employs experiential learning theory to show how scaffolded, reflective engagement with GenAI can foster digital and ethical literacy.

Together, these studies affirm that effective education in the digital age requires more than technology adoption. It demands thoughtful design, ethical frameworks, and strategies that empower learners and educators alike. This CJLT issue illuminates a rapidly changing educational landscape where technology is not an end but a means to empower learners and educators. As we continue to navigate the requirements of inclusivity, ethics, and innovation, this collection offers both evidence and inspiration for designing learning that is responsive, responsible, and resilient.

Acknowledgement

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Author

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Éditorial Volume 51 Numéro 3

Martha Cleveland-Innes, rédactrice en chef

Bienvenue au volume 51, numéro 3 de la Revue canadienne de l'apprentissage et de la technologie (RCAT).

Ce numéro fournit des orientations aux conseillers et conseillères pédagogiques, aux personnes enseignantes, aux personnes responsables des politiques institutionnelles et aux leaders des espaces et des systèmes éducatifs. Chaque cas est décrit avec soin, et les données sont détaillées et interprétées. Les questions d'actualité liées à l'intelligence artificielle et au-delà, telles que la conception universelle de l'apprentissage, les classes inversées, l'interaction de groupe et la littératie numérique, sont présentées ici.

À travers les cas, les contextes et les conclusions, cette recherche met en évidence l'intersection évolutive entre la pédagogie, la technologie et la diversité des personnes apprenantes dans l'éducation contemporaine. Dans divers contextes liés à la conception des cours postsecondaires, à la préparation des personnes enseignantes, aux stratégies en classe et aux technologies émergentes, un thème récurrent se dégage : les environnements d'apprentissage doivent être conçus de manière intentionnelle pour favoriser l'inclusion, l'engagement et les pratiques éthiques, tout en tirant parti de la technologie de manière significative.

La première étude présente un cadre à trois niveaux pour le développement de cours en ligne, combinant les principes de la conception universelle de l'apprentissage avec l'intégrité intellectuelle et des perspectives autochtones afin de créer des espaces d'apprentissage flexibles, éthiques et culturellement adaptés. En complément, la deuxième étude examine les approches des programmes de formation des personnes enseignantes en matière de compétences numériques, révélant une dépendance à l'égard des cours spécialisés et indépendants et appelant à une intégration plus profonde des compétences numériques dans les programmes d'études afin de préparer les futures personnes enseignantes à des salles de classe riches en technologies.

Les stratégies pédagogiques occupent également une place centrale. Le troisième article montre comment le processus de rédaction associée à l'apprentissage inversé améliore considérablement la performance des personnes étudiantes en écriture et leurs habiletés de pensée supérieure, soulignant ainsi la valeur d'un apprentissage actif et itératif. De façon similaire, la quatrième étude explore les salles de petits groupes dans les cours en ligne des cycles supérieurs, identifiant à la fois les avantages des activités collaboratives et les défis liés à la participation inégale, et proposant des recommandations pour des instructions plus claires et des outils innovants afin de renforcer le travail d'équipe virtuel.

Les deux derniers articles traitent de l'émergence rapide de l'intelligence artificielle générative (IAg) dans l'enseignement supérieur. Une étude documente l'évolution de la perception qu'ont les personnes étudiantes de premier cycle à propos de l'IAg en tant que partenaire cognitif tout au long du cycle d'apprentissage, tout en soulignant les préoccupations liées à l'exactitude, à l'intégrité et à

l'autorégulation. L'autre étude utilise la théorie de l'apprentissage expérientiel pour montrer la façon dont une utilisation étayée et réfléchie de l'IAg peut favoriser la littératie numérique et éthique.

Ensemble, ces études confirment qu'une éducation efficace à l'ère du numérique exige plus que la simple adoption des technologies. Elle exige une conception réfléchie, des cadres éthiques et des stratégies qui outillent à la fois les personnes apprenantes et enseignantes. Ce numéro de la RCAT met en lumière un paysage éducatif en rapide évolution, où la technologie n'est pas une fin en soi, mais un moyen d'outiller les personnes apprenantes et enseignantes. Alors que nous continuons à naviguer entre les exigences d'inclusivité, d'éthique et d'innovation, ce recueil offre à la fois des preuves et de l'inspiration pour concevoir un apprentissage adaptatif, responsable et résilient.

Remerciements

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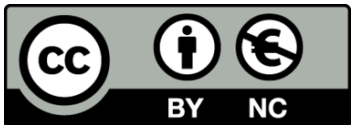
Martha Cleveland-Innes est professeure en innovation pédagogique à l'Université Athabasca en Alberta, Canada. Elle est rédactrice en chef de la revue bilingue Revue canadienne de l'apprentissage et de la technologie et coautrice des publications en libre accès The Guide to Blended Learning (2018), Participant Experience in an Inquiry-Based Massive Open Online Course (2022) et Principles of Blended Learning (2024). The Design of Digital Learning Environments: Online and Blended Applications of the Community of Inquiry a été coédité par le Dre Cleveland-Innes (Taylor & Francis, 2024). En tant que chercheuse principale, Martha a reçu un financement du Fonds d'excellence en recherche Apogée Canada du CRSH pour étudier les ***Wellness outcomes and education participation for sick children from marginalized populations*** (2024-2027). En 2019, elle a reçu un doctorat honorifique de l'Université Mid-Sweden, le prix de leadership du Réseau canadien pour l'innovation en éducation, puis a siégé au Digital Literacy Advisory Group avec le ministère de l'Enseignement supérieur de la Colombie-Britannique (2021-2022). Martha était enseignante virtuelle en résidence à l'Université nationale de Singapour (automne 2022). Elle a obtenu d'importantes subventions de recherche pour soutenir ses travaux sur l'expérience des personnes étudiantes grâce à la technologie. Ses domaines de recherche comprennent 1) l'apprentissage en ligne et hybride, 2) l'intelligence artificielle et les communautés d'enquête en ligne, 3) la réforme de l'enseignement supérieur et l'apprentissage tout au long de la vie, et 4) le leadership dans l'éducation. Elle est actuellement vice-présidente du Réseau canadien pour l'innovation en éducation et professeure invitée en pédagogie à l'université Mid-Sweden (depuis 2018). Pour plus d'informations, consultez la page Faculté de l'Université Athabasca.



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A Framework for Ethical Online Course Development with Universal Design for Learning

Un cadre pour le développement éthique de cours en ligne avec une conception universelle de l'apprentissage

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Abstract

Postsecondary institutions increasingly recognize the importance of designing educational experiences that reflect students' diverse identities and life experiences. As online course enrollment continues to rise, it becomes crucial to address how course design can effectively support this diverse student population. Traditional course designs often fail to accommodate the broad spectrum of student backgrounds, resulting in barriers to success and inclusion. In response to this gap, we propose a framework for online course design that prioritizes inclusivity, flexibility, and ethical considerations. This three-layer framework systematically integrates Universal Design for Learning principles with academic integrity values and Indigenous academic integrity principles, providing educators with practical guidance to create ethical and supportive online learning environments that address learner agency while maintaining academic standards.

Keywords: academic integrity, blended learning, equity, inclusion, online, teaching, universal design for learning

Résumé

Les établissements d'enseignement postsecondaire reconnaissent de plus en plus l'importance de concevoir des expériences d'enseignement qui reflètent la diversité des identités et des expériences de vie des personnes étudiantes. Alors que les inscriptions aux cours en ligne continuent d'augmenter, il devient essentiel de se pencher sur la façon dont la conception des cours peut soutenir efficacement cette population étudiante diversifiée. La conception traditionnelle des cours ne tient souvent pas compte de la grande diversité des parcours des personnes étudiantes, ce qui crée des obstacles à la réussite et à l'inclusion. Pour combler cette lacune, nous proposons un cadre de conception des cours en ligne qui

priorise l'inclusivité, la flexibilité et les considérations éthiques. Ce cadre à trois niveaux intègre systématiquement les principes de la conception universelle de l'apprentissage aux valeurs d'intégrité académique et aux principes d'intégrité académique autochtones, fournissant ainsi aux personnes enseignantes des orientations pratiques pour créer des environnements d'apprentissage en ligne éthiques et de soutien qui favorisent l'autonomie des personnes étudiantes tout en maintenant les exigences académiques.

Mots-clés : intégrité académique, cours hybrides, équité, inclusion, en ligne, enseignement, conception universelle de l'apprentissage

Introduction

In their spring survey, the Canadian Digital Learning Research Association (2024) reported that 100 of the 132 participating postsecondary institutions stated they expected growth in hybrid offerings (courses offered with a blend of online and in-person instruction), and 83 anticipated growth in fully online offerings (all instruction and interaction is entirely online). With this growth comes increased assumptions and misconceptions regarding academic integrity in online learning.

Although research exists about the benefits and challenges of online learning for educators, students, and institutions, there is less research about academic integrity in online course design and the use of technology (Bretag, 2019; Canadian Digital Learning Research Association, 2024; Eaton, 2021). Here we synthesize evidence-informed practice integrating the Universal Design for Learning (UDL) framework (CAST, 2025), UDL-based online course design considerations (Rao, 2021), and academic integrity.

Background and Positionality

This work began as a workshop series we co-developed and facilitated at a western Canadian institution (Anselmo & Eaton, 2023). Throughout the design process, we discussed how UDL principles implicitly include aspects of academic integrity, yet we found limited research or practice-oriented resources making these connections explicit. We wanted to explore how UDL and academic integrity could be systematically integrated into online course design.

Our proposed framework differs from existing approaches by creating intentional synergies between UDL principles and academic integrity values specifically tailored for online environments. While UDL frameworks exist for online learning and academic integrity policies address student conduct, to our knowledge, no previous work has systematically integrated these approaches to address the unique challenges of ethical online course design. This layered approach provides several advantages over using individual frameworks: (a) it ensures that accessibility and inclusion efforts align with academic standards, (b) embeds ethical considerations into instructional design from the outset rather than as an afterthought, and (c) creates coherent support systems that address learner agency, variability, and academic integrity simultaneously. The result is a more comprehensive approach to online course design that positions ethics and inclusion as complementary rather than competing priorities.

Universal design for learning is a framework that can guide the development of inclusive learning environments to support all students (CAST, 2025). A 2019 survey of first-year undergraduate students in Canadian postsecondary institutions indicated that 44% identified as from an equity-deserving group, while 24% reported having a disability (Usher, 2021). The UDL framework can serve as a model to support postsecondary instructors in their instructional design to help best meet students' diverse learning needs and position them as successful learners.

The UDL framework includes three grounding principles: designing for multiple means of engagement, multiple means of representation, and multiple means of action and expression (CAST, 2025). These principles may offer an instructional design model for educators to strive for inclusive, flexible, and ethical learning environments for their students based on how instructional material is presented, how students demonstrate their learning, and how they are engaged throughout their learning (CAST, 2025). Dwyer-Kuntz (2022) points out that the primary objective of UDL is to reduce barriers to empower learners to reach their maximum potential; while CAST (2025) refers to learner agency as a goal where students become intentional, authentic, and strategic in their learning. We propose that reducing barriers supports the development of learner agency and becomes a particularly important component of course design in the online learning environment where technology and access are key considerations for learner success. Applying the three UDL principles to online learning may enhance student learning by integrating learning technologies that support learner inclusivity, and provide flexible pathways for students to learn in an ethical environment (Basham et al., 2020; Rao, 2021; Zhu et al., 2024). In online environments, these UDL principles address specific challenges: (a) multiple means of representation accommodate diverse ways learners perceive information (e.g., audio, visual, and text formats); (b) multiple means of action and expression recognize different skill sets for navigating and demonstrating knowledge (e.g., oral presentations, infographics); and (c) multiple means of engagement sustain motivation through varied opportunities that reflect learners' interests and identities (CAST, 2025). The three UDL principles, grounded in addressing learning variability, learner agency, and reducing barriers to learning, can be integrated through intentional and proactive online course design (Rao, 2019).

Centring intentional and proactive online course design around learner variability, learner agency, and reducing barriers to learning highlights the student as a complex learner who needs to balance their preferences and desire to learn within the boundaries and systems of an educational institution. How students approach this balance may be influenced by their values and principles (Clark et al., 2020). We position the UDL framework (CAST, 2025) and the values of academic integrity (ICAI, 2021) with Indigenous academic integrity principles (Gladue, 2020) as a layered approach for intentional online course design that is inclusive, flexible, and holistic for students.

Existing UDL applications to online learning focus primarily on accessibility and learning variability but rarely address the ethical dimensions of course design. Similarly, academic integrity frameworks concentrate on student conduct rather than instructional design decisions. This creates a gap where well-intentioned accessibility efforts may inadvertently undermine academic standards, or where academic integrity policies may create barriers for diverse learners. Our integrated approach addresses

this gap by demonstrating how ethical considerations can strengthen rather than conflict with inclusive design principles.

Definitions

To ensure clarity and consistency throughout this framework, we define the following key terms:

Universal Design for Learning. A framework that guides the development of flexible learning environments and spaces that can accommodate individual learning differences, based on three principles: multiple means of engagement, representation, and action and expression (CAST, 2025).

Academic Integrity. The commitment to fundamental values including honesty, trust, fairness, respect, responsibility, and courage in academic work and scholarly practice (ICAI, 2021). We also recognize Indigenous academic integrity principles of relationality and reciprocity (Gladue, 2020).

Ethics in Online Course Design. The intentional integration of moral principles and values into instructional design decisions, ensuring courses support student learning while maintaining academic standards and promoting equity.

Flexibility. The provision of multiple pathways, options, and supports that allow students to engage with content, demonstrate learning, and participate in courses in ways that align with their individual needs, circumstances, and strengths.

Online Learning Environment. Educational settings where instruction and interaction occur primarily through digital platforms and technologies, requiring specific design considerations for accessibility, engagement, and academic integrity.

Learner Agency. The development of students who are purposeful and reflective in their thinking, resourceful and authentic in their approach, and strategic and action-oriented in their learning (CAST, 2025).

Academic Integrity

Values and principles have long been used to frame academic integrity. One globally dominant framework is the Fundamental Values of Academic Integrity (ICAI, 2021) which articulates these six values of academic integrity: courage, fairness, honesty, respect, responsibility, and trust. Although educators, academic integrity practitioners, and policymakers have adopted this values framework in many jurisdictions, it is not without its limitations or criticisms. For example, Indigenous and Métis scholars in Canada have pointed out that Indigenous ways of knowing, being, doing, and learning should be recognized and valued in their own right (Gladue, 2020; Lindstrom, 2022; Poitras Pratt & Gladue, 2022). Gladue (2020) highlights three principles of Indigenous academic integrity, focusing on relationality, reciprocity, and respect. Lindstrom (2022) notes that, “the notion of integrity is holistic,

which means it is infused in all areas of life" (p. 126) and asserts that, "the ways postsecondary institutions translate and mobilize academic integrity equates to complicity in ongoing colonization and disrupts institutional efforts aimed at Indigenization and decolonization" (p. 127). An in-depth discussion of such complicity is beyond the scope of this article; however, we note the wisdom in Poitras Pratt and Gladue's (2022) assertion that Western and Indigenous values and principles can be complementary and parallel, rather than contrary to one another. Poitras Pratt and Gladue assert that "parallel ways of expressing and centering truth are essential to the work of redefining academic integrity for all because they challenge the oft (consciously or unconsciously) held belief that western axiology and ethics are the pinnacle and definition of truth in academic culture" (2022, p. 115). This parallel approach recognizes that Indigenous and Western integrity frameworks can enhance rather than compete with each other in educational contexts. For example, the ICAI value of respect aligns with and is enriched by Indigenous principles of relationality, creating a deeper understanding of how academic work connects individuals to broader communities. The Western emphasis on individual responsibility finds complementary expression in Indigenous concepts of reciprocity, which emphasize our obligations to give back to the knowledge communities that support our learning. Rather than requiring choice between frameworks, our layered approach demonstrates how these parallel ways of understanding integrity can strengthen online course design by providing multiple entry points for students to connect with ethical academic practices.

Conceptual Framework

Layering UDL, Online Course Design, and Academic Integrity

Complementary and parallel ways of knowing that include a plurality of values and principles can underpin our understanding of academic integrity. The UDL framework is applied to educational purposes to reduce the "learning barriers that occur as an interaction between learners' strengths, challenges, and preferences" (Basham et al., 2020, p. 810). The framework has been applied in various contexts, including accessibility, technology, and blended and online learning (Basham et al., 2020; Celestini & Palalas, 2024). Our conceptual framework is a three-layer approach to inclusive, flexible, and ethical online course design (Table 1).

Table 1

Layering of UDL-Based Online Design With Academic Integrity

Design layer	Learner experience	Learning goals	Assessment	Materials and methods
UDL design cycle considerations (Rao & Meo, 2016)	Pay attention to learner variability.	Identify clear goals.	Develop assessments.	Develop methods and materials.

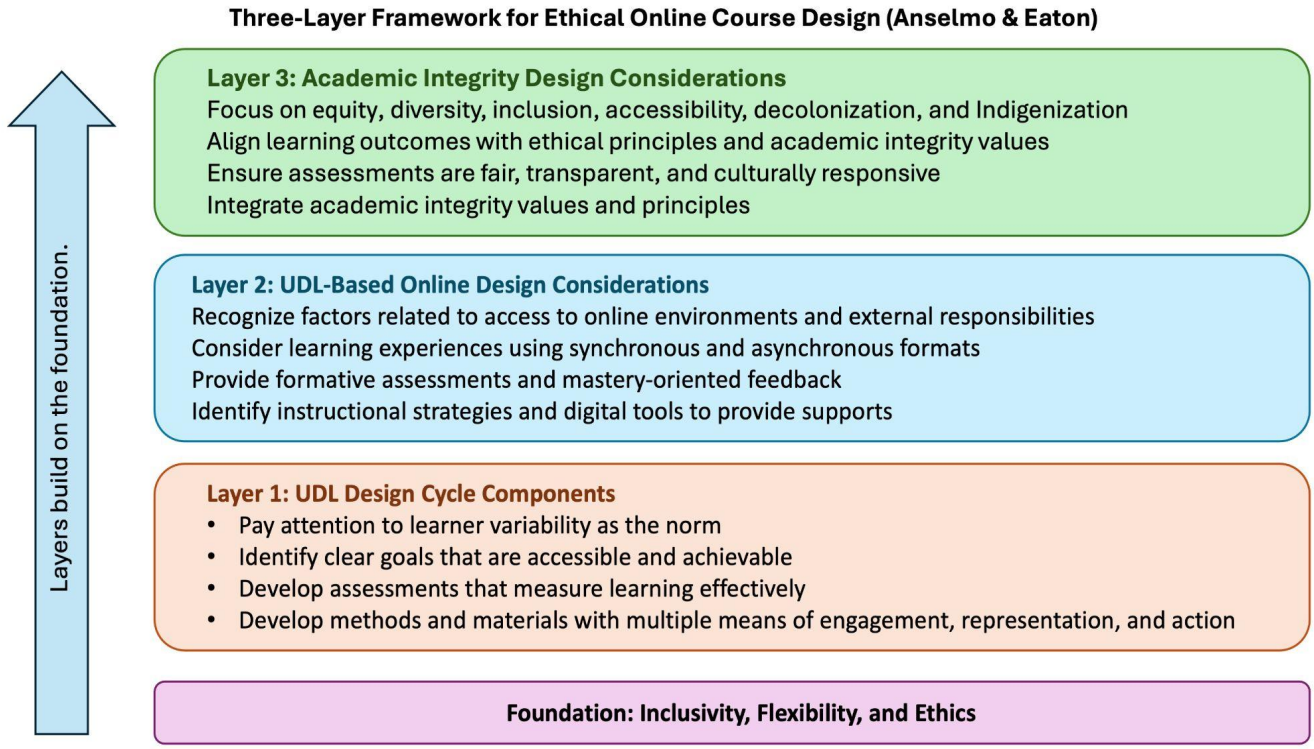
Design layer	Learner experience	Learning goals	Assessment	Materials and methods
UDL-based online design considerations (Rao, 2021)	Recognize factors related to access to online environments and the external responsibilities of learners.	Consider learning experiences that use synchronous and asynchronous formats.	Provide formative assessments and mastery-oriented feedback to clarify expectations.	Identify instructional strategies and digital tools to provide supports and reduce barriers.
Academic integrity considerations	Focus on equity, diversity, inclusion, accessibility, decolonization, and Indigenization as academic integrity and social justice priorities.	Align learning outcomes with course goals, program objectives, and assessments. Setting clear expectations for upholding academic integrity.	Ensure formative and summative assessments are fair and clearly explained. Ensure assessment criteria are transparent.	Ensure materials and methods are up-to-date, accessible, and relevant to the course assessments, learning outcomes, and program goals.

Note. UDL = Universal Design for Learning

The first layer focuses on considerations for a UDL-based design: learner variability, clear goals, assessments, and methods and materials (Rao & Meo, 2016). The second layer incorporates UDL-based design considerations for the online learning environment: access, asynchronous and synchronous interactions, engagement and feedback, instructional strategies, and learning technology tools (Rao, 2019). Finally, the third layer incorporates academic integrity principles and values such as the fundamental values of academic integrity: honesty, trust, fairness, respect, responsibility, and courage (ICAI, 2021) and the Indigenous academic integrity principles: relationality and reciprocity (Gladue, 2020). Together, these layers form the foundation for a framework for online course design that has at its core inclusivity, flexibility, and ethics (Figure 1).

Figure 1

Three-Layer Framework for Ethical Online Course Design



Note. Figure created by the authors.

Layer One: UDL Design Cycle Components

Universal design for learning can provide an inclusive instructional design framework when implemented as an iterative design cycle. Our approach emphasises three foundational UDL elements: flexibility (supporting iteration and responsiveness to diverse learner needs), clear goals (guiding purposeful planning and ensuring learner understanding), and aligned assessment (providing feedback loops that refine instruction throughout the cycle) (Rao, 2019).

Course design with UDL begins with learner variability as the norm, accommodating diverse abilities, backgrounds, and preferences (Getenet et al., 2024; Hart, 2010; Rose & Meyer, 1999; Zhu et al., 2024). This foundation supports clear goal setting, relevant assessments, and flexible methods that integrate multiple pathways for engagement, representation, and expression (Rao, 2019; Rao & Meo, 2016). Together, these four components may ensure that an online course is designed with UDL principles, including flexibility and inclusivity for all students. The next phase of our conceptual framework incorporates online learning environment design considerations.

Layer Two: UDL-Based Online Design Considerations

The flexibility of UDL serves instructors across disciplines and modalities, particularly in online environments where technology access and digital literacy create unique barriers (Basham et al., 2020; Celestini & Palalas, 2024; Getenet et al., 2024; Rao, 2019; Trust & Pektas, 2018).

Online environments require specific adaptations of each UDL component. Clear goals must reflect chunked content delivery with multiple practice opportunities through institutionally supported learning management systems and digital tools (Rao, 2019). Assessment development focuses on supporting memory, generalization, and transfer through collaborative tools that facilitate multimodal feedback and foster instructor-student relationships (Flock, 2020; Rao, 2019; Trust & Pektas, 2018). Methods and materials selection prioritizes digital tools that align with UDL's three principles while centring learner needs in instructional design decisions (Celestini & Palalas, 2024; Wenzel & Moreno, 2022).

Designing assessments with ethical principles in mind, such as reciprocity (Gladue, 2020), transforms evaluation from individual measurement to community accountability. This shifts online assessment from isolated testing to collaborative learning that honors relationships and mutual responsibility.

Layer Three: Academic Integrity Design Considerations

Framing academic integrity through UDL means designing for learner agency (i.e., not policing students) so that ethical choices are supported at every step of the course. Through UDL's three main categories, ethics can become an intentional design feature: (a) engagement (the why of learning)—recruit interest with relevant, choice-rich tasks, sustain effort with staged deadlines and feedback, and build self-regulation with time-management tools and brief reflections on tool use; (b) representation (the what of learning)—provide accessible materials, model citation and paraphrasing, translate policies into plain language, and acknowledge Indigenous knowledge protocols to make attribution practices explicit; and (c) action & expression (the how of learning)—offer multiple modes of demonstration under a shared rubric that emphasizes originality and attribution, require drafts and process notes, and support executive function with checklists, exemplars, and planning prompts (CAST, 2025; Gladue, 2020). Together, these design choices include ethics as an intentional part of online learning success.

When these UDL principles integrate with academic integrity values of courage, fairness, honesty, respect, responsibility, and trust (ICAI, 2021) alongside Indigenous principles of relationality and reciprocity (Gladue, 2020), online courses transform from spaces of surveillance to environments of ethical growth. For example, considering both the ICAI value of responsibility and Indigenous principles of reciprocity may involve designing assessments that ask students to seek knowledge from community members and share findings back with those communities in multiple formats (audio, written, or visual). This approach honors diverse communication strengths while embedding ethical community accountability into the learning process.

Intentional online course design that considers ethical values (ICAI, 2021) and Indigenous academic integrity principles (Gladue, 2020) in parallel with UDL considerations may serve as an ethical guide for instructors to design their online courses. Students develop agency not just as learners, but as ethical practitioners who understand how their academic work connects to broader communities and responsibilities.

Discussion

An ethical online course design grounded in UDL principles requires more than inclusive intent: it becomes operational when learning outcomes explicitly foreground inclusivity, flexibility, and ethics, and when institutions provide sustained scaffolds—policy, resources, time, technology, and faculty development—to implement, evaluate, and refine those commitments. For example, intentionally designing ethical learning outcomes that reflect both academic integrity values and Indigenous principles of academic integrity may better support students in connecting with the content and becoming courageous learners.

Courage is often connected to academic integrity. In this sense, courage can refer to "being willing to take risks and risk failure" (ICAI, 2021, p. 10). In their role as educators, rather than an enforcer, the instructor creates connection and community with the students by designing this personalized space that includes supplementary resources and supports. Students who feel a sense of belonging through the online learning space may feel a sense of relationality or connection to the course and the instructor. In turn, this may impact how they make ethical decisions related to their learning (Gladue, 2020). In an inclusive, flexible, and ethical online learning space, learners can develop a sense of belonging, feel safe expressing their opinions, and have the courage to make mistakes without fearing punitive consequences.

Ethical Approaches to Learning Outcomes

Another UDL-based online design consideration relates to feedback (Rao, 2021). Ethical approaches to course learning outcomes could reflect academic integrity considerations regarding assessment and feedback. Clark et al. (2020) noted that in addition to postsecondary institutions' goals of graduating students with the necessary skills and abilities required to begin careers in their fields, "an emerging priority is also to ensure that these graduates are ethical, contributing members of society" (p. 1). In this manner, ethical approaches to course learning outcomes could involve a more holistic and intentional approach to academic integrity by designing learning outcomes that focus on process versus product and integrate creativity and higher-order thinking skills. Taking this approach supports academic integrity values (ICAI, 2021), especially fairness, when assessing students, as well as the Indigenous academic integrity principle of respect in providing meaningful feedback that "connects to create new knowledge" (Gladue, 2020, p. 5). Including values such as fairness and respect explicitly in course learning outcomes may allow students to examine each value, reflect on their connection, and influence individual academic decisions regarding the course (Clark et al., 2020).

Institutional Support

Ethical online course design is not a task to be completed, nor a checkbox to be ticked, but rather a long-term commitment enacted through regular and sustained practice. Designing ethical courses is not about getting it right the first time but rather committing to a continual and intentional process which is revised and refined over time. Creating inclusive, flexible, and ethical courses requires comprehensive institutional support across multiple domains. Essential formal support networks include collaboration with academic services units for accessibility accommodations and learning support; partnerships with instructional design teams for pedagogical consultation; coordination with information technology services for reliable technology infrastructure; and alignment with academic integrity offices for policy guidance and student education programs (Bertram Gallant, 2016; Bretag, 2016; Davis, 2022; Kenny & Eaton, 2022). Informal support networks are equally crucial, including communities of practice among faculty, mentorship programs for course design, and peer consultation opportunities for sharing effective strategies (Kenny & Eaton, 2022).

Institutional commitment must also address practical considerations such as adequate time allocation for thoughtful course development, professional development funding for UDL and academic integrity training, technology resources that support multiple learning modalities, and assessment practices that allow flexibility while maintaining rigor. Without this multi-layered institutional support, individual instructors face unrealistic expectations to implement comprehensive ethical course design within existing constraints.

Recommendations

Postsecondary students face challenges and incentives that previous generations of students did not (Usher, 2021). The onset of contract cheating companies, artificial intelligence applications, and external factors mean that our courses, especially our online courses, require a new approach that meaningfully and intentionally builds academic integrity values and principles into online course design.

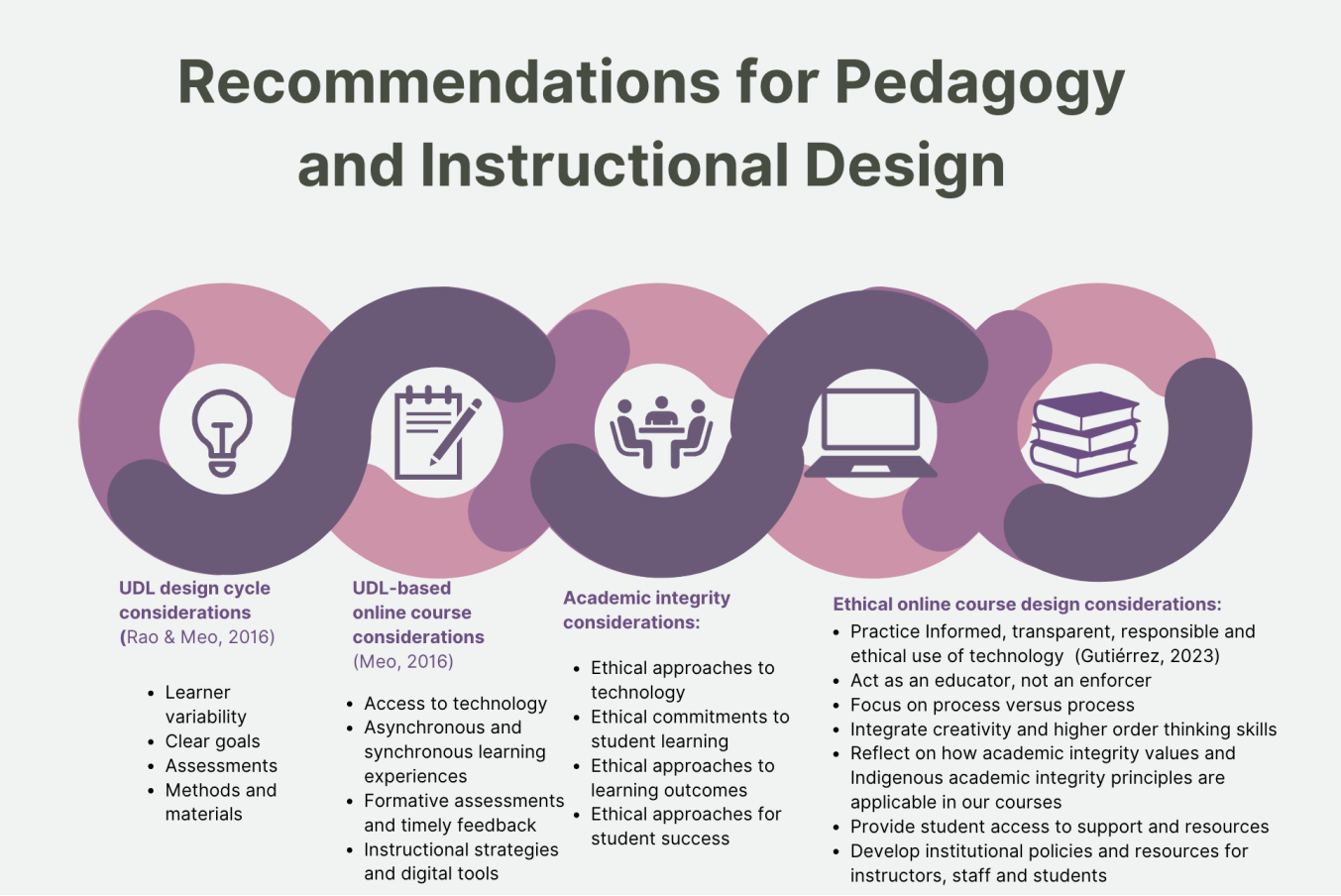
We propose an ethical online course design framework that incorporates UDL considerations with academic integrity values (ICAI, 2021) and Indigenous academic integrity principles (Gladue, 2020) to highlight the following academic integrity online course considerations: ethical uses of learning technologies, ethical commitments to student learning, ethical approaches to course learning outcomes, and ethical commitments to student success. Ethical use of learning technologies is considered informed, transparent, ethical, and responsible use (Gutiérrez, 2023). Ethical commitments to student learning include creating an online learning space for courageous learning supported by committed instructors. Ethical approaches to course learning outcomes incorporate values and principles explicitly in the course learning outcomes so students can apply these values to their online academic decisions. Finally, ethical approaches for student success involve the institution supporting and assisting online students with policies and procedures that enhance and encourage ethical academic behaviour.

Recommendations for Pedagogy and Instructional Design

We offer recommendations for instructional design and pedagogy not in the form of prescriptive tasks or checkbox items because this would be antithetical to thoughtful and intentional course design. We also recognize that educators and learning designers in different jurisdictions may have varying levels of independence or constraints, which can impact their level of autonomy in their work. For these reasons, we offer recommendations in the form of points to consider and provocations in guided questions (Figure 2). Figure 2 employs a circular design to emphasize the iterative and interconnected nature of ethical course design. Unlike linear checklists that suggest a fixed sequence, the overlapping elements represent how these four considerations must be addressed simultaneously and revisited throughout course development. The visual metaphor reflects our framework's core principle that ethical design emerges from continuous reflection rather than one-time implementation.

Figure 2

Recommendations for Pedagogy and Instructional Design



Note. Figure created by the authors.

Ethical UDL-aligned design requires transparency in technology choices, positioning instructors as coaches rather than enforcers, emphasizing process alongside product in assessments, offering

flexible modalities mapped to consistent outcomes, framing academic integrity relationally, and maintaining visible supports with plain-language policies.

Layer 1 Application (UDL Design Cycle). The instructor recognizes learner variability by providing course content in multiple formats: recorded lectures with auto-generated captions and transcripts, interactive H5P modules with built-in accessibility features, and downloadable PDF summaries for offline reading. Clear goals are established through weekly learning objectives that scaffold toward larger course outcomes, with a visual progress tracker showing students their advancement. Assessments include options such as traditional written papers (1,500 words), video presentations (8–10 minutes), or research infographics with citations to accommodate different strengths and communication preferences.

Layer 2 Application (Online Considerations). Recognizing access barriers, the instructor provides both synchronous student hours via video conferencing and asynchronous discussion forums for questions. Technical support resources are prominently linked in the course menu, including video tutorials for accessing materials on low-bandwidth connections. Formative assessments include weekly discussion posts with peer responses and self-check quizzes with immediate explanatory feedback.

Layer 3 Application (Academic Integrity Integration). Learning outcomes explicitly include integrity values: "Students will demonstrate respect for diverse perspectives through thoughtful peer responses that acknowledge sources and build on others' ideas." The major research assignment emphasizes process through required submission of research journals documenting source evaluation, interview notes from community conversations, and reflection on ethical considerations in psychological research. Students interview community members about mental health perspectives and must share their findings back with those communities, embodying reciprocity. The rubric transparently outlines expectations for original analysis while providing APA resources and citation tutorials.

Synergistic Result. A student can choose the video presentation format (Layer 1 accommodation) while participating asynchronously (Layer 2 consideration) and still engaging in community-based reciprocal learning that builds ethical research skills (Layer 3 integration). The accommodation enhances rather than undermines the ethical learning goals. This implementation requires institutional support through accessible technology infrastructure, instructor training time, and coordination with community partners, but leverages existing institutional resources rather than requiring entirely new systems.

We further offer reflecting questions for course developers recognizing that context and institutional guidelines impact course design choices.

Guiding Questions for Course Developers

- What does the ethical use of technology look like for you?
- How are clear goals articulated throughout your course?
- In what ways are assessments designed with ethical considerations in mind?
- How is the course content ethical, inclusive, and representative of your students?

One potential area of further research for classroom practical applications of the UDL framework includes investigating how applying the UDL framework in classes might facilitate "attitudinal change" and "develop inclusive values" amongst learners (Sewell et al., 2022, p. 374). We also recognize the immense impact generative artificial intelligence has had on online course design and acknowledge that this area is outside the scope of this paper.

Our conceptual framework layers 1) UDL design cycle components, 2) UDL-based online design considerations, and 3) academic integrity design considerations provide a basis for an ethical approach to online course design that considers the fundamental values of academic integrity (ICAI, 2021) in parallel with Indigenous academic integrity principles (Gladue, 2020).

An ethical online course design framework addresses the fundamental UDL goal of removing barriers to develop learner agency through inclusive, flexible, and ethical design while highlighting values and principles that support ethical online learning.

Limitations

This conceptual framework presents several limitations that future work should address. First, as a theoretical model, it requires empirical testing to validate its effectiveness in improving student learning outcomes and reducing academic misconduct. Second, full implementation demands significant institutional resources including professional development time, technological infrastructure, and ongoing pedagogical support that may not be available to all educators. Third, the framework assumes instructors have sufficient autonomy to modify course design and assessment practices, which may not reflect the constraints faced by adjunct faculty or those in highly regulated programs. Fourth, while we have attempted to integrate Indigenous and Western approaches to academic integrity, this integration represents our interpretation and may not reflect the diversity of Indigenous perspectives across different communities. Finally, the framework's emphasis on community-based learning may not be appropriate for all disciplines or learning contexts, requiring adaptation that we have not fully explored.

Conclusion

We recognize that conceptual frameworks must be interrogated and tested. In this article, we have introduced a framework that can be used as a guide. By using this framework, instructors and course designers may be able to make more intentional decisions about integrating academic integrity values (ICAI, 2021) and Indigenous principles of academic integrity (Gladue, 2020) in their online courses and thereby design online courses which promote and develop ethical global citizens. However, the ultimate utility of the framework would be determined by testing, reflective and reflective pedagogical feedback, and revisions in future iterations. We offer the ethical online course design framework as a point of departure, rather than a destination, for intentional integration of UDL with academic integrity to promote inclusivity, flexibility, and ethical pedagogy.

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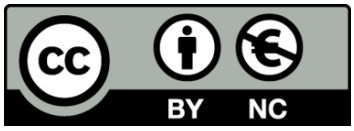

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An Environmental Scan of Educational Technology Courses in Ontario Teacher Education Programs

Analyse de l'environnement des cours sur les technologies éducatives dans les programmes de formation des personnes enseignantes en Ontario

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Abstract

In light of lessons learned from online teaching during the pandemic in 2020 and the rapid advancement of educational technologies, greater attention has been directed toward how teachers are being prepared for future classrooms. In teacher education programs, two main models exist to promote the digital competence of teacher candidates (TCs): (a) specialized, stand-alone courses on educational technology, and (b) an infused model in which digital skills are integrated into other courses. We conducted an environmental scan of educational technology courses in teacher education programs across Ontario between April and August of 2024 to explore the models adopted for preparing TCs. The findings show that 14 out of 16 Primary/Junior programs, 9 out of 12 Junior/Intermediate programs, and 9 out of 15 Intermediate/Senior programs, offer stand-alone courses on educational technology, most of which are mandatory. This reliance on stand-alone courses demonstrates an attention to technology training for TCs. However, a potential limitation lies in that most programs rely on only one course. To obtain detailed insights, we also conducted a thematic analysis of the course descriptions, highlighting areas of strength and those needing improvement. This study informs teacher education programs and researchers on future opportunities to develop TCs' digital competence.

Keywords: educational technology, stand-alone courses, teacher education, technology infusion

Résumé

À la lumière des enseignements tirés de l'enseignement en ligne pendant la pandémie de 2020 et des avancées rapides des technologies éducatives, une attention accrue a été accordée à la manière dont les personnes enseignantes sont préparées aux classes de demain. Dans les programmes de formation des personnes enseignantes, deux modèles principaux existent pour promouvoir les compétences numériques des personnes étudiantes en formation à l'enseignement : (a) des cours spécialisés et

indépendants sur les technologies éducatives, et (b) un modèle intégré dans lequel les compétences numériques sont intégrées à d'autres cours. Nous avons procédé à une analyse de l'environnement des cours de technologie éducative dispensés dans les programmes de formation des personnes enseignantes en Ontario entre avril et août 2024 afin d'examiner les modèles adoptés pour la préparation des personnes étudiantes en formation à l'enseignement. Les résultats montrent que 14 des 16 programmes *Primary/Junior*, 9 des 12 programmes *Junior/Intermediate* et 9 des 15 programmes *Intermediate/Senior* proposent des cours indépendantes sur les technologies éducatives, dont la plupart sont obligatoires. Ce recours à des cours indépendants témoigne de l'importance accordée à la formation technologique des personnes étudiantes en formation à l'enseignement. Cependant, le fait que la plupart des programmes ne proposent qu'un seul cours constitue une limite potentielle. Afin d'obtenir des informations détaillées, nous avons également procédé à une analyse thématique des descriptions des cours, mettant en évidence les points forts et les domaines à améliorer. Cette étude informe les programmes de formation à l'enseignement et les personnes chercheuses sur les possibilités futures de développer les compétences numériques des personnes étudiantes en formation à l'enseignement.

Mots-clés : cours spécialisés, formation des personnes enseignantes, intégration de la technologie, technologie éducative

Introduction

Incorporating technology in teaching involves understanding the tools and applying them strategically to enhance educational practices (Steel & Hudson, 2001). For preservice teachers, integrating technology effectively begins with training in teacher education programs (Mishra & Koehler, 2006). Thus, it is crucial to explore how teacher candidates (TCs) are being prepared to use technology in their future classrooms. This question has become more pressing following the transition to online teaching during the COVID-19 pandemic, which revealed shortcomings in our educational systems, especially in terms of technology-enhanced teaching (DeCoito & Estaiteyeh, 2022a, 2022b). The recent advancements in educational technologies including the use of artificial intelligence (AI) tools in education have also fueled those discussions. Accordingly, this research aimed to identify how educational technology concepts were integrated into teacher education programs in Ontario, Canada, by addressing the following research questions:

1. What model(s) do teacher education programs in Ontario predominantly adopt in preparing TCs in educational technologies (stand-alone courses versus infused approaches)?
2. What do stand-alone educational technology course descriptions reveal about the intended scope and focus of these courses?

To answer the research questions, we conducted a comprehensive environmental scan and content analysis of course offerings on educational technology in preservice teacher education programs in Ontario. The findings highlight strengths, areas for improvement, and future research directions on promoting TCs' digital competence in teacher education.

Literature Review

Digital Competence and TPACK

Digital competence, an important 21st century skill, refers to the numerous abilities required to navigate a digital society (McDonagh et al., 2021). Early conceptualizations of digital competence drew from multiple traditions. Gilster (1997) framed digital literacy primarily as an extension of computer and information literacy, which focused on operational skills and the ability to use hardware and software effectively. With the growth of the Internet, the concept has expanded to include information literacy, shifting attention from specific devices to the information they handle and emphasizing the ability to locate, evaluate, and use information effectively (Bawden, 2001; Koltay, 2011). As technologies became increasingly networked and participatory, digital literacy emerged as an umbrella concept that encompassed earlier forms while extending to social, cultural, and communicative engagement with technology (Cordell, 2013). Furthermore, in the early 2000s, school-based initiatives often linked digital competence more closely to the media education movement. Media literacy perspectives were incorporated into digital literacy, adding critical and creative dimensions that address how digital media shape meaning, identity, and power relations (Buckingham, 2003, 2015; Koltay, 2011). Frameworks such as Canada's MediaSmarts' *Use, Understand, Create* model have echoed this view to emphasize that individuals advance from functional use to critical understanding and responsible creation in a digital environment (Hoechsmann & DeWaard, 2015). Collectively, these perspectives have positioned digital competence as a multifaceted literacy that encompasses technical proficiency, critical awareness, cultural engagement, and ethical participation in a digitally mediated world (Belshaw, 2012; Ferrari, 2012; Hoechsmann & DeWaard, 2015).

In educational settings, teachers are leaders in fostering students' digital competence (Redecker, 2017). Research has suggested that teachers' digital competence enables them to create more dynamic and interactive learning environments with multimedia resources, educational software, or online platforms (Palacios-Rodríguez et al., 2023), and that those with strong digital competence would promote digital literacy among students (Pérez-Navío et al., 2021). Thus, it is essential for teachers to be equipped with technological skills and the ability to incorporate technology into their teaching practice (Starkey, 2020). While our study focuses on how teacher education programs address digital competencies, we acknowledge the tension between technocratic and humanist orientations of teaching with digital technology. Beyond developing technical proficiency, preparing future teachers also involves fostering critical awareness of technology's social, ethical, and cultural implications.

Several frameworks explore the competencies and skills required by educators to teach with digital technologies. The Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) is frequently adopted to guide teachers' digital competence development in teacher education programs. TPACK emphasizes the necessity for teachers to merge three core knowledge domains: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). It suggests that for teachers to integrate technology in their teaching successfully, they must understand the content and teaching methods, as well as how technology can enhance the learning experience.

However, researchers have identified a few limitations in the TPACK framework (Graham, 2011; McDonagh et al., 2021). Falloon (2020) argued that the TPACK framework lacks explicit reference to ethical and professional issues. To address this gap, Falloon developed the Teacher Digital Competence (TDC) framework, offering a holistic view of digital competence. The TDC framework expands digital competence with two sets of integrated competencies: personal-ethical and personal-professional. Personal-ethical competence emphasizes the necessity for teacher education students to understand and model sustainable, safe, and ethical use of digital resources. Personal-professional competence focuses on teachers' well-developed information literacies and strategically engaging in online professional networks. Falloon emphasized that successful technology integration in teacher education should go beyond understanding content, pedagogy, and technology. It requires TCs to understand how to assist their future students in accessing and using digital resources in a sustainable, safe, and ethical way within diverse, digitally mediated environments. Overall, we view both TPACK and TDC as essential and complementary in framing how teacher education programs can prepare future teachers for technology-enhanced classrooms. This balance of technological and pedagogical skills combined with ethical, professional, and critical awareness of technology use by TCs has informed our analysis of educational technology courses in this paper. This perspective recognizes that developing digital competence extends beyond mastering tools to understanding their educational and societal implications.

Teachers' Training on Educational Technologies in Canada

The 2015 report by MediaSmarts on digital literacy policy and practice across Canada emphasized that understanding digital literacy should move beyond the basic technical skills toward a holistic approach that includes creativity, cultural engagement, and civic participation (Hoechsmann & DeWaard, 2015). A recent systematic review examining professional development programs on digital literacy for teachers and TCs in Canada highlighted that gaps in these dimensions persist (Rong & Estaiteyeh, 2024). Additionally, DeCoito and Estaiteyeh (2022a, 2022b) conducted a mixed-methods study to investigate the transition of grades 1–12 science, technology, engineering, and mathematics (STEM) teachers to online teaching in Ontario and identified a significant gap in prior training in digital technologies among educators. Similarly, Van Nuland et al. (2020) reiterated that there is a need to address essential questions about what technology skills and tools teacher educators will require in the coming decades. Hadziristic (2017) maintained that gaps in TC training hinders their use of technology in innovative ways in their teaching. Research has also highlighted that teachers' attitudes, beliefs, and perceptions of technology usefulness strongly shape their ability to integrate technology (Farjon et al., 2019; Scherer et al., 2019). Overall, these results highlight the need for teacher education programs to seek to advance TCs' digital competence intentionally and strategically.

Despite these challenges, research has documented several successful interventions in teacher education aimed at improving teachers' digital competence across various divisions and teaching subjects in Canada. Hagerman and Coleman (2017) implemented the Digital Hub, an open Web-based professional portfolio strategy, which led to a significant enhancement in digital literacy skills and confidence in technology integration among TCs. Horst et al. (2023) implemented a digital platform that

used mobile technology to enhance the digital competence of secondary TCs in their teacher education program. Moreover, Estaiteyeh et al. (2024) examined the benefits of a technology-enhanced STEM curriculum and pedagogy course on TCs' TPACK and readiness for online teaching. Therefore, it is essential to thoroughly explore current teacher education program practices in Canada to understand how educational technology course settings are structured to support and enhance teachers' digital competence.

Conceptual Framework

Practical applications and early exposure to technology help in shaping a positive digital professional identity among TCs, preparing them to create enriching learning opportunities for their future students (Sillat et al., 2017). The integration of technology in teacher education also increases TCs' confidence in using digital tools and offers them a deeper understanding of incorporating technology into pedagogical practices (Filiz & Kurt, 2022).

Importantly, two main models exist in teacher education programs to promote TCs' digital competence: (a) specialized, stand-alone courses on educational technology, and (b) an infused model in which digital skills are integrated into all courses, especially teaching methods courses. This section discusses the definitions of both approaches, as well as their advantages and limitations, to understand their impact on teacher preparedness.

Stand-Alone Educational Technology Courses

Stand-alone educational technology courses are designed to improve technology proficiency among TCs and enhance their ability to integrate technology effectively into their teaching practice (Wang, 2006). This approach ensures educational technology knowledge is systematic among TCs (Roblyer & Hughes, 2019). These courses allow educators to concentrate deeply on educational technology, such as instructional design, digital tools, and pedagogical methods (Mehlinger & Powers, 2002). Stand-alone courses offer in-depth knowledge and skills specific to educational technology, which allows educators to develop their digital competence and TPACK in a focused approach. Zakrzewski and Newton (2023) also noted significant improvements in TCs' comfort levels with technology and a deeper understanding of the importance of its integration as a result of stand-alone courses.

On the other hand, stand-alone courses have a few limitations. Bakir (2015) presented a qualitative multiple-case study examining practices and barriers in technology implementation at three teacher education programs with stand-alone courses. The results showed that preservice teachers did not benefit from single technology courses because learning in isolation did not provide them with the necessary skills and abilities to integrate technology into their practice. Similarly, Foulger et al. (2015) compared stand-alone courses with a tech-infusion model in a teacher education program. The results demonstrated that stand-alone courses often lack integration with broader content knowledge and pedagogical skills, which can limit their real-world applicability. A report from the United States Department of Education (2017) highlighted that many preservice teacher education graduates felt

unprepared to effectively use technology in the classroom, even though over 80% of the preparation programs in the United States deliver their technology curriculum through stand-alone courses. These findings suggest that while stand-alone courses can be effective in enhancing specific technological skills, they may fall short in fostering TCs' comprehensive technology integration capabilities.

The Technology-Infused Model in Teacher Education

The infused model of educational technology is designed to integrate technology training throughout various teacher education courses (Foulger et al., 2019). The infused approach aligns with the TPACK framework as it integrates technology training directly within course content, making its use more relevant and practically applicable (Koehler et al., 2013). Additionally, it promotes a comprehensive understanding of how technology can enhance TCs' skills in technology use and confidence in applying these skills in educational settings (Mishra & Koehler, 2006). Buss et al. (2015) compared the effects of stand-alone courses and infused strategies in teacher education on teachers' TPACK domain scores. They found that technological knowledge (TK) and technological pedagogical knowledge (TPK) developed more quickly among students in the stand-alone course. Yet, content knowledge (CK) and pedagogical knowledge (PK) developed more rapidly in the technology-infused methods courses. Another 2-year longitudinal mixed method study tracked 71 TCs' understanding and application of TPACK from the start of their training in an infused model until the start of their teaching career. Findings indicated a significant increase in TPACK scores, specifically TCs' technology integration growth (such as using diverse kinds of hardware, software, and Web-based applications to aid students' learning) in coursework and classroom teaching (Buss et al., 2018).

However, challenges also exist within the infused model. Research by Wang (2006) highlighted the difficulty in achieving comprehensive technology integration across all courses within educational institutions. Nelson (2017) added that the effectiveness of technology integration heavily relies on the faculty, particularly those mentor teachers whose TPACK proficiency conditionally influences preservice teachers' intentions to use technology. In concurrence, Foulger et al. (2017) emphasized that teacher educators need to define competencies, including knowledge, skills, and attitudes, to effectively support TCs' integration of technology. Similarly, Admiraal et al. (2017) highlighted the critical role of mentors and teacher educators. Their mixed-method research illustrated that mentors were crucial in fostering preservice teachers' effective use of technology and the development of TPACK competencies. Tondeur et al. (2017) emphasized that technology proficiency and willingness to integrate technology among teacher education faculty pose a significant barrier to the infused model's success. Moreover, Dinc (2019) identified barriers such as inadequate funding, equipment shortages, limited skills, and time constraints, which all pose additional challenges to the successful implementation of the infused model in teacher education programs. Foulger et al. (2019) reflected on their 5-year experience with infusing technology into their teacher education program. They emphasized that the technology infusion process was not an immediate solution; it typically required a commitment of up to five years to fully integrate and yield results. They also highlighted the need for strong administrative support, dedicated resources, personnel, and ongoing professional development for successful implementation.

Given all the above, we do not see both approaches as mutually exclusive. Teacher education programs can complement stand-alone educational technology courses with an infused approach to ensure an effective preparation of TCs for technology-enhanced teaching. It is still important to explore current teacher education programs' practices in Ontario as programs strive to promote TCs' digital competence.

Methods

A qualitative methodology was adopted (Creswell & Creswell, 2023). We conducted an environmental scan to explore how educational technology is integrated into teacher education programs across Ontario. An environmental scan is an effective approach to information gathering for a range of purposes, such as reviewing the current state of services and programs, evaluating community needs, identifying service gaps, assessing professional education and training needs, supporting quality improvement initiatives, and informing program and policy development (Charlton et al., 2019).

The team, comprised of a principal investigator and three research assistants, reviewed preservice teacher education program providers in Ontario on the Ontario College of Teacher Education website. We used publicly available information on the websites of those programs to examine their adopted model(s). Between April and August 2024, two research assistants independently visited each program's website to ensure comprehensive coverage and collected details about all courses offered in each program across three divisions: Primary/Junior (P/J), Junior/Intermediate (J/I), and Intermediate/ Senior (I/S). The research assistants identified whether stand-alone educational technology courses were offered or not. They filled out a structured template to gather data, which included the number of educational technology courses, their course descriptions, number of credits, and whether these courses were required or elective. The team also noted information about non-stand-alone courses that mentioned technology in their descriptions, which hinted at an infused model in technology integration. However, this data was limited and inconsistent. As such, only a few examples of the technology-infused approach were included in the dataset presented as a sample.

After the independent data collection phase, we met to review and confirm the data collection results. This process was crucial for ensuring the accuracy and consistency of the information gathered, allowing for a reliable analysis (Creswell & Creswell, 2023). The collected data were then organized into a spreadsheet for systematic comparison. We calculated the number of institutions offering stand-alone courses across different divisions, noted the number of such courses, and calculated the percentage of programs offering them as either required or elective, or both.

After identifying the stand-alone courses, we obtained their descriptions from each program website and organized them into a structured template. It is important to note that course descriptions were last checked August 2024, as they may have been updated afterwards. We could not find detailed course syllabi online, and hence the reliance on course descriptions. We conducted an in-depth analysis of the course descriptions of the stand-alone courses to gain detailed insights into their content, as part of addressing our second research question. Using an inductive content analysis approach (Schreier, 2013),

one research assistant and the principal investigator independently conducted thematic coding of the course descriptions' contents (Clarke & Braun, 2017). After completing their independent analyses, we all met to unify the emerging themes and ensure the analysis' trustworthiness.

Results

Environmental Scan Findings

The environmental scan included 17 teacher education programs whose language of instruction is English. Table 1 provides an overview of educational technology course offerings in these programs. It is noted that 14 out of 16 Primary/Junior (P/J) programs, 9 out of 12 Junior/Intermediate (J/I) programs, and 9 out of 15 Intermediate/Senior (I/S) programs offer stand-alone courses on educational technology. Moreover, many of these courses are required rather than elective (9 out of 14 P/J programs, 6 out of 9 in J/I programs, and 5 out of 9 in I/S programs). Additionally, most programs offer only one course on educational technology in each division.

Table 1

Overview of Educational Technology Course Offerings in Ontario's Teacher Education Programs

Characteristic	Number of programs		
	P/J	J/I	I/S
Analyzed in this research	16	12	15
Offers stand-alone courses	14	9	9
Offers one course	11	8	4
Offers two courses	1	1	2
Offers three or more courses	2	0	3
Courses are required	9	6	5
Courses are elective	4	3	3
Offers both required and elective courses	1	0	1

Note. P/J = Primary/Junior; J/I = Junior/Intermediate; I/S = Intermediate/Senior.

Analysis of Educational Technology Courses' Description

We analyzed the content of course descriptions available online on the websites of teacher education programs offering stand-alone educational courses. We examined 14 programs within the P/J/I division and 9 programs within the I/S division to identify common themes of stand-alone educational technology courses. Table 2 presents a summary of the emerging themes resulting from this analysis and the frequency of repetition of each theme across programs. The numbers indicated in each

cell represent how many programs cover each theme out of the total number of analyzed teacher education programs.

Table 2

Summary of Educational Technology Course Description Content Analysis

Theme	Frequency in P/J/I programs	Frequency in I/S programs	Total
Strategies for teaching using technology	14/14	9/9	23/23
Digital literacy	9/14	6/9	15/23
Evaluation and assessment	3/14	2/9	5/23
Theories	2/14	2/9	4/23
Online teaching	2/14	1/9	3/23
Education policy and law	2/14	1/9	3/23
Game-based learning	2/14	1/9	3/23
Programming and coding	1/14	1/9	2/23

Note. P/J/I = Primary/Junior/Intermediate; I/S = Intermediate/Senior.

As shown in Table 2, a total of eight themes emerged in the educational technology course descriptions: strategies for teaching using technology, digital literacy, evaluation and assessment, theories, online teaching, education policy and law, game-based learning, and programming/coding. The two most common themes were strategies for teaching using technology and digital literacy. All other themes were mentioned five or fewer times across both P/J/I and I/S programs.

First, with respect to strategies for teaching using technology, all programs in P/J/I and I/S offering stand-alone courses highlighted this theme. This theme refers to technology as a valuable tool in education, used to create a more effective, engaging, and personalized learning environment for students. It involves using various technological tools and resources to enhance the educational teaching and learning processes. It also emphasizes the importance of teachers being innovative and resourceful in their instructional approaches. Three sample course descriptions from the universities' websites follow:

> The purpose of this course is to prepare teacher candidates for a technology-enhanced classroom. The course will focus on research-based strategies and concrete suggestions for effective integration of information and communication technologies (ICT) across the curriculum in a way that enhances learning, with special emphasis on topics, strands, and expectations detailed by the Ontario Ministry of Education curriculum documents… (Brock University EDBE 8P73, I/S division)

> The goal of the course will be for teacher candidates to build an intelligent and thoughtful disposition towards the use of educational technology in K–12 classrooms… (Queen's University EDST 218, P/J/I division)
>
> This course is designed to offer teachers and administrators the opportunity to use and to implement the many forms of technology in delivering curriculum and instructional content to their students… (Niagara University EDU 498, P/J/I division)

Second, digital literacy was a common theme in 9 of the 14 programs in P/J/I and 6 of the 9 programs in I/S. In these courses, digital literacy refers to the ability to use, understand, and critically evaluate information and technology in various contexts. It encompasses a wide range of skills, knowledge, and attitudes essential for navigating digital environments. It also includes a critical perspective on the use of digital tools for creative and instructional purposes, the impact on mental health, and the consideration of the potential consequences of our actions in the digital world, to make choices that align with ethical principles (Hoechsmann & DeWaard, 2015). Three relevant course descriptions follow:

> The impact of technology and the Internet, particularly social media and the tools of the "Read-Write" web, form a significant portion of the course content. Students will also explore relevant digital hardware and software tools to create, communicate, instruct, and inspire… (Lakehead University Education 3516, P/J/I division)
>
> Teacher candidates engage with a range of tech devices and platforms from a practical stance in order to subsequently analyze classroom implications, including professional standards, laws and policies, the impact of social media on mental health and device use, and evidenced-based practices related to effective uses of technology in the classroom… (Trent University EDUC 4388H, P/J/I division)
>
> This course will address practical and technical knowledge … and the intersections of race, gender, ethnicity, class, ability and culture as they relate to the consumption, production and utilization of technology… (Ontario Tech University EDUC 2401U, P/J/I division)

Third, the evaluation and assessment theme was covered in three programs in P/J/I and two programs in I/S. These courses emphasized how technology could be used to investigate the outcomes of learning experiences and provide timely feedback. This theme includes how educational technology can be integrated into assessment strategies to enhance efficiency and accuracy. An example from one course description follows:

> This course deals with issues of technology, grade-level curricular specificity, classroom management, multicultural content and the construction of tests and other assessments as outlined by the Ontario Ministry of Education relevant to the teaching in this content area. (Niagara University EDU 463B/466E, I/S division)

Fourth, theories were referenced in two P/J/I programs and two I/S programs. This theme refers to connecting educational technology and/or learning theories to practice using educational technology tools. For example, the University of Ottawa course stated:

> Examination of the roles and applications of Information and Communications Technologies in the teaching and learning process; integration of current theories and available tools. (University of Ottawa PED 3119, I/S division)

Fifth, online teaching was referenced in two P/J/I programs and one I/S program. For example, the Wilfrid Laurier University course description stated:

> This course is designed to focus on deepening understanding [of] online learning and technology enhanced teaching and learning… (Wilfrid Laurier University EU441, P/J/I division)

Sixth, the education policy and law theme was mentioned in two P/J/I programs and one I/S program. This theme relates to some education policies and measures regarding technology in teaching and learning. It aims to ensure that technology is used effectively and ethically to enhance educational outcomes while addressing potential challenges and ensuring equitable access. For example, the Trent University course stated:

> Teacher candidates engage with a range of tech devices and platforms from a practical stance in order to subsequently analyze classroom implications, including professional standards, laws and policies… (Trent University EDUC 4388H, I/S division)

Seventh, game-based learning was mentioned in two P/J/I programs and one I/S program. This theme concerns the game-based learning pedagogical approach, which uses video games and game-like elements to enhance learning, engagement, and skill development. For example, one of the Ontario Tech University course descriptions includes the following:

> The purpose of this course is to discuss strategies for integrating digital technologies in the classroom …. The tools and resources available to students will be introduced on a thematic basis …. This includes, but is not limited to: digital presentations, game-based learning, digital storytelling, website design… (Ontario Tech University EDUC 2401U, P/J/I division)

Finally, programming and coding were mentioned in only one P/J/I program and one I/S program. This includes writing computer programs, understanding how coding software works, and applying computational thinking to solve problems. For example, one of the Ontario Tech University course descriptions includes the following:

> By exploring and analyzing an array of child-friendly software aimed at developing the basics of coding and digital communication for K–6 learners, teacher candidates will develop innovative pedagogies for teaching and learning in the 21st century. Topics may include: coding educational games, developing mobile apps, LEGO robotics, and digital storytelling. (Ontario Tech University EDUC 2408U, P/J/I division)

Discussion and Conclusion

Our environmental scan of preservice teacher preparation programs in Ontario revealed a relatively positive outcome being that most teacher education programs feature at least one stand-alone course on educational technology, potentially equipping TCs with essential digital competencies and pedagogical skills (Wang, 2006). This demonstrates an attention to equipping TCs with comprehensive training to ensure they gain a solid foundation in educational technology. This outcome also reflects the compliance of faculties of education to the accreditation requirements laid out by the Ontario College of Teachers (2022), specifically on the "use of information and communication technology as a teaching and learning tool" (p. 15). Moreover, most programs require the stand-alone course rather than offering it as an elective, which further underscores the commitment to providing essential technology training for future teachers.

However, the analysis also revealed that most programs offer only one stand-alone course on educational technology. This indicates a potential limitation in the breadth and depth of content covered in stand-alone courses, as highlighted by Foulger et al. (2015)—a finding that was further confirmed by our subsequent analysis of course content. Moreover, there is limited flexibility in course choices, with only one program providing both required and elective courses. This suggests a potential lack of customization and specialization options for TCs interested in exploring deeper or more specialized aspects of educational technology, including a flexible approach to emerging technology trends such as AI.

Furthermore, analyzing stand-alone educational technology course descriptions highlighted the two most common themes out of eight in total. All programs offering these courses emphasized teaching with technology, hinting at the TPACK framework (Mishra & Koehler, 2006). Also, most programs included promoting TCs' digital literacy and competence (Falloon, 2020) as part of their course descriptions. These two concepts are foundational for TCs to effectively integrate technology into their teaching practices. Overall, this analysis signals a strong emphasis on preparing TCs with essential digital competencies and pedagogical skills required to teach using technology.

On the other hand, the analysis also revealed certain gaps and areas needing improvement. For instance, less than half the programs mentioned the remaining six themes, including online teaching, educational technology theories, digital assessment, and coding. This result indicates an imbalance in the coverage of these concepts despite their importance. Although these concepts may be included in the courses' contents despite not being mentioned in their descriptions, offering just one course on educational technology makes the inclusion of all these concepts very challenging. Also, there was limited attention to critical dimensions of educational technology, including issues such as datafication, privacy, ethics, citizenship, and the influence of corporate agendas on curriculum. Consequently, course instructors may find it challenging to strike a balance between technocratic and humanist orientations when teaching with digital technologies. Finally, the lack of mention of emerging technologies such as AI and immersive technologies was notable. This may also be due to the aforementioned time limitations or the fact that teacher education programs are covering those concepts but have not revised the public-facing course descriptions yet. Therefore, future updates to the variety of course offerings and

the contents of educational technology courses are essential to promote TCs' digital competence and TPACK and advance their readiness for the classrooms of the future.

Limitations

Although we believe this analysis is insightful and beneficial in uncovering details about TCs' preparation in educational technology, a few limitations exist. For instance, this analysis was limited to educational technology course titles and descriptions available on universities' publicly accessible websites. Course outlines and syllabi were not publicly available for analysis. Also, course descriptions and teacher education programs' information were last checked in August 2024, so there may have been updates afterwards. Additionally, no direct contact was made with representatives from the teacher education programs. Anecdotal evidence from a few universities indicates that they incorporated modules on AI in their educational technology courses (Estaiteyeh et al., 2025). However, these changes were not noted in the course descriptions at the time of data collection and analysis. As a result, the findings may not fully capture the depth and breadth of each program. A more in-depth analysis of course syllabi would provide clearer understanding.

This study focused exclusively on Ontario's teacher education programs, which limits the generalizability of the findings. Each province and territory in Canada has different educational policies, structure of teacher education programs, and practices. Therefore, the results do not reflect other regions in Canada.

Finally, the study focused on stand-alone educational technology courses; it may not fully capture how technology is integrated across teacher education in Ontario. This limitation is mainly because it is challenging to evaluate the adoption of the technology-infused approach across different universities. That would require analyzing the detailed contents of all courses in each division across all teacher education programs. For instance, our search yielded a few examples of the technology-infused approach in various subject areas, such as language courses integrating digital storytelling (DeWaard, 2022), digital timelines in STEM education courses (DeCoito & Vacca, 2020), and digital tools in curriculum and assessment courses (Hagerman & Coleman, 2017). As such, a detailed analysis of how the technology-infused approach is being implemented is possible and recommended for further insights on the matter.

Implications and Future Directions

This research is timely given recent developments in educational technologies and the need to reflect on TCs' readiness for technology-enhanced teaching. The research advances the knowledge of teacher education program administrators, teacher educators, and educational researchers in educational technology. This analysis will help determine if the currently available courses are comprehensive and aligned with the teachers' need to integrate technology into their teaching effectively. It will also provide insights into how these courses can be improved to better equip future teachers with digital competence.

This study offers multiple directions for research and curriculum development. Future research can analyze detailed course outlines and syllabi to be obtained through official requests from teacher education programs/faculties of education. Studies can also investigate a broader, cross-provincial analysis to better understand how preservice teachers are trained in educational technology across Canada. Further, there is a need to augment the findings around stand-alone courses and study the technology-infused approach in teacher education programs. As such, future research can address how subject-specific courses in teacher education programs incorporate technology, and whether they attempt to complement/compensate for the contents offered or not offered in stand-alone courses. Moreover, future studies can investigate the impact and effectiveness of stand-alone courses and the infused approach on TCs' digital competence and readiness. Research can explore the successes and challenges teacher educators face in preparing TCs for technology-enhanced teaching, as relevant to the Canadian context. Finally, it is essential to monitor AI integration in teacher education programs and how concepts such as AI literacy are being introduced in educational technology and subject-specific courses.

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Extended Writing Performance and Higher-Order Thinking Skills via Flipped Learning

Performance en rédaction longue et habiletés de pensée supérieures grâce à la classe inversée

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Abstract

This study investigates the impact of process writing and flipped learning on enhancing students' extended essay writing performance and higher-order thinking skills (HOTS). The process writing approach emphasises writing as a recursive activity involving multiple drafts, feedback, and revisions to improve coherence and clarity. A quasi-experimental design was applied, involving 120 Form Four students in northern Malaysia. Participants were divided into an experimental group, which received process writing-based flipped learning instruction, and a control group, which received textbook-based instruction in a flipped setting. Data were collected through pre-test and post-test assessments of writing and HOTS, along with qualitative feedback from student interviews. Analysis of covariance (ANCOVA) revealed significant improvements in the experimental group's writing across content, communicative achievement, organisation, and language use. Additionally, the experimental group showed marked growth in HOTS, particularly in analysing, evaluating, and creating. Although originally proposed in 1981, Flower and Hayes' model remains relevant for understanding the cognitive processes involved in students during writing, especially in instructional design contexts**.** This study supports the integration of process writing and flipped learning to enhance writing performance and HOTS, offering practical insights for educators seeking an effective and engaging instructional approach in teaching and learning of extended essay writing.

Keywords: extended writing, flipped learning, higher-order thinking skills, process writing, writing performance

Résumé

Cette étude examine l'impact du processus de rédaction et de la classe inversée sur l'amélioration de la rédaction de dissertations et des habiletés de pensée supérieures chez les élèves. Le processus de rédaction met l'accent sur l'écriture comme une activité récursive impliquant plusieurs brouillons, des rétroactions, et des révisions afin d'améliorer la cohérence et la clarté du texte. Une méthode quasi-expérimentale a été utilisée, impliquant 120 élèves de niveau scolaire *Form four* dans le nord de la Malaisie. Les personnes participantes ont été réparties en deux groupes : un groupe expérimental, qui a reçu un enseignement fondé sur le processus d'écriture utilisant une approche de classe inversée, et un groupe témoin, qui a reçu un enseignement basé sur un manuel scolaire également dans une approche de classe inversée. Les données ont été recueillies à l'aide d'évaluations prétest et post-test sur la rédaction et les habiletés de pensée supérieures, ainsi que par des entretiens qualitatifs avec les élèves. Une analyse de covariance (ANCOVA) a révélé des améliorations significatives chez les élèves du groupe expérimental dans les domaines du contenu, de la réussite communicative, de l'organisation et de l'usage de la langue. De plus, ce groupe a montré une amélioration notable des habiletés de pensée supérieure, particulièrement en matière d'analyse, d'évaluation et de créativité. Bien que proposé initialement en 1981, le modèle de Flower et Hayes reste pertinent pour comprendre les processus cognitifs liés à l'écriture des élèves, notamment dans le cadre de la conception pédagogique. Cette étude soutient l'intégration du processus de rédaction et de la classe inversée pour améliorer la performance en écriture et les habiletés de pensée supérieures, offrant des perspectives pratiques aux personnes enseignantes à la recherche d'approches pédagogiques efficaces et engageantes pour l'enseignement du processus de rédaction de dissertations.

Mots-clés : rédaction longue, classe inversée, habiletés de pensée supérieures, processus de rédaction, performance en écriture

Introduction

There has been growing interest in exploring innovative strategies to improve writing performance and promote higher-order thinking skills (HOTS) among students. Among these, the process writing and flipped learning approaches have drawn particular attention due to their potential to enhance students' writing performance and promote HOTS abilities. The process writing approach, based on the collaborative work of Flower and Hayes (1981), emphasises the recursive nature of writing, where multiple drafts, peer feedback, and revision are integral components. On the other hand, flipped learning coined by Bishop and Verleger (2013), involves the pre-learning of content through resources before class, allowing for more active engagement and application during in-class activities. While both strategies have independently demonstrated success, little research has explored their combined effects.

Writing requires not just language skills, but critical thinking, decision-making, and the ability to revise ideas that complement each other, all of which align with the higher levels of Bloom's Taxonomy. The combination of flipped learning and process writing is thus pedagogically significant, as it allows students to improve their work through several steps of writing. The rationale behind combining process

writing and flipped learning is their complementary nature, as they both offer student-centred and interactive learning, promoting students' independent exploration and application of writing concepts. By incorporating flipped learning, students have the opportunity to engage with writing concepts independently, allowing for a more in-depth understanding and application of these concepts during class time (Tucker, 2017).

The primary objectives of this research are twofold: first, to assess the effects of integrating the process writing approach and flipped learning on students' performance in writing extended essays; and second, to evaluate the development of the students' HOTS resulting from this instructional approach. These outcomes are vital in preparing students for 21st-century learning and lifelong problem-solving, particularly in an English as a second language (ESL) context where language development and cognitive growth must go hand-in-hand.

Process Writing Approach

Process writing highlights the importance of writing as a multi-stage journey, prompting students to participate in prewriting, drafting, revising, and editing their work through several iterations prior to publishing (Seow, 2002). This approach significantly differs from the conventional product-oriented view of writing, which emphasises the outcome over the process involved in achieving it. The writing process is fundamentally viewed as a complex and recursive activity rather than a linear one, with substantial benefits derived from its division into manageable stages (Bayat, 2014).

Flower and Hayes (1981) provide a profound understanding of the cognitive processes involved in writing, as a cornerstone of the process writing approach. They indicate that writing is not limited to the mechanical act of composing words on paper, but it incorporates a sequence of cognitive activities, such as formulating ideas, drafting thoughts, and revising and editing content before publishing the essay. By concentrating on these stages individually, students can approach writing tasks with a greater sense of clarity and confidence, resulting in improved writing skills and outcomes (Allmendinger, 2017; Stefanou & Xanthaki, 2016).

The process writing approach creates a supportive classroom environment where students can explore ideas, focusing on expression rather than immediate perfection (Alodwan & Ibnian, 2014; Dörnyei & Muir, 2019; Faraj, 2015). Teachers act as facilitators, guiding students with feedback and encouragement throughout each stage, rather than as final judges of quality (Hayes & Flower, 2016). Incorporating the process writing approach in the classroom involves various activities that support each stage of the writing process (Bean & Melzer, 2021; Harris, 2023; Nabhan, 2019). Brainstorming sessions, peer reviews, and revision exercises are integral components helping students internalise the steps involved in producing a coherent and polished piece of writing. Such activities not only enhance students' writing skills but also promote a collaborative learning environment where ideas are shared and critiqued constructively.

Flipped Learning Approach

Flipped learning in writing instruction represents a transformative approach to teaching and learning, effectively inverting the traditional classroom model to prioritise active learning and student engagement (Karabulut-Ilgu et al., 2017). By delivering instructional content through online and offline mediums outside of the classroom, this innovative method allows for classroom time to be dedicated to more interactive, hands-on activities (Hava, 2021). Such activities may include discussions, collaborative problem-solving, and the practical application of genre-based elements in teaching and learning of writing. This model not only facilitates a deeper understanding of writing principles but also encourages students to apply these principles in a supportive, interactive environment.

The pioneering work of Bergmann and Sams (2023) and Lage et al. (2000) has been instrumental in demonstrating the efficacy of flipped learning in writing instruction (Amiryousefi, 2019). Their research highlights how this approach can lead to significant improvements in students' writing capabilities by fostering an environment that promotes active engagement and allows for personalised learning experiences. The flipped classroom model acknowledges the diverse learning needs and paces of students, providing opportunities for them to engage with instructional material at their own pace before coming to class (Campillo-Ferrer & Miralles-Martínez, 2021). This personalised engagement with the material prepares students to participate more fully in classroom activities.

In the context of writing instruction, the flipped learning model has potential to be integrated in the writing process which includes brainstorming, drafting, revising, and editing (Scott & Vitale, 2003). By engaging with instructional content prior to and outside of class, students are prepared to delve into more complex discussions and collaboration during in-class writing activities. This preparation and the in-class focus on application and feedback make the writing process more transparent and approachable for students, often demystifying aspects of writing that they may find challenging.

Moreover, flipped learning facilitates a shift from a teacher-centred classroom to a student-centred learning environment (Bond, 2020; Raman et al., 2021). This shift encourages students to take ownership of their learning, fostering a sense of responsibility and autonomy. In writing instruction, this autonomy is crucial, as it empowers students to explore their voices, experiment with different styles, and take constructive criticism in stride, viewing it as a necessary part of the writing process rather than a personal critique. The implementation of flipped learning in writing instruction also allows teachers to devote more in-class time to addressing individual and small group needs, thereby enhancing the feedback loop between student and teacher (Nerantzi, 2020; Raman et al., 2022). This personalised feedback is invaluable in writing instruction, where nuances, style, and structure can significantly impact the written work.

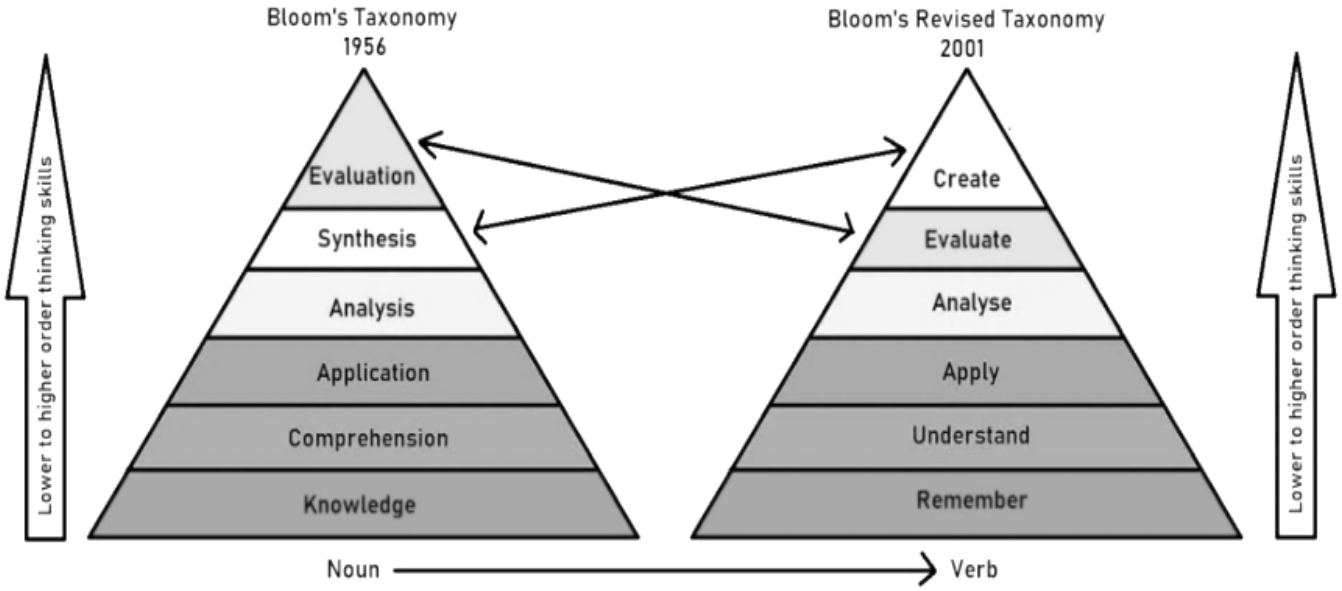
Higher-Order Thinking Skills in Writing

The incorporation of HOTS in writing instruction has been identified to significantly enrich the learning experience for students, promoting their involvement in complex cognitive processes such as analysing, evaluating, and creating rather than mere recall of information (Hyland, 2007). This paradigm shift is essential in cultivating critical thinking and advanced problem-solving abilities, which are

essential for both academic and professional success. The revised version of Bloom's Taxonomy (Figure 1), as proposed by Anderson and Krathwohl in 2001, provides a comprehensive framework for the integration of these advanced cognitive skills into writing, offering a scaffolded approach to encourage deeper levels of engagement and to facilitate the production of more sophisticated outputs from students.

Figure 1

The Revised Bloom's Taxonomy



Note. Adapted from Anderson and Krathwohl (2001).

The emphasis on HOTS in writing instruction is grounded in the belief that writing is not just a mechanical skill but a complex intellectual activity that requires students to engage deeply with content, context, and audience (Yuliati & Lestari, 2018). By focusing on analysis, students learn to dissect texts, identify underlying themes, and understand different perspectives. Evaluation tasks push them to judge the validity of arguments, assess the quality of evidence, and synthesise information from multiple sources. Finally, creative tasks challenge students to generate original ideas, propose solutions, and articulate complex thoughts coherently. Incorporating these skills into writing instruction involves a variety of strategies and activities. The revised Bloom's Taxonomy offers educators a structured way to design these activities, ensuring that students are not only engaging with content at a surface level but are also challenged to apply, analyse, evaluate, and create based on what they learn (Quan et al., 2017). This approach fosters a deeper understanding of the subject matter and promotes cognitive skills that are essential for navigating complex academic and professional landscapes.

Effects of Combining Approaches

The synergistic integration of the process writing approach in the context of flipped learning offers a compelling and innovative framework for writing instruction (Lee, 2020). This fusion creates a dynamic, interactive learning environment that not only enhances students' writing skills but also

significantly boosts their cognitive abilities. By leveraging the strengths of both approaches, educators can provide more personalised, process-oriented instruction in writing, while simultaneously fostering an atmosphere ripe for active learning and critical thinking in the classroom. These integrated approaches not only aim to elevate students' proficiency in writing but also seek to comprehensively develop their HOTS, thus offering a holistic approach to education addressing both skill acquisition and cognitive development (Bielinska, 2015; Deane et al., 2008; Schoonen et al., 2011). Rather than assuming guaranteed improvements, this study investigates whether this combined approach contributes meaningfully to students' writing performance and HOTS abilities.

The process writing approach emphasises writing as an iterative process cycle—prewriting, drafting, revising, editing, and publishing—rather than a one-off effort to produce a final product (Onozawa, 2010; Seow, 2002). This perspective encourages students to delve deeply into their writing, understanding it as a craft that requires patience, reflection, and continuous improvement. On the other hand, flipped learning flips the traditional educational model on its head by delivering instructional content outside the classroom, thus freeing up in-class time for interactive, hands-on activities that promote application, analysis, and synthesis of knowledge.

When these approaches are combined, students first engage with the conceptual and foundational aspects of writing outside the classroom, through digital platforms or pre-assigned readings. This preparation allows them to be ready when entering the classroom to actively participate in discussions, collaboration, and peer review sessions. The active learning component inherent in the flipped classroom approach ensures that students are not passive recipients of information but are actively constructing knowledge, thereby deepening their understanding and retention of writing principles (Akçayır & Akçayır, 2018; Bishop & Verleger, 2013; DeLozier & Rhodes, 2017). Furthermore, this integrated approach provides a framework for continuous feedback and revision, which is critical for writing development and cognitive growth. Students learn to view feedback not as criticism but as a valuable part of the learning process, encouraging a growth mindset and resilience (Burgess et al., 2020).

By creating a more personalised, interactive, and process-oriented learning experience, these integrated approaches not only prepare students for academic success but also equip them with the critical thinking, problem-solving, and creative skills necessary for professional and personal growth (Bernacki et al., 2021; Bulger, 2016; Grant & Basye, 2014; Shemshack et al., 2021; Zhang et al., 2020). Holistic integration to writing instruction underscores the importance of adopting innovative educational practices that respond to the diverse needs of students within the demands of the 21st-century landscape.

The educational landscape is replete with innovative instructional strategies designed to enhance learning outcomes and foster cognitive development. Among these, the process writing approach, flipped learning, and the integration of HOTS stand out as particularly effective ways for improving students' writing skills and HOTS abilities. Individually, each of these approaches has been subject to extensive research, demonstrating respective benefits in educational settings. However, the literature reveals a noticeable research gap when it comes to examining the synergistic effects of combining these strategies. Even though combining the process writing approach, flipped learning, and HOTS might

theoretically lead to better learning outcomes, there are not many empirical studies that look at how they affect students' writing performance and cognitive development as a whole. This study aims to address this gap by investigating the combined influence of these instructional approaches on students' performance in writing extended essays and their HOTS abilities. By exploring how these approaches interact and complement each other, the research seeks to provide a comprehensive understanding of their potential to jointly improve writing performance and HOTS.

Table 1 summarises the conceptual framework underpinning this study. It illustrates how these constructs inform the instructional design and expected learning outcomes of the intervention.

Table 1

Conceptual Framework of the Study

Construct	Source	Key ideas	Role in study
Process writing approach	Flower & Hayes (1981); Graham & Sandmel (2011); Seow (2002)	Writing as a recursive, multi-stage process involving prewriting, drafting, revising, editing, and publishing.	Forms the basis for writing instruction in the experimental group.
Flipped learning	Bishop & Verleger (2013); Bergman & Sams (2023); Tucker (2017)	Content is delivered before class; class time is used for engaging activities.	Used to maximise student engagement with writing processes.
HOTS	Anderson & Krathwohl (2001); Brookhart (2010)	Focus on analysing, evaluating, and creating.	Skills integrated in the steps of writing according to genres.
Synergistic integration	Bielinska (2015); Burgess et al. (2020); Lee (2020)	Combining flipped learning and process writing promotes active engagement and cognitive development.	Explored as an innovative intervention strategy.

Note. HOTS = Higher order thinking skills.

Methodology

Research Design

This study employed a quasi-experimental design to investigate the effects of integrating the process writing approach and flipped learning on students' extended essay writing performance and the development of HOTS. A quasi-experimental design, characterized by the absence of random assignment, was chosen for its practical applicability in educational settings where randomly assigning students to conditions is often not feasible or ethical. This design is suitable for educational research as it

allows for the examination of instructional interventions in real-world classroom settings. According to Cook and Campbell (1979), quasi-experimental designs can provide valuable insights into the effects of educational practices, despite potential challenges in controlling all confounding variables.

In this study, the quasi-experimental design involved the comparison of two groups. The experimental group received instruction through a combined approach of process writing and flipped learning in the form of activities. In contrast, the control group received textbook-based writing instruction in a flipped learning setting without the specific integration of the approaches as experienced by the experimental group. Both groups were selected from similar educational backgrounds to ensure comparability and avoid bias. The following measures were addressed to mitigate potential validity threats inherent in quasi-experimental designs. Both groups went through pre-test and post-test assessments to measure their essay writing performance and HOTS development. This will help in determining the changes attributable to the intervention. Advanced statistical technique, such as analysis of covariance (ANCOVA) was employed to adjust for any initial differences between groups, enhancing the credibility of the findings.

Sampling

The sample consisted of Form Four students—16-year-old secondary school students (equivalent to Grade 10 internationally)—sourced from daily secondary schools in Malaysia. In this context, English language is a compulsory subject and writing extended essays is a compulsory sub-section of the writing requirements. The study followed Creswell's (2014) guidelines for a quasi-experimental design, which emphasise clear selection criteria, demographic characteristics, and a description of the context. Eligibility for participation hinged on registration as a Form Four student, willingness to engage in the study, and access to the Internet resources necessary for the flipped learning aspect of the research.The researchers used convenience sampling to select participants for this study. Convenience sampling was chosen because it allowed the researchers to select participants based on their availability and willingness to participate in the study, making it a practical and efficient method given the constraints of time and resources (Emerson, 2021; Raman et al., 2015). A total of 120 students, consisting of 45 males and 75 females, were chosen for the study. The control group consisted of 65 students, whereas the experimental group had 55 students. The control group was exposed to a textbook-based instruction in the form of flipped learning, whereas the experimental group was exposed to flipped learning-based process writing activities.

Instruments

The researchers developed flipped learning-based process writing activities for an eight-week intervention. A total of 40 lessons in the form of units were taught, covering various aspects of writing such as prewriting, drafting, revising, editing, and publishing. The researchers assessed the participants' writing performance before and after the intervention through pre-test and post-test writing tasks. The Malaysia Examination Syndicate created a rubric with construct such as content, communicative achievement, organisation, and language for assessing extended essay writing performance and it was used in this study. This rubric offers a standardised approach for determining writing quality, facilitating

objective scoring of essays, and ensuring consistency across evaluations. In addition, students' HOTS were assessed using a rubric adapted from Brookhart (2010), targeting skills in analysing, evaluating, and creating. The rubric is geared toward appraising students' capabilities in using HOTS. These rubrics provided a good picture of how students were growing in these important cognitive areas, especially in analysing, evaluating, and creating. The dual assessments ensured a holistic evaluation of students' writing performance and higher-order thinking skills.

Intervention

The experimental group received flipped learning-based process writing instruction and activities, integrating online videos, interactive slide decks, and worksheets for pre-class preparation. The process writing approach emphasises the circular nature of writing through multiple drafts. Flipped learning enabled students to access the online resources and offline materials before class to learn more and use what they had learned in-class. In contrast, the control group experienced flipped learning using textbook-based materials. They accessed digital PDF versions of the textbook for pre-reading but did not engage in structured writing stages or receive targeted feedback. In-class activities for the control group focused on general discussion and comprehension checks, without explicit scaffolding of writing tasks according to process writing. The intervention was carried out for eight weeks.

Data Collection

Quantitative data were collected via pre-test and post-test assessments to quantitatively measure students' writing performance and their HOTS development at the beginning and end of the study period. Additionally, qualitative data were gathered through student interview, aimed at capturing students' HOTS development and experiences of the instructional approaches employed. The comprehensive approaches to data collection were designed to provide a multifaceted understanding of the effects of the interventions on students' writing performance and HOTS, ensuring a well-rounded analysis of the outcomes.

Data Analysis

Quantitative data from pre-test and post-test assessments were analysed using ANCOVA to compare the performance of the experimental and control groups, controlling for pre-intervention performance. Qualitative data related to HOTS development were analysed using techniques described by Merriam & Tisdell (2025): (1) transcripts were read and coded inductively, (2) meaningful units were grouped under initial codes, (3) categories were refined through iterative comparison, and (4) final themes were derived to reflect patterns in students' experiences related to HOTS development. This included thematic analysis of responses from interviews and an analysis of instructors’ observations. The goal was to identify patterns and themes related to how the instructional approaches influenced students' HOTS, providing a nuanced understanding of the intervention's effects. The combination of quantitative and qualitative methods provides a robust analysis of the effect of these approaches.

Analysis of Extended Writing Performance

To examine how well the experimental and control groups did on the extended essay writing task, Cohen et al. (2018) suggests doing statistical tests to compare their scores on the pre-test and post-test. In accordance with established research practices, the results are presented as mean scores and standard deviations, and the analysis utilises ANCOVA, which adjusts for any initial differences between the groups at the baseline. The use of ANCOVA is a recommended practice in research as it considers any potential biases or confounding factors that may impact the results, thus strengthening the validity and reliability of the findings. The mean scores indicate the average performance of students in each group, with the standard deviations reflecting the variability of scores within each group.

Table 2

Analysis Results for Experimental and Control Groups

Group	Group size	Pre-test mean (SD)	Post-test mean (SD)
Experimental	55	65 (8.56)	85 (8.23)
Control	65	71 (9.21)	75 (10.11)

The statistical analysis still indicates a statistically significant difference in the post-test scores between the experimental and control groups, $F(1, 118) = 22.35$, $p < 0.001$, with a medium effect size (Partial $\eta^2 = 0.18$). The intervention significantly enhances the students' performance in extended essay writing. The mean scores and standard deviations, along with the adjusted group sizes, underscore that the students in the experimental group not only significantly improved in their essay writing performance post-intervention but also exhibited less variability in their performance outcomes compared to the control group. This suggests the educational intervention's positive and uniform impact across the experimental group. The ANCOVA test results reveal the statistical significance of differences between the groups while controlling for initial performance levels.

For each component, an ANCOVA test was conducted to adjust for initial differences and compare the mean post-test scores between the experimental and control groups, using pre-test scores as the covariate. The ANCOVA results summary applies to all components:

- F-value: Ranges from 20.35 to 22.35 for different components
- p-value: <0.001 for all components
- Effect size (Partial η^2): Ranges from 0.17 to 0.18

The results of the detailed analysis demonstrate a significant improvement in all four components of essay writing for the experimental group post-intervention as compared to the control group (Table 3). The statistical values, including the F-values and p-values, indicate a strong level of significance for each component, with effect sizes indicating a medium impact of the intervention. These

findings highlight the effects of the intervention in enhancing students' overall essay writing performance. Moreover, the use of rigorous statistical analysis adds credibility to the validity of the results. Overall, this study contributes to the existing literature on essay writing interventions and emphasises the importance of targeted instruction in promoting students' writing performance.

Table 3

Four Constructs of Essay Writing Performance

Component	Group	Pre-test mean (SD)	Post-test mean (SD)
Content	Experimental	67 (10.1)	85 (8.75)
	Control	65 (7.95)	75 (10.30)
Communicative achievement	Experimental	62 (9.45)	83 (7.70)
	Control	65 (8.77)	74 (9.28)
Organisation	Experimental	69 (9.68)	84 (8.68)
	Control	67 (9.35)	73 (9.66)
Language	Experimental	71 (9.68)	82 (7.68)
	Control	70 (8.37)	72 (9.52)

The findings of this study present compelling evidence for the effectiveness of the combined use of the process writing and flipped learning approaches in improving overall essay writing performance. Specifically, the intervention has been shown to positively impact content development, communicative efficiency, organisational skills, and language use in writing. These results suggest that the implementation of such instructional approaches may hold great promise in optimising writing instruction, as they promote the multifaceted enhancement of writing skill. Therefore, it is recommended that educators consider incorporating these approaches into their writing instruction and further exploring their potential for fostering holistic writing performance.

Analysis of Higher-Order Thinking Skills

The qualitative analysis employed thematic analysis techniques, focusing on students' interview responses. The methods outlined by Merriam and Tisdell (2025) guided the coding process, enabling the identification of recurring themes and patterns related to the development of HOTS among participating students. The analysis of these themes and patterns provided valuable insights into the effects of the intervention. One of the most notable improvements reported by students after the implementation of the

combined approaches was an enhanced ability to critically analyse texts. This was evident in their essays, demonstrating a deeper insight and a more sophisticated understanding of the material. Additionally, participants noted a significant increase in their problem-solving skills, as they felt better equipped to tackle complex questions and integrate their solutions into their written work. Furthermore, the incorporation of both approaches seemed to foster creative skill in students, leading to original thinking and the presentation of unique arguments in their essays. Another important aspect of the HOTS displayed was students' newfound confidence in constructing and defending arguments, a recurring theme among participants. These reflect the success of the combined approaches in promoting students' HOTS abilities to not only form their own viewpoints but also evaluate and counter opposing perspectives.

Table 4 reflects core aspects of HOTS themes: analyzing, evaluating, and creating (Anderson & Krathwohl, 2001), suggesting that the integrated approach supports cognitive skill development.

Table 4

Themes From Qualitative Interviews on HOTS Development

Theme	Description	Illustrative quote
Critical analysis	Students showed improved ability to break down writing prompts and source material.	"Now I can identify what is really asked in the essay and focus my arguments better."
Problem solving	Increased confidence in tackling complex essay tasks and finding relevant ideas.	"I used to get stuck halfway… now I plan and connect ideas more easily."
Creativity	Ability to generate original arguments and writing styles.	"I like that we can rewrite and try again. I became more confident to write my own ideas."
Argumentation & evaluation	Greater skill in organizing points and evaluating opposing views.	"We had to think if our points make sense and explain clearly why we chose them."

Instructors Observations

Instructors have reported a palpable shift, with students demonstrating higher critical thinking toward the course content in every phase of the process writing. This has been reflected in the quality of class discussions, where students have displayed a more insightful and analytical approach. Additionally, there has been a discernible improvement in the depth and quality of peer feedback, with students exhibiting proficiency in offering constructive critiques that reflect HOTS. These include the identification of logical fallacies, proposing alternative interpretations, and suggesting strategies for stronger argumentation. Such improvements in critical thinking and peer feedback skills have proven to be valuable in enhancing the overall student learning experience.

Discussion

This study aimed to assess the effects of integrating the process writing approach with flipped learning on students' extended essay writing performance and development of HOTS. The findings from both quantitative and qualitative analyses offer strong support for the intervention's effectiveness.

Quantitative results revealed statistically significant gains for the experimental group in all four essay writing components—content, communicative achievement, organisation, and language. The ANCOVA tests showed medium effect sizes ($\eta^2 = 0.17$ to 0.18), indicating a consistent and meaningful improvement across writing domains. These results align with prior research affirming that structured, scaffolded writing processes improve writing performance (Graham & Sandmel, 2011; Seow, 2002).

Qualitative results complemented these findings. Students reported increased analysing, evaluating, and creating abilities which are key indicators of HOTS. Thematic analysis identified four major areas of growth—critical analysis, problem solving, creativity, and argumentation—reflecting students' deeper engagement with writing as a cognitive task, not just a linguistic focused task.

The synthesis of results suggests that flipped learning enables learners to access foundational writing concepts before class, while in-class activities guided by the process writing approach create opportunities for applying, refining, and expanding these ideas. The iterative feedback comprising peer review, self-evaluation, and teacher feedback is instrumental in helping students develop metacognitive awareness of their writing and thinking processes.

Additionally, instructors' observations confirmed students' increased independence, reflective thinking, and peer engagement, reinforcing the interview data and providing further evidence of HOTS development. These observations highlight how instructional design based on Bloom's revised taxonomy can lead to not only academic improvement but also cognitive transformation.

Overall, the study demonstrates that combining flipped learning with process writing offers a powerful model for enhancing both writing performance and higher-order thinking in ESL writing contexts. This dual-focus approach is particularly relevant in preparing 21st-century learners to be effective communicators and critical thinkers.

Limitations

While this study yielded promising results, several limitations should be acknowledged. The relatively small and homogeneous sample may limit the generalizability of findings to other educational contexts. The eight-week intervention period, though adequate for observing short-term gains, may not reflect long-term skill retention. Additionally, the instruments used in this study, though validated, may not capture the full range of writing and thinking competencies developed during the intervention. Furthermore, the qualitative component relied on student self-report, which, while valuable, is inherently subjective. Instructor bias and implementation fidelity could have also influenced outcomes.

Future Research Implications

Future research should explore the scalability of flipped-based process writing instruction across different educational levels, subjects, and learner demographics. Longitudinal studies can assess the sustained impact of such interventions on writing performance and critical thinking. Researchers are also encouraged to compare different approaches for ESL writing context. The role of self-regulated learning strategies within this framework may also warrant exploration. Additionally, with the increasing integration of artificial intelligence in education, future studies could examine how AI-based writing tutors, chatbots, or adaptive feedback systems can complement or enhance flipped-based process writing instruction. This could open new pathways for personalised and scalable learning interventions. Broader investigations into student motivation, self-efficacy, and engagement in flipped-based writing classrooms would provide a more holistic picture of learning outcomes.

Conclusion

The integration of flipped learning and the process writing approach significantly improved both extended essay writing performance and HOTS among Malaysian Form Four ESL students. Quantitative data showed consistent improvement across all writing constructs, i.e., content, organisation, communicative achievement, and language. Qualitative data reinforced these outcomes, highlighting student growth in analysis, evaluative, and creative thinking. This synergy of approaches aligns with Bloom's revised taxonomy and supports student-centred, recursive and reflective learning. Importantly, the study demonstrates that when students engage with foundational writing concepts and apply them collaboratively during class, they achieve higher quality writing and deeper cognitive processing.

This integration of approaches is especially relevant, where students must be prepared to think critically and write effectively. Educators and curriculum designers are encouraged to adopt and adapt these blended instructional approaches to support students' academic and cognitive development. The study offers practical evidence for the value of integrating structured writing processes with flipped learning, especially in ESL and high stakes writing contexts.

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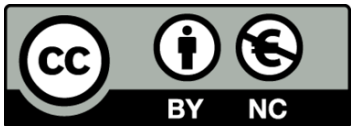

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Exploring University Students' Experiences and Perceptions of Breakout Rooms in Online Classes

Explorer les expériences et les perceptions des personnes étudiantes universitaires à l'égard des salles de petits groupes dans les cours en ligne

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Abstract

This research focuses on the use of breakout rooms in online classes at a private university in Saskatchewan, Canada. It aims to explore factors that contribute to successful collaborative graduate student learning experiences and identify challenges students face during peer-to-peer interactions in breakout rooms. A qualitative research approach was employed and data were collected through a qualitative survey and focus group discussion. The survey was distributed to graduate students in three unique online courses within the college of education at the university. The findings highlight a variety of breakout room activities, ranging from open-ended discussions to problem-solving exercises facilitated by collaborative tools such as shared documents and Padlet. The students expressed a preference for activities that were simpler and more accessible, which fostered teamwork and facilitated the exchange of ideas among group members. The challenges that students mentioned dealt with the non-availability of written instructions for activities, unequal participation or dominance by group members, and potential conflicts arising from differing opinions. Recommendations include further exploration of innovative tools to enhance virtual collaboration, comparative studies across different academic levels, and investigations into the long-term impacts of breakout room usage on student learning outcomes.

Keywords: breakout room, collaborative learning, graduate students, online environment

Résumé

Cette recherche porte sur l'utilisation des salles de petits groupes dans les cours en ligne d'une université privée de la Saskatchewan, au Canada. Elle vise à explorer les facteurs qui contribuent à la réussite des expériences d'apprentissage collaboratif des personnes étudiantes aux cycles supérieurs et à identifier les

défis auxquels les personnes étudiantes sont confrontées lors des interactions avec leurs camarades de classe dans les salles de petits groupes. Une approche de recherche qualitative a été utilisée et les données ont été recueillies à l'aide d'une enquête qualitative et d'une discussion de groupe. L'enquête a été distribuée aux personnes étudiantes aux cycles supérieurs dans trois cours en ligne uniques dispensés au sein de la Faculté d'éducation de l'université. Les résultats mettent en évidence une variété d'activités menées dans les salles de petits groupes, allant de discussions ouvertes à des exercices de résolution de problèmes facilités par des outils collaboratifs tels que des documents partagés et Padlet. Les personnes étudiantes ont exprimé leur préférence pour des activités plus simples et plus accessibles, qui favorisaient le travail d'équipe et facilitaient l'échange d'idées entre les membres du groupe. Les défis mentionnés par les personnes étudiantes concernaient l'absence d'instructions écrites pour les activités, la participation inégale ou la domination de certains membres du groupe, et les conflits potentiels résultant de divergences d'opinions. Les recommandations incluent l'exploration plus approfondie d'outils innovants pour améliorer la collaboration virtuelle, des études comparatives entre différents niveaux académiques et des recherches sur les impacts à long terme de l'utilisation des salles de petits groupes sur les résultats d'apprentissage des personnes étudiantes.

Mots-clés : salle de petits groupes, apprentissage collaboratif, personnes étudiantes aux cycles supérieurs, environnement en ligne

Introduction

The online delivery of courses using technology has evolved significantly and continues to attract increasing attention in higher education. The pressing need for technology-supported educational practices has been evidenced by the COVID-19 pandemic that affected most educational systems around the world (Antunes & Farooq, 2022). However, the global shift to online teaching presents a range of challenges to educators in higher education (Nordmann et al., 2020). Emerging evidence from the pandemic further indicates that student engagement, attendance, and learning outcomes declined during the transition to online learning (Hollister et al., 2022).

Breakout rooms have emerged as a potential way to actively engage students and enhance their learning and connectivity in synchronous online classes. The use of breakout rooms has been shown to increase student participation and collaboration compared to classes without such groups (Wachenheim et al., 2023). The advantages of using breakout rooms in online classes include enhanced student learning, improved grades, increased retention, and improved communication and teamwork abilities.

Despite these benefits, more studies into the contextual use of breakout rooms, particularly in Canadian higher education, are needed (Wachenheim et al., 2023). This calls for research that investigates not only the use of breakout rooms in general but also students' preferences regarding specific activities or discussions in virtual environments and their perspectives on collaboration and teamwork opportunities. Additionally, there is a need to investigate preferences for optimal group size in a breakout room.

The aim of this research was to explore graduate students' experiences and perceptions of using breakout rooms in their online classes within the curriculum studies department of the college of education at a private Canadian university. The study sought to identify factors contributing to successful collaborative learning experiences and provide insights into the challenges students encounter during peer-to-peer interaction in breakout rooms.

Research Questions

To accomplish the study's purpose, the following research question guided the investigation: What are the experiences, perceptions, and challenges graduate students face when using breakout rooms at a Canadian higher education institution?

Subsidiary Questions:

1. How are breakout rooms used in online synchronous classes?
2. What are the experiences and perceptions of university students toward participating in breakout rooms in online classes?
3. What are the challenges university students face while participating in breakout rooms in online classes?

Literature Review

Social Constructivism Theory

According to the social constructivist perspective, knowledge is produced by students working together with classmates, teachers, and other students. According to Vygotsky (1978), social interaction is essential for learners in the lifelong process of development, and social learning promotes cognitive growth.

Although Vygotsky was a cognitivist, he disagreed with Piaget's views (Huang, 2021) that learning could be isolated from its social environment. He maintained that learning was the process by which students were integrated into a knowledge community and that learning was more than just the assimilation and accommodation of new information by learners (Vygotsky, 1978).

The social constructivism theory supports the creation of opportunities that enable students to collaborate with peers and teachers to construct their knowledge and understanding through interaction and collaboration. Kapur (2018) asserts that the social construction of knowledge occurs across a variety of contexts and forms, taking place in diverse educational settings where cooperative learning, group discussions, and other modes of in-person or online instruction are found. As students interact with one another, the curriculum, and their environment, they acquire the information and experience needed to lead meaningful lives (Akpan et al., 2020).

According to Akpan et al. (2020), the social constructivism theory permits interaction, collaboration, and interactive techniques for effective learning. These groupings include group discussions, student-led projects or assignments, or discussions in smaller groups. The premise behind

the approach is that students work together in groups, sharing ideas, producing solutions to problems, or simply creating new content to supplement what they currently know. All instructional exercises that students complete in the classroom can be categorised as either written, reading-based, or thought-provoking.

Additionally, social constructivism promotes the idea that engaging in educational activities is worthwhile labour. It provides students with opportunities, improves their ability to work together, and aids in their understanding of new concepts and tactics. It enables them to analyse their thought processes and identify areas in which they need to make revisions (Turner & Patrick, 2004). Zhan (2008) posits that collaborative learning activities have the potential to foster student participation and interaction as they work toward a shared academic objective. Additionally, these activities may heighten students' emotions of fulfilment and community (Alzahrani & Woollard, 2013).

Breakout Rooms in Online Learning

Since the COVID-19 pandemic, breakout rooms are increasingly used within online learning environments (Carr, 2023). Breakout rooms are a separate virtual section of the main classroom or meeting, and as per Chandler (2016), are effective in promoting student engagement and collaborative learning. Read et al. (2022) indicated that engaging in group problem-solving exercises in breakout rooms is beneficial for students since it provides them with a chance to share knowledge with each other. According to Redish et al. (1997, as cited in Saltz & Heckman, 2020), educators have begun investigating the use of gamification and online room narratives to provide a structured framework for breakout room experiences. This approach offers two advantages: it provides students with a clear, problem-based structure and enhances student participation. Similarly, in Ahmed's (2021) research, students were in favour of using breakout rooms for their online classes. The learners believed that small group activities opened the doors for them to have peer interaction. However, there have been some limitations noted in research with regard to moderating breakout rooms in that an instructor can only assist one group at a time, which can be problematic for struggling students. Therefore, instructors must ensure they adequately prepare students for activities before letting them enter the breakout room (Almazmome, 2022).

Breakout Rooms for Student Learning

Douglas (2023) evaluated the effectiveness of breakout rooms in achieving university students' learning through peer-to-peer dialogue. The results concluded that breakout rooms have the potential to facilitate successful peer-to-peer discourse and effective learning. However, the study also concluded that success is highly dependent on students' participation. To ensure that breakout rooms are productively used, educators must set clear tasks and regularly visit breakout rooms to encourage participation and provide support. Thus, establishing clear guidelines and expectations is important to create a positive and effective virtual learning environment. In addition, there are other studies in international settings that support students favouring small group discussions through breakout rooms while increasing students' confidence, social connectedness, and academic benefits (Chacon et al., 2023; Fotaris & Mastoras, 2019; Nisa et al., 2021).

On the other hand, educators must be aware that certain factors contribute to students feeling anxious and pressured to interact with peers in breakout rooms. For this, Wilkins et al., (2023) argued that collaborative learning is successful when the right individuals work together. Their research identified specific learner attributes that contributed to the achievement of purposeful interactions among students such as students' technology readiness, social identification, and intercultural communication competence. As such, creating the right groups is important in having a successful collaboration in an online environment. However, this can become challenging for an instructor especially when students are assigned randomly to a breakout room group.

Similarly, Wali and Tammam (2024) showed that breakout rooms do pose challenges to some students who lack confidence, including overseeing their own learning, following instructions, interacting with a group of unrelated individuals, and completing the given tasks collaboratively at a distance. From these studies, it can be concluded that considering learners' attributes and different challenges they face in breakout room activities is important and to pay attention to these factors when collecting and analysing data for this research.

Breakout Room Environment

A breakout room environment refers to a virtual space where small participant groups work on specific tasks, engage in focused discussions, and collaborate on activities in separate rooms within an online conferencing platform (Chandler, 2016). The design and utilisation of breakout rooms vary across different platforms and settings. A wide range of scenarios or activities can be provided to students in breakout rooms. Veldkamp et al. (2020) found that task-based activities and puzzles are favoured by students as they engage them, challenge their thinking process, and help them finish their group task.

A growing body of research highlights key factors that contribute to effective breakout room experiences in online learning. Almazmome (2022) emphasises that the design of activities and the provision of a supportive online environment are crucial, with careful consideration of task type to enhance student engagement. Building on this, Wachenheim et al. (2023) and Gimpel (2022) underscore the importance of instructor presence, noting that active guidance ensures all group members participate fully and remain focused on the task. Complementing these findings, Douglas (2023) as well as Saltz and Heckman (2020) identify specific strategies that instructors can implement to create an effective breakout room environment, including clear instructions, structured activities, inclusive group formation, time management, technical support, ongoing monitoring and feedback, and fostering a supportive atmosphere. Taken together, these studies convey that both activity design and instructor facilitation are interdependent factors: when thoughtfully combined, they create an environment that maximises student engagement, collaboration, and learning outcomes in online group sessions.

Methodology

Design

A qualitative approach was chosen in gathering data for the given research questions because qualitative design allows researchers to investigate everyday human behaviour in real context (Thomas, 2003) while encouraging the integration of innovative ideas. Moreover, the exploratory design within the qualitative paradigm was most suitable to address the research questions proposed in this study (Merriam & Tisdell, 2015). The purpose of this study was to conduct an intensive examination of the virtual learning context, specifically how breakout rooms help students build on their experiences in online classrooms at a higher education institution in Saskatchewan. The exploratory design enabled us to gain a better understanding of students' experiences and behaviour in using breakout rooms. It also provided flexibility in obtaining pertinent data necessary for the study (Merriam & Tisdell, 2015).

Participants and Context

The participants were graduate students from three online education courses at a private university in Saskatchewan. All the participants belonged to the field of education and were engaged in teaching. A purposive sampling technique was chosen in this research, as it targeted a specific group of students who had some experience with breakout rooms in their online courses (Marshall et al., 2022). All the participants had become aware of and had started using breakout rooms during the COVID-19 period. This criterion was important – the students' familiarity with breakout rooms enabled them to better express their ideas and views during the study (Punch, 2006). The online class sizes ranged from 20 to 25 students from diverse backgrounds, representing many different parts of Canada.

There were 14 survey responses and one focus group discussion, with four students participating in the discussion.

Data Collection Methods

The data were collected through a qualitative survey questionnaire and a focus group discussion. The survey questionnaire contained mostly open-ended questions to provide a broad context for understanding students' experiences within breakout rooms, as well as collecting underlying reasons and motivations to guide the researchers in the focus group discussion (see Appendix A).

The focus group discussion lasted 90 minutes and was conducted online through the Zoom platform. This discussion provided further clarification on the responses gathered from the questionnaire. The questions for the focus group discussion began with general ones and progressed to specific questions based on participant responses. The participants gave their written consent before the discussion was recorded.

Data Analysis

Analysing qualitative survey data included reviewing open-ended responses and comments for a comprehensive understanding. The focus group discussion with the students helped the researchers to

further analyse the descriptive data. As per Saldana (2013), an inductive thematic analysis took place in this research, where the recorded data were first transcribed and reviewed to eliminate errors and inconsistencies. After data cleaning and organisation, different codes were generated and categorised from the data which captured the essence of the students' perceptions. In the next phase, the different categories were merged into themes to pull the data together for further discussion and interpretation.

Results

Use of Breakout Rooms in Online Classes

In their survey responses, the students mentioned that the frequency of breakout room usage varied depending on the course, and on average there were two to three breakout room sessions in a typical online class meeting. The duration of breakout room time depended on the activity for that session, ranging from 15 to 20 minutes per activity. On average, there were three or four students in each breakout room. Some instructors briefly visited breakout rooms during activities, whereas others preferred to let students complete the tasks independently and later offered feedback in the main session. The students in the focus group discussion mentioned that they did not mind the absence of their instructor if the instructions were clear, and they knew what to do in that session. Moreover, a student in the focus group discussion said that "we can actually talk freely and more comfortably when the teacher is not monitoring our discussions. If we need any help, we can always ask for it."

The types of breakout room activities that students engaged in were open-ended group discussions, in which students were given time at the beginning of the class to discuss or talk about any matter of their choice. This first breakout room session was followed by structured problem-solving exercises, case studies, or peer-reviewed tasks. For these sessions, the students used collaborative online tools like shared Word documents and Padlet to work together on a task. The online conferencing platform that was used to house the breakout room activities was Zoom, which was standard across all online courses offered by the university.

Aspects of Breakout Rooms that Facilitate Students' Learning Experience

The majority of the students expressed a preference for breakout room activities that require simplicity in technical skills requirements. The students identified that they felt there was specific allocated time for breakout rooms and that overly complicated activities within a group could hinder the collaboration and discussion. Related to this aspect, a student in the focus group discussion stated, "Since we have limited time in breakout rooms, I think most of us prefer platforms that are easy to use and allow multiple people to work simultaneously." Thus, the students found collaborative tools such as shared Word documents and Padlet easy to use as they were more familiar with them.

The students also emphasised the advantages of open-ended discussion time to foster stronger relationships between classmates. In an online learning environment, it might be difficult for students to share their opinions, ask questions of one another, and foster a feeling of community. However, these unstructured discussions in a breakout room provided students with the right opportunity. A student said

that they "look forward to the open-discussion time," as they are in a smaller group and can comfortably communicate with each other and ask questions regarding the course or upcoming assignment, which at times becomes difficult to communicate in front of the whole class.

Students also stated in the focus group discussion that they preferred having smaller groups of three students to have a proper chance to contribute, receive peer feedback, and ask to clarify questions with each other. A student explained, "it is actually better to have fewer students in a breakout room activity, as we can easily communicate and listen to each other. More students can make things complicated in a group." This finding is important for educators to consider when forming breakout room groups in their online classes.

Challenges of Engaging in Breakout Rooms

Students in the survey and focus group discussion stated that they found it difficult to carry on with a task if clear instructions were not provided in the main room before being assigned to the breakout room. For this, students mentioned that instructions or guidelines should be explained properly beforehand.

Another issue raised by students was unequal participation or possibly dominance by certain group members. Students further explained that in a larger group of more than three students in a breakout room, not everyone can get a chance to participate due to limited time. A student in the focus group discussion mentioned that "Some students who are shy or disinterested do not speak up and are often left out in group discussions." This disparity results in some students dominating the discussion while others contribute less, potentially leading to feelings of isolation or exclusion.

Another point mentioned in the focus group discussion was differences of opinion leading to conflicts. Students said that if group members did not get along well, it could lead to conflicting opinions and disagreements. Moreover, students shared another important element of a breakout room and that was the selection of a spokesperson to represent the group in the main room. A student stated that, "it is easy for some of us to participate actively in small groups as no one is judging us, but we hesitate to speak in front of the whole class once we return to the main room." The reason that was provided by the student was the fear of making a mistake or being judged by other group members in a larger group.

Discussion

Breakout Room Use in Online Classes

This study explored the experiences and perceptions of university students in using breakout rooms in online classes. The first research question dealt with the ways breakout rooms are utilised in online classes. The findings highlighted that the frequency of breakout room sessions varied depending on the learning outcomes of the lesson. Moreover, the duration of breakout room activities varied based on the nature of the task. This adaptability is crucial in maintaining student engagement in breakout rooms and ensuring the time spent in discussion is productive. Shorter sessions may be more suitable for

quick discussions or brainstorming activities, while longer sessions are more appropriate for structured tasks like case studies or problem-solving exercises (Smith et al., 2020).

The group size is also important for maintaining a balance between diverse input and group dynamics. Smaller groups facilitate more active participation from each student, thereby enhancing the collaborative learning experience of the whole group (Nisa et al., 2021; Sharmin & Zhang, 2022).

While the research by Wachenheim et al. (2023) and Gimpel (2022) favour the instructor's presence in breakout room sessions, the data from this research presents a contradictory finding. At the graduate level, the majority of the students do not mind the instructor's absence in breakout rooms. They appreciate the freedom that their instructors provide to them, as they are able to take ownership of their learning and engage more freely with their peers in breakout room sessions (Chandler, 2016). However, to better manage the breakout room sessions, the instructor can provide a clear timeline for the duration of the breakout session, using broadcast messages to communicate with students while they are in a breakout room, as well as indicating the Ask for Help button when required.

Aspects of Breakout Rooms that Facilitate Students' Learning Experience

The second research question looked at the aspects that encourage students' learning, and for this reason, preference is given to breakout room activities that require minimal technical skills. The students in the focus group discussion emphasised that overly complicated activities can hinder collaboration and discussion, which suggests that simplicity in the design of breakout room tasks is crucial for the effectiveness of activities. The need for simplicity aligns with the reported use of user-friendly collaborative tools such as shared Word documents and Padlet, which students find easy to use and conducive to productive collaboration (Read et al., 2022).

Students also highlighted the value of open-ended discussion time within breakout rooms. These unstructured discussions allow for the cultivation of deeper connections among peers, which is often challenging in an online learning environment. Such interactions enable students to share their perspectives, learn from one another, and build a sense of community. As per Tsihouridis et al. (2022), this sense of community is essential for fostering a supportive learning environment, which can enhance student engagement and motivation.

Moreover, the findings by Read et al. (2022) indicate that engaging in structured activities like problem-solving exercises and peer-review tasks in breakout rooms are equally beneficial for students since it provides them with a chance to share knowledge and learn from their peers. Such discussions not only support academic learning but contribute to the social aspect of education, which is particularly important in the context of online learning where students may feel isolated if they are taking the course from a distance.

Challenges of Engaging in Breakout Rooms

The third research question dealt with the challenges students face in breakout rooms. One issue mentioned by the students was the difficulty they encounter when clear instructions are not provided in the main room before being assigned to breakout rooms. To address this issue, students emphasised the

need for clear tasks and suggested that providing instructions in writing would be beneficial. Written guidelines would allow students to refer to them once they are in their breakout rooms, thereby ensuring that everyone understands the task and can proceed efficiently. This recommendation highlights the importance of clear communication and preparedness in online learning environments (Douglas, 2023; Saltz & Heckman, 2020).

Another significant challenge identified by students is unequal participation and dominance by certain group members. In larger groups with more than three students, not everyone gets an equal opportunity to participate in the discussion due to limited time. This situation could result in some students dominating the discussion while others feel isolated or left out. To address this issue, educators should consider forming smaller groups to ensure equitable participation (Ahmed, 2021). Smaller groups facilitate more balanced interactions, allowing each student to contribute meaningfully and preventing any single member from dominating the discussion.

Moreover, conflicts arising from differences of opinion were also mentioned as a concern. Students noted disagreements could occur in a breakout room if group members did not engage well with each other or had completely different personalities. Another key point was raised particularly regarding the selection of a spokesperson to represent the group in the main room. This issue underscores the need for effective conflict resolution strategies and the development of interpersonal skills within the group. Educators can help mitigate these conflicts by providing guidelines for respectful communication and decision-making processes (Saltz & Heckman, 2020). Additionally, rotating the role of spokesperson among group members could ensure that all students contribute equally and fairly in an online class.

Conclusion

This research explored graduate students' experiences with breakout rooms in online classes. The students' survey and focus group discussion responses indicate that the dynamics of virtual collaborative spaces like breakout rooms hold significant promise for enhancing the quality of online education and students' learning. The findings suggest that breakout rooms can provide opportunities for smaller groups to collaborate, converse, and engage in targeted discussions, which may enhance students' communication and engagement. Moreover, the expanding use of breakout rooms as a teaching tool and the necessity for a thorough understanding of how students interact with and interpret this technology have been revealed in the literature research.

By exploring graduate students' experiences with breakout rooms in the context of Canadian online education, this study may inform universities seeking to optimise the use of breakout rooms in online classes. The focus on breakout room experiences was intentionally chosen to provide a more in-depth understanding of how small-group interactions shape learning in virtual environments. These boundaries helped maintain a clear research focus but also introduce certain limitations. The findings may not be generalizable beyond this specific context, as the study involved a relatively small sample of participants from a single institution. Moreover, the exclusive inclusion of graduate students means that

their perceptions and experiences may differ from those of undergraduate learners or students in other disciplines. These contextual and sampling boundaries should be considered when interpreting the findings and assessing their applicability to broader educational settings.

It would be worthwhile to further explore innovative tools and methodologies aimed at enhancing virtual collaboration in breakout rooms. Future research could involve advanced virtual platforms like AI-driven collaborative tools or mixed-reality environments that could elevate student engagement and interaction in breakout sessions. Additionally, conducting a comparative research study between undergraduate and graduate students would provide valuable insights into the use of breakout rooms at different academic levels, shedding light on the differences and adjustments required to cater to the diverse needs of students.

Moreover, it would be valuable to examine the long-term impacts of breakout room utilisation on students' learning outcomes, examining sustained improvements in student achievement, retention of knowledge, and development of critical skills over extended periods. These avenues of inquiry promise to deepen understanding and inform strategic enhancements in online education practices.

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Appendix A

Survey Questions

1. How frequently are breakout rooms utilised in your online classes?

   Never - every other class - every class – other (please specify)

2. On average how many minutes do you spend in a breakout room?

3. a. What types of activities have you typically engaged in within breakout rooms? (Select all that apply)

   - Group discussions
   - Problem-solving exercises
   - Collaborative projects
   - Peer review sessions
   - Other (please specify):

   b. Which activities do you find least interesting and most interesting: _____

   c. Please elaborate on your answer from b _____

4. Rate the extent to which you find breakout rooms useful in enhancing your learning experience, where 1 is "None" and 4 is "To a great extent".

   None - Very little - Somewhat - To a great extent

   Can you elaborate on your answer:

5. Rate the extent to which you feel adequately prepared for breakout room activities in your online classes, where 1 is "None" and 4 is "To a great extent".

   None - Very little - Somewhat - To a great extent

   Can you elaborate on your answer:

6. What challenges if any, have you faced while participating in breakout room activities (Select all that apply)

   - difficulty with technology
   - lack of participation from group members
   - uneven distribution of workload
   - communication barriers
   - other (please specify):

7. How do you think the challenges faced in breakout rooms could be addressed or improved?

8. Rate the extent to which you interact with other participants within breakout rooms, where 1 is "None" and 4 is "To a great extent".

   None - Very little - Somewhat - To a great extent

   Can you elaborate on your answer:

9. Do you prefer online classes with or without breakout room activities?

   With breakout rooms _____; without breakout rooms _____

   Can you elaborate on your answer:

10. Do you believe breakout rooms contribute to a sense of community and connection in your online classes? Yes/No

    Can you elaborate on your answer:

11. Rate the extent to which you feel breakout rooms promote collaboration and teamwork among students, where 1 is "None" and 4 is "To a great extent".

    None - Very little - Somewhat - To a great extent

    Can you elaborate on your answer:

12. Rate the extent to which you find your tutor's presence valuable in breakout rooms, where 1 is "None" and 4 is "To a great extent".

    None - Very little - Somewhat - To a great extent

    Can you elaborate on your answer:

13. Rate the extent to which you find the incorporation of breakout rooms useful in your online classes, where 1 is "None" and 4 is "To a great extent".

    None - Very little - Somewhat - To a great extent

    Can you elaborate on your answer:

14. What aspects of breakout room activities do you find most beneficial to your learning experience?

15. What, if anything, would make your experience with breakout rooms more positive?

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Examining Canadian Undergraduates' Perspectives with Using GenAI for Learning

Examen des perspectives des personnes étudiantes canadiennes de premier cycle concernant l'utilisation de l'IA générative pour l'apprentissage

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Abstract

The rapid emergence of generative artificial intelligence (GenAI) tools presents new opportunities and challenges for higher education, yet little is known about how undergraduate students choose to engage with these technologies. This study examined Canadian undergraduates' perspectives on GenAI as a learning support across three phases of the lecture cycle: before, during, and after class. Using a mixed-format survey ($N = 296$), we analyzed 118 student-written responses through Mayring's qualitative content analysis and mapped themes onto Zimmerman's model of Self-Regulated Learning (SRL). Results indicate that students see GenAI as a versatile cognitive partner—supporting preparation before lectures, engagement and clarification during, and review and assignment help afterward. Students also expressed critical concerns about overreliance, accuracy, academic integrity, and data privacy, which align with vulnerabilities in SRL processes such as self-control, self-evaluation, and help-seeking. Findings highlight a conceptual shift from institutional framings of GenAI as a production tool toward student framings of GenAI as a mechanism for intellectual capacity building. We argue that deliberate integration of GenAI into teaching practices and institutional policies—aligned with SRL subprocesses—can support responsible, student-informed adoption. The study contributes timely evidence for educators and policymakers navigating the pedagogical and ethical dimensions of GenAI in postsecondary learning.

Keywords: generative artificial intelligence, higher education, qualitative research, self-regulated learning

Résumé

L'émergence rapide des outils d'intelligence artificielle générative (IAg) présente à la fois de nouvelles opportunités et des nouveaux défis pour l'enseignement supérieur, toutefois, on en sait encore peu sur la manière dont les personnes étudiantes de premier cycle choisissent d'utiliser ces technologies. Cette étude a examiné les perspectives de personnes étudiantes canadiennes de premier cycle quant au rôle de l'IAg comme soutien à l'apprentissage tout au long des trois phases du cycle d'un cours magistral : avant, pendant et après le cours. À l'aide d'un sondage mixte (n = 296) nous avons analysé 118 réponses écrites par les personnes étudiantes à l'aide de l'analyse de contenu qualitative de Mayring et avons cartographié les thèmes dégagés avec le modèle d'autorégulation de l'apprentissage de Zimmerman. Les résultats indiquent que les personnes étudiantes conçoivent l'IAg comme un partenaire cognitif polyvalent qui les aide à se préparer avant les cours, à participer et à clarifier des points pendant les cours, et à réviser et avoir de l'aide avec les devoirs après les cours. Les personnes étudiantes ont également exprimé des préoccupations critiques liées à la dépendance excessive, à l'exactitude des réponses, à l'intégrité intellectuelle et à la protection des données, lesquelles correspondent aux vulnérabilités dans les processus d'autorégulation tels que le contrôle de soi, l'autoévaluation et la recherche d'aide. Les résultats mettent en évidence un changement conceptuel passant d'une conception institutionnelle de l'IAg comme outil de production à une conception étudiante de l'IAg comme mécanisme de renforcement des capacités intellectuelles. Nous soutenons qu'une intégration intentionnelle de l'IAg dans les pratiques pédagogiques et les politiques institutionnelles—alignée sur les sous-processus de l'autorégulation de l'apprentissage—peut favoriser une adoption responsable et éclairée par les personnes étudiantes. Cette étude apporte des données probantes et opportunes pour les personnes enseignantes et les responsables institutionnels qui naviguent entre les dimensions pédagogiques et éthiques de l'IAg dans l'apprentissage postsecondaire.

Mots-clés : intelligence artificielle générative, enseignement supérieur, recherche qualitative, apprentissage autorégulé

Introduction

The rapid emergence of generative artificial intelligence (GenAI) tools presents both opportunities and challenges for teaching and learning in higher education. Recent studies, such as those by Bittle and El-Gayar (2025) and Wu and Chiu (2025), are shedding light on the ways that GenAI use in postsecondary education is influencing teaching practices, academic integrity, and institutional policies. Yet far less attention has been given to how undergraduate students themselves are navigating and making sense of these tools individually as part of their learning. This gap matters because students are not only the primary users of GenAI in academic contexts, but also the ones whose practices ultimately determine the success of institutional policies and classroom integration (Qu et al., 2024; Soliman et al., 2025; Xu et al., 2025). Understanding their perspectives and practices is therefore critical for aligning technological innovation with pedagogical intent.

Few studies have invited students to describe, in their own voices, how GenAI supports, or could ideally support, their engagement with lectures. In particular, little is known about how students view GenAI across different phases of the learning cycle (before, during, and after class), and how these perspectives connect to broader processes of self-regulated learning (SRL). Zimmerman's (2000) SRL model provides a useful framework for interpreting student expectations of GenAI, as it highlights the cyclical interplay of forethought, performance, and self-reflection. Positioning GenAI within this framework allows us to examine not only how students use these tools, but also how they envision them as supports or potential risks for autonomy, strategy use, and evaluative judgment.

This study addresses these gaps by investigating Canadian undergraduates' perspectives on GenAI as a learning support. Our analysis focuses on two guiding research questions:

1. How do undergraduate students use GenAI to support their learning before, during, and after lectures?
2. What concerns do undergraduate students report about using GenAI in higher education?

By mapping students' reported uses and concerns onto Zimmerman's SRL framework, this study makes two contributions. First, it offers one of the earliest Canadian investigations that systematically integrates student perspectives with a well-established model of self-regulated learning. Second, it provides evidence for a conceptual shift: while institutions often frame GenAI primarily as a production tool, students increasingly view it as a cognitive partner for intellectual capacity building. These insights carry important implications for teaching and policy. Understanding how students conceptualize GenAI can inform more deliberate course design, guide the development of AI literacy initiatives, and support institutional policies that balance innovation with ethical responsibility.

Literature Review

In higher education, leveraging GenAI offers exciting benefits to learners, educators, and researchers. However, alongside these benefits are significant risks involving potential unethical, inappropriate, or incorrect use of these tools. Canadian researchers, e.g. Ally and Mishra (2025) and Chambers and Owen (2024), emphasize the urgent necessity for educational institutions to establish and enforce guidelines, policies, and standards for GenAI's application in higher education (Ally & Mishra, 2025). They advocate for advancing digital literacy across all academic sectors, including ethical usage guidelines pertinent to teaching, learning, assessment, and research. Responding to this call, an Australian team developed the "AI Literacy: Principles of ETHICAL Generative Artificial Intelligence" resource (Eacersall et al., 2024), which seeks to provide a principled framework to develop GenAI literacies and offer pragmatic ethical guidance for researchers addressing the intricate challenges posed by GenAI-enhanced research.

A survey conducted by Shaw et al. (2023) involving 1,600 postsecondary students and 1,000 faculty members revealed a notable usage gap. More than twice as many students (49%) as faculty (22%) reported using GenAI, with usage trends rising among both groups. Furthermore, a U.S. survey

involving 361 undergraduates indicated that two-thirds perceive GenAI as enhancing learning, provided it is employed responsibly and ethically (Holechek & Sreenivas, 2024).

Ally and Mishra (2025) propose several critical policy considerations for AI in higher education, which range from technological access and data privacy to AI ethics, teaching methodologies, academic integrity, cost implications, and sustainability. They underscore the importance of institutions setting clear AI policies and investing in educational programs and training to foster AI competencies, thereby enhancing learning, teaching, and research priorities.

In this study, we delved into understanding how Canadian undergraduate students navigate the use of GenAI supports around their lectures and their concerns about GenAI in higher education. We also aimed to identify the types of support that can maximize students' effective use of GenAI tools for learning. Research synthesis reveals intriguing trends in GenAI utilization; for instance, a large-scale survey from China highlights widespread academic use across various educational settings (Yang et al., 2025). Additionally, experimental studies have shown that GenAI can significantly enhance learning outcomes when aiding task completion (Yang et al., 2025). Comprehensive behavioural analyses also emphasize diverse usage patterns among students from content creation and metacognitive prompts to language refinement, especially in autonomous learning and STEM-related environments (Ammari et al., 2025; Sajja et al., 2025; Wang et al., 2024).

It is crucial to recognize that GenAI's role spans numerous learning activities at the undergraduate level. Golding et al. (2024), in their exploration of college students' engagement with GenAI, found students were well-acquainted with these tools but primarily sought them for assignment assistance. Johnston et al. (2024) discussed students' views on technologies like ChatGPT, revealing general hesitance toward using GenAI for writing entire essays, with a call for universities to facilitate meaningful integration. Factors such as perceived usefulness and autonomy emerge as pivotal predictors in students' decisions to use GenAI educationally (Soliman et al., 2025). Tang et al. (2025) similarly identified facilitating conditions and social influence as significant drivers of this adoption. Through these insights, we connect with the evolving landscape of GenAI in academic settings, inviting thoughtful conversation and innovation.

Specific applications of GenAI in education are catching attention across the academic landscape. Johnson and Doss (2024) discovered that undergraduate agriculture students adeptly engaged ChatGPT for microcontroller programming, highlighting its role in technical disciplines. Guillén-Yparrea et al. (2024) shed light on GenAI's resonance within higher education, particularly among engineering cohorts, revealing a prevalent use of ChatGPT but also noting the less enthusiastic perspective of their professors. This discussion continues with Sun and Zhou (2024), who emphasize in their meta-analysis how students are harnessing GenAI for both learning and academic performance enhancement. Other vital factors, such as AI literacy and varying disciplinary norms, surface through the investigations of Wang et al. (2024) and Qu et al. (2024), painting a broader picture of this evolving educational tool.

Diving into studies from various fields, we find undergraduates employing GenAI in manifold ways to bolster their learning journey, both within and outside the classroom. For instance, Chambers

and Owen (2024) detail how introductory psychology students used chatbots to clarify complex concepts, prepare for exams, and assist in essay tasks. Additionally, Hamerman et al. (2025) engaged with 115 U.S. business students in a survey and a subsequent case study, illustrating GenAI's impact on homework approaches. Razmerita's (2024) interviews investigate business students' chatbot adoption, balancing the benefits and challenges it presents. Comprehensive analyses, utilizing case studies, intervention, and various mixed methodologies, paint a vibrant landscape owing to scholars like Aure and Cuenca (2024), Holecheck and Sreenivas (2024), Huang et al. (2024), and Johri et al. (2024). Through these collective explorations, encompassing over 900 students, GenAI emerges as a compelling academic ally.

In exploring the variety of GenAI tools used in academic environments, ChatGPT emerges frequently in the literature. However, individual studies have also highlighted the application of other tools, such as Bard, Gemini, Perplexity, Elicit, Tiimo Vercel, My AI, essaywriters.ai, Microsoft Bing, Dall-E, Midjourney, Copilot, and Claude. These tools serve multiple roles, particularly as brainstorming partners, writing tutors, and real-time feedback coaches (Aure & Cuenca, 2024; Hamerman et al., 2025; Rasmerita, 2024). Their use spans various phases of education, evident in business education, introductory psychology, undergraduate research methods, and technology courses, both before and after lectures (Aure & Cuenca, 2024; Chambers & Owen, 2024; Huang et al., 2024; Johri et al., 2024).

What insights can we gather directly from students about the utilization and benefits of GenAI tools? Undergraduate students, in various studies, express that these tools significantly enhance their research efficiency by simplifying the extraction of key findings and unraveling complex concepts, thus improving comprehension (Aure & Cuenca, 2024; Chambers & Owen, 2024). They further note improvements in academic writing, exam performance, and the generation of writing ideas while analyzing large datasets (Hamerman et al., 2025; Holechek & Sreenivas, 2024). These tools facilitate studying through diverse formative e-assessments and boost overall productivity by providing prompt responses and fostering personalized, collaborative learning opportunities (Johri et al., 2024).

Students who feel they benefit from GenAI tend to use it more frequently. Hamerman et al. (2025) found a correlation between students' perceived peer usage and their own GenAI utilization. Gender differences are apparent too, with males using these tools more often, although perceptions of GenAI as academic dishonesty deter usage. Johri et al. (2024) highlighted awareness among students about potential pitfalls such as inaccuracies and overreliance, alongside ethical concerns like cheating and privacy risks. Rasmerita (2024) emphasizes that despite these challenges, students overwhelmingly believe GenAI benefits outweigh its drawbacks, enhancing learning if used appropriately, though they note concerns like flawed referencing and ethical dilemmas.

Proactive teaching strategies are key to integrating these tools effectively. Studies recommend scaffolded assignments, critical evaluation, and metacognitive reflection to mitigate ethical and academic integrity concerns, promoting a balanced approach to GenAI use in educational contexts (Johri et al., 2024).

Methodology

Given the study's aim to capture broad patterns in how undergraduate students use GenAI as a learning support, as well as to gather more detailed perspectives in their own words, we employed a mixed-format survey methodology that combined select-response and open-ended questions. This approach was selected for its ability to balance breadth and depth: the structured, close-ended items enabled us to map usage patterns across a larger and more diverse group of students, while the open-ended prompts provided richer qualitative insights into students' expectations, practices, and concerns. We contend that this survey design is particularly suited to emerging areas of educational technology research, where exploratory evidence is needed both to identify widespread trends and to surface nuanced, context-specific perspectives. Given our focus on student use patterns, we did not include questions on the learning modality or the instructor's role.

The survey design allowed us to capture students' reflections across the full lecture cycle before, during, and after class thereby situating GenAI use within the temporal rhythm of academic learning. This framing was informed by SRL theory, which emphasizes the cyclical interplay of forethought, performance, and reflection. By aligning survey questions with these phases, we were able to explore not only the functional tasks students associate with GenAI, but also the metacognitive and motivational processes they perceive it to influence. The combination of quantitative and qualitative data therefore provided a multidimensional picture of student engagement with GenAI, enabling us to examine both the prevalence of practices and the meanings students ascribe to them.

Ethical approval of the study protocol was granted, and participants were recruited from undergraduate programs at a large research university in Western Canada. The team combined digital and in-person recruitment strategies to maximize outreach and response rates. An invitation to participate in an anonymous online survey was disseminated via email to all associate deans and department heads of undergraduate programs across all disciplines, with a request to forward the questionnaire link to undergraduate students. While this method allowed for broad potential reach, the response rate to email recruitment was low.

A supplementary recruitment strategy had members of the research team visiting several busy areas on campus to approach students directly with a flyer inviting them to complete the survey. We also distributed the flyer, with a brief study description and QR code that linked to the survey, in high-traffic areas. This face-to-face method and use of flyers proved significantly more effective in generating responses, as it allowed for immediate engagement and clarification of the study's purpose, thereby increasing rates of student participation. Overall, 296 students submitted survey responses, and were only allowed to enter once. In this paper, we focus analysis on the 118 textual responses that participants submitted to four open-ended survey questions.

Qualitative Content Analysis

In exploring how students conceptualize the ideal GenAI support surrounding their lectures, we utilized Mayring's (2014, 2021) qualitative content analysis as our guiding methodology. This structured

method enables an inductive analysis of textual data, facilitating the iterative categorization and interpretation that helps uncover underlying themes. We examined responses aligned with four open-ended questions: *Ideal Support Before a Lecture* (24 responses), *Ideal Support During a Lecture* (16 responses), *Ideal Support After a Lecture* (44 responses), and *Student Concerns about AI* (34 responses). Mayring's criteria were applied uniformly to each question set, as exemplified through the analysis of data from the *Ideal Support Before a Lecture* section. Following Mayring's structured approach, our initial step involved defining the analytic material as comprising 24 written statements from students responding to the survey question on ideal GenAI support before lectures. These data were collected within a broader online questionnaire addressing students' experiences and expectations with GenAI in higher education. Each bullet-pointed response was treated as an individual coding unit, facilitating a clear, inductive analysis. Our goal was to derive meaningful categories and reveal thematic patterns, capturing participants' expectations for GenAI's role in preparing for learning experiences.

In considering our conceptual framework, our analysis was guided by the research questions we posed. We embraced an inductive category development approach to organically generate categories directly from our data. To achieve this, we engaged in a systematic procedure of paraphrasing, generalization, and reduction of individual statements to encapsulate their essential meanings, ultimately forming overarching categories. We valued every bullet-point statement as a coding unit, each one representing a distinct insight or perspective shared by a participant. For example, statements were paraphrased to reveal their core essence; "Summarizing lecture slides before class" evolved into "summarizing lecture content." These paraphrased statements were then grouped into thematic clusters following Mayring's (2021) approach; the first author conducted the initial clustering, and the second author independently reviewed and verified the categories: Content Summarization, including tasks like summarizing readings and upcoming topics; Definitions and Key Concepts, capturing efforts like providing definitions and deconstructing concepts; Learning Objectives and Preparation, where objectives and preparation strategies were outlined; Reviewing Previous Material; and Question Preparation.

To reduce the number of themes, we simplified and structured each thematic cluster, thoughtfully merging closely related clusters. For instance, Content Summarization and Definitions and Key Concepts were united into the broader category of Content Understanding. Similarly, we integrated Learning Objectives and Preparation, Reviewing Previous Material, and Question Preparation into the category of Learning Preparation.

Finally, in our categorization stage, we delineated two principal categories: (1) Content Understanding, encompassing the summarization of readings and lecture materials and the explanation of key terms and concepts; and (2) Learning Preparation, which includes the identification of learning objectives, support for class and content organization, reviewing prior content, formulating questions, and familiarizing with upcoming topics.

To validate our two primary categories, we carefully reviewed and reassigned each original statement into one of these final categories. For example, statements such as "summarizing unread texts" or "breaking down concepts" were thoughtfully placed under Content Understanding, while those like

"assisting with class preparation" or "helping prepare questions" were classified under Learning Preparation. In the concluding analysis and thematic interpretation, our category framework revealed much about the data: Content Understanding mirrored students' desire for concise summaries and clear elucidations of the materials, while Learning Preparation focused on organizational assistance, goal setting, and cognitive readiness before lectures. Throughout the initial phases of our analysis, Mayring's (2021) method of content analysis guided us and provided a systematic path through incorporating and considering all textual data from all four questions.

Results

Through our qualitative content analysis, we discovered something interesting: students seem to view GenAI as an adaptable learning companion that supports them at every stage of the lecture cycle before, during, and after class. This insight, quite excitingly, linked seamlessly with our interpretation of the SRL model. Greene and Azevedo (2007), along with Panadero (2017), have extensively discussed these phases and subprocesses within self-regulated learning, which helped us draw parallels between our thematic patterns and their scholarly work. Zimmerman's (2000) model of SRL provides a valuable foundation that underscores this alignment. In the sections that follow, we delve deeper into how we interpreted how the themes correspond to Zimmerman's model of SRL (Figure 1).

Support Before the Lecture

Before our lectures, many students found themselves seeking help to better organize and orient their learning activities – a collection of actions providing a hallmark of the Forethought phase in SRL. The most frequent scenario they described involved summarizing lecture content and the preparatory materials, like slides and readings. This kind of support is seen as pivotal for task analysis, aiding students in assessing scope, relevance, and pinpointing the conceptual focus during this foundational phase. Furthermore, students voiced a clear need for GenAI by identifying and explaining complex terms and concepts, aligning with both the task analysis stage and the performance phase's self-control subprocess (Panadero, 2017). They wanted content reformulated in a way that feels cognitively approachable. Additionally, students pointed out the crucial role of GenAI in defining learning objectives and creating strategies for preparation. Engaging in reviewing past materials, drafting potential questions, and diving into new topics showcases strategic planning and self-judgment, reflecting students' keen awareness of the cyclic, metacognitive journey of learning preparation.

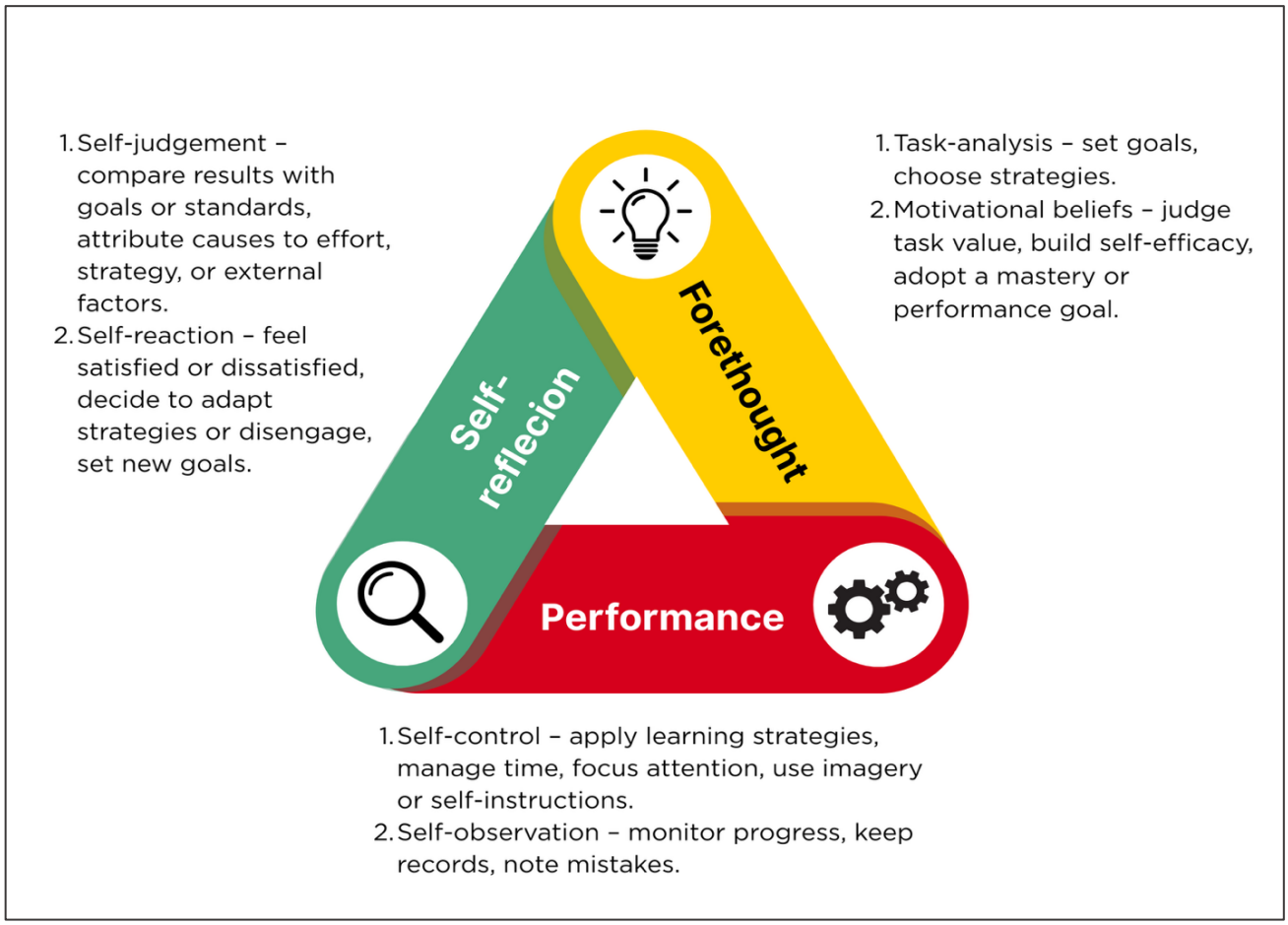
Support During the Lecture

During our lectures, we framed GenAI as a real-time cognitive aid aimed at enhancing learning performance. Students expressed hopes for support in three main areas: (1) transcription and notetaking, (2) immediate clarification and questioning, and (3) ongoing engagement with instructional content. These anticipations align with the performance phase of SRL, particularly the aspects of self-control, like effective notetaking and time management, self-observation, such as recognizing real-time confusion, and task strategies, including problem-solving and maintaining focus. For instance, students

saw automated transcription and summarization as means to reduce cognitive load, allowing them to focus more on comprehension and elaboration rather than on manually documenting information. The capacity to ask questions and receive instant clarification from GenAI tools appeared integral to help-seeking and self-observation processes, especially when instructors were not immediately available. Moreover, students described GenAI as a scaffold for active participation and comprehension through its adaptive ability to track and elucidate lecture content dynamically.

Figure 1

Zimmerman's Model of Self-Regulated Learning



Note. Zimmermann (2000).

Support After the Lecture

After attending lectures, many students increasingly turn to GenAI to consolidate their knowledge, review materials, and apply new concepts, a trend that aligns with the self-reflection and performance phases of SRL. Students commonly employ GenAI for self-evaluation by generating summaries, practice quizzes, and flashcards which are tools crafted to both assess and enhance their understanding. Moreover, they appreciate GenAI's capability to explain complex concepts, offer detailed explanations, and provide tailored feedback, directly supporting their elaboration and self-reaction

processes during learning. An emerging critical application of GenAI within academic settings is its use for assignments and homework, with students frequently seeking assistance in understanding tasks, completing them, and managing their study plans. This behaviour ties into resource management, task strategy execution, and help-seeking, suggesting GenAI's dual role as a mentor and study manager. Additionally, students rely on GenAI for organizing notes, scheduling study sessions, and linking various resources, which corresponds with strategic planning and resource management. We have synthesized these findings and mapped the expectations and SRL processes throughout the lecture timeline in Table 1. In our subsequent analysis phase, we delve deeper, using SRL theory as a lens for the deductive interpretation of themes identified during the inductive phase.

Concerns About GenAI Use in Education

In response to the fourth question regarding the use of GenAI in education, our exploration reveals insightful perspectives from students. Although there is palpable enthusiasm for integrating GenAI into academic routines, students demonstrate a crucial awareness of its inherent risks and limitations. Many concerns align closely with vulnerabilities identified in the SRL framework.

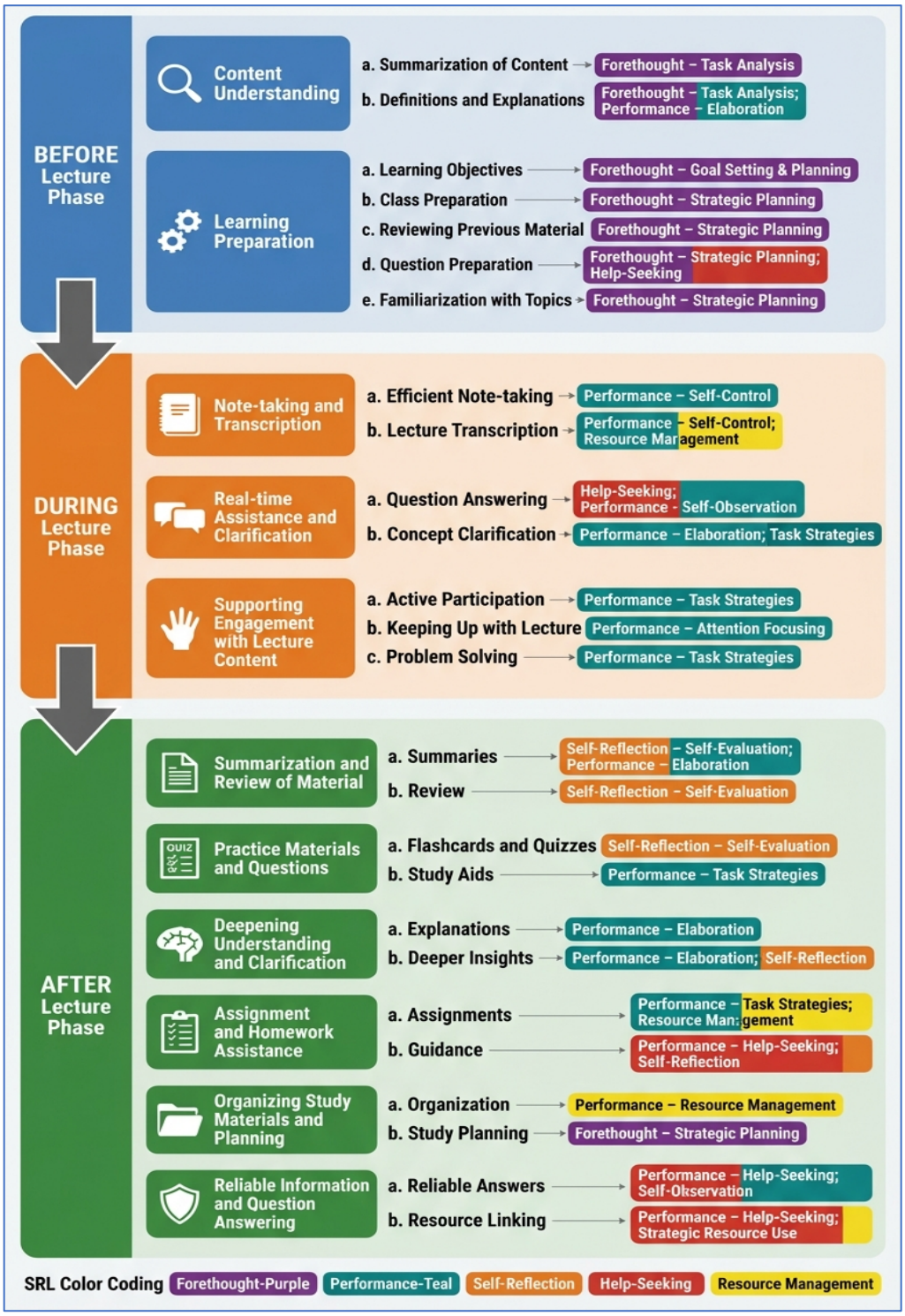
Firstly, students perceive overreliance on GenAI as potentially detrimental to developing self-control and sustaining motivation. They worry that consistent AI support might dampen independent learning, impede critical thinking, and reduce engagement with tough material. Such observations echo findings in the existing SRL literature.

Secondly, concerns about content accuracy and contextual appropriateness surface prominently. Students express that unreliable AI outputs could jeopardize their self-evaluation processes, offering misleading benchmarks for academic performance. Ethical considerations were another significant theme. Many students voice apprehensions about crossing academic integrity boundaries such as plagiarism or unauthorized assistance in the absence of explicit institutional guidelines. These ethical concerns could disrupt strategic help-seeking behaviours, a core aspect of SRL. Additional points of concern include apprehensions regarding data privacy, algorithmic bias, and a lack of transparency in AI decision-making processes, which were topics repeatedly emphasized in student feedback.

Ultimately, these reflections highlight how students' concerns relate to the potential impact of GenAI on self-regulated learning. Their critical awareness of overreliance, inaccuracies, and ethical dilemmas underscores GenAI's dual role: both a tool for intellectual capacity building and a potential challenge in educational contexts. Students' perspectives reflect their nuanced understanding of GenAI within the educational sphere, paralleling the institutional portrayals of GenAI as a productive tool.

Figure 2

Mapping Student Use of GenAI Across Lecture Phases Using Self-Regulated Learning Processes



Note. Figure created with Nano Banana AI.

Interpretation of Qualitative Data Through SRL Lens

Taken together, the mapping of themes with phases of SRL suggests that students conceptualize GenAI as more than just a production tool, contrary to the framing in many institutional discourses, and regard it as a mechanism for intellectual capacity building. Student expectations for GenAI reflect an integrated understanding of cognitive, metacognitive, and motivational needs across all phases of the SRL process. However, this vision is tempered by an acute awareness of GenAI's potential to disrupt SRL processes. The risk of reduced learner autonomy (*self-control*), impaired evaluative judgment (*self-evaluation*), and ethical ambiguities (*strategic use*) suggests a need for pedagogically guided integration of GenAI in higher education settings. These tensions between enhancement and erosion of SRL highlight the importance of designing GenAI systems that support rather than supplant students' self-regulatory capabilities.

Discussion

This study explored how undergraduate students use GenAI tools to support learning before, during, and after lectures, and documented their concerns about GenAI in higher education. Through qualitative content analysis, we identified that students envision distinct, phase-specific roles for GenAI: preparation (e.g., summarizing materials), real-time support (e.g., note-taking, clarifications), and post-lecture consolidation (e.g., review aids, assignment assistance). These expectations aligned closely with Zimmerman's (2000) SRL, highlighting subprocesses such as task analysis, strategic planning, self-control, self-evaluation, and help-seeking. However, students also expressed critical concerns, emphasizing risks such as overreliance on GenAI weakening self-control and motivation, inaccuracies undermining self-evaluation, and ethical issues related to academic integrity, data privacy, and responsible use.

Our study makes a unique contribution to ongoing discourse by explicitly mapping undergraduate students' use of GenAI onto Zimmerman's SRL framework, systematically aligning student expectations with SRL subprocesses across instructional phases. Prior research has broadly discussed GenAI usage patterns and ethical considerations (e.g., Ally & Mishra, 2025; Shaw et al., 2023), but the structured alignment presented here extends existing insights into how students actively self-regulate their learning with GenAI tools through metacognitive and motivational engagement. This alignment resonates with recent empirical findings, underscoring the synergistic interaction between learner characteristics and GenAI affordances to enhance SRL capacities, particularly through personalized feedback, positive attitudes, and strategic engagement (Wu & Chiu, 2025). Furthermore, our results align with Pan et al. (2025), who found that GenAI-enabled interactive personalized support significantly boosted university English as a foreign language learners' self-regulated strategy use and reading engagement, highlighting GenAI's role in fostering deeper cognitive engagement and strategic reading processes. Additionally, our findings reinforce the argument made by Xu et al. (2025) that GenAI, while supporting learning tasks effectively, also presents risks such as decreased self-regulatory effectiveness if not coupled with adequate metacognitive scaffolding.

Moreover, our findings reveal a critical conceptual shift: while institutions often frame GenAI primarily as a production-focused tool, emphasizing outputs and raising concerns about academic integrity and cheating, students perceive these technologies fundamentally differently, viewing them as tools for intellectual capacity building. Echoing Chu's (2025) conceptualization of GenAI as a tool for thinking, students describe GenAI as a collaborative partner that supports intellectual labour, facilitates deeper understanding, and fosters critical engagement. This student-oriented view aligns closely with findings from Fayaza and Senthilrajah (2025), who demonstrated that interaction with GenAI aids students in grasping complex concepts, thereby improving intellectual capacity and information retention, though they caution that improper use could negatively affect skills development. Extending this perspective, Qu et al.'s (2025) meta-analysis revealed that GenAI significantly enhances lower-order cognitive outcomes, such as understanding and application of concepts, while also influencing higher-order cognitive skills, indicating a direct impact on students' intellectual growth. Daniel et al. (2025) further substantiate GenAI's contribution to academic skills development, framing it explicitly as a tool for intellectual enhancement. Likewise, Yusuf et al. (2025) acknowledge GenAI's capability to manage complex tasks, hinting at its potential to engage and develop sophisticated intellectual abilities. Collectively, these findings underscore the importance of reframing GenAI integration in education from a purely production-centric perspective to one that emphasizes cognitive support, intellectual agency, and deeper learning.

Limitations

Our methodological approach provided insights while presenting several important limitations. Using a qualitative survey methodology enabled us to efficiently capture diverse student perspectives across various disciplines, enhancing the generalizability of our findings beyond disciplines typically overrepresented in qualitative research, such as engineering or computer science. Furthermore, employing face-to-face recruitment strategies combined with QR-coded flyers improved response rates compared to email-based recruitment alone, underscoring the importance of direct student engagement. However, the reliance on open-ended questions within our survey design restricted the depth and context-specific detail of responses, limiting our ability to probe or clarify student answers. As a result, we likely missed nuanced explanations of how students use GenAI tools differently across learning contexts or for the same tasks (e.g., summarization) in varied ways. Additionally, the absence of demographic analysis (e.g., gender, year of study, previous GenAI experience, learning modality) further constrains our understanding of how different student populations perceive or engage with GenAI. Future research could address these limitations through complementary qualitative methods, such as interviews, focus groups, or diary studies, allowing for deeper, context-rich exploration of students' real-time interactions, evolving perceptions, and individual differences regarding GenAI tools across diverse learning scenarios.

Practical Recommendations for Teaching and Policy

Educators should intentionally integrate GenAI tools into course designs that mirror the phases of SRL. Before lectures, instructors can assign tasks that use GenAI for summarizing readings, defining key concepts, and setting learning goals to foster task analysis and strategic planning. During class, GenAI can support real-time notetaking, on-the-fly clarification, and prompts for reflection to strengthen self-control and help-seeking behaviours. After lectures, structured activities such as GenAI-generated practice quizzes, flashcards, and guided review prompts can reinforce self-evaluation and elaboration. To address student concerns, instructors should embed explicit discussions and reflective exercises about overreliance, accuracy, and academic integrity. For example, brief in-class exercises comparing AI-generated and human-created summaries can sharpen evaluative judgment, while ethics case studies can enhance awareness of responsible use. At the policy level, institutions should shift from restrictive bans toward comprehensive frameworks that emphasize digital literacy, capacity-building, and ethical guidance. This includes offering workshops on effective GenAI use, developing clear guidelines that balance innovation and integrity, and providing ongoing support for faculty to co-design assignments that leverage GenAI as a cognitive partner. By aligning teaching practices and policies with students' nuanced understanding of GenAI as a tool for intellectual capacity, higher education can foster responsible, self-regulated learning.

Conclusions and Next Steps

The findings highlight the importance of conceptualizing GenAI not solely as a single-purpose technology but as a dynamic support system that can be tailored to each phase of the learning cycle. Students' reported use demonstrates that AI can augment—and not supplant—their active engagement with course material. In practice, instructors should embed GenAI tools deliberately into their course design, providing clear guidance on ethical and effective usage before, during, and after lectures. Such integration can cultivate critical digital literacy and address student concerns about overreliance, misinformation, and academic integrity. Future research would benefit from more granular qualitative approaches such as in-depth interviews or diary studies to observe students' real-time interactions with GenAI across varied learning contexts. It should also include the learning modality and the instructor's role, as well as specifying learning outcomes, to make the impact more visible and comparable with other research. Comparative investigations across different institutions, disciplines, or cultural settings could reveal broader patterns in GenAI adoption. Finally, the ethical issues raised by students including data privacy and intellectual autonomy demand focused attention from both researchers and developers to ensure GenAI's responsible and supportive role in higher education.

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Experiential Learning to Support Digital and Artificial Intelligence Literacies in Postsecondary Education

Apprentissage expérientiel pour soutenir la littératie numérique et en intelligence artificielle en enseignement supérieur

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Abstract

This mixed-methods study examined how experiential learning theory (ELT) can support the development of digital and artificial intelligence literacies in postsecondary education through the integration of generative artificial intelligence (GenAI) tools. Guided by ELT's four-stage cycle, concrete experience, reflective observation, abstract conceptualisation, and active experimentation, this study explored how students engaged with GenAI to enhance their learning, critical thinking, and ethical awareness. Data were collected from 17 students and one instructor through surveys and semi-structured interviews. Descriptive and thematic analyses revealed that students initially identified as beginners in GenAI use, employing the technology primarily for functional tasks such as organizing information or conducting surface-level research. Through experiential engagement and guided reflection, students demonstrated growth in confidence, ethical understanding, and critical evaluation of AI-generated outputs. Instructor findings converged with student perspectives, emphasizing the value of scaffolded, reflective engagement for literacy development. The integration of quantitative and qualitative results underscored the effectiveness of experiential learning in a GenAI-designed course.

Keywords: artificial intelligence literacy, ethics, experiential learning theory, digital literacy, generative artificial intelligence

Résumé

Cette étude à méthodes mixtes a examiné la façon dont la théorie de l'apprentissage expérientiel (AE) peut soutenir le développement de la littératie numérique et la littératie en intelligence artificielle dans l'enseignement supérieur grâce à l'intégration d'outils d'intelligence artificielle générative (IAg). Guidée par le cycle en quatre étapes de l'AE, à savoir l'expérience concrète, l'observation réfléchie, la conceptualisation abstraite et l'expérimentation active, cette étude a exploré la manière dont les

personnes étudiantes ont utilisé l'IAg pour améliorer leur apprentissage, leur esprit critique et leur conscience éthique. Les données ont été recueillies auprès de 17 personnes étudiantes et d'une personne enseignante à l'aide de sondages et d'entretiens semi-structurés. Des analyses descriptives et thématiques ont révélé que les personnes étudiantes initialement identifiées comme débutantes dans l'utilisation de l'IAg utilisaient principalement cette technologie pour des tâches fonctionnelles telles que l'organisation d'informations ou la réalisation de recherches superficielles. Grâce à une approche expérientielle et à une réflexion guidée, les personnes étudiantes ont démontré une amélioration de leur confiance, de leur compréhension éthique et de leur évaluation critique des résultats générés par l'IA. Les conclusions de la personne enseignante ont convergé avec les points de vue des personnes étudiantes, soulignant la valeur d'une approche étayée et réfléchie pour le développement des compétences. L'intégration des résultats quantitatifs et qualitatifs a mis en évidence l'efficacité de l'AE dans un cours conçu par l'IAg.

Mots-clés : littératie en intelligence artificielle, éthique, théorie de l'apprentissage expérientiel, littératie numérique, intelligence artificielle générative

Introduction

The pace at which generative artificial intelligence (GenAI) has unfolded in education has been unprecedented (Adiguzel et al., 2023; Pelletier et al., 2022). As such, its influence on the field of education is now being considered in relation to the learning sciences and subsequent implications for course design, assessment, and the methods instructors employ to support digital and AI literacy for postsecondary students (Atlas, 2023; Chan & Hu, 2023). The advent of GenAI has significantly reshaped various landscapes, including education. GenAI, which includes models such as GPT-4 and tools such as DALL-E, can create text, images, and other content based on input data (i.e., large language models), presenting new opportunities for enhancing learning experiences.

In postsecondary education, where fostering critical thinking, creativity, and deep engagement is crucial, integrating GenAI tools into pedagogical practices can be transformative and deeply cultivate these competencies. The UNESCO framework for AI in education served as a rich foundation for informing this study and how well these learning opportunities prepare postsecondary students for the digital age (Chan & Hu, 2023; Floridi & Cowls, 2021). For example, the framework emphasizes the importance of four tenets of AI literacy: (a) recognizing and understanding AI, (b) using AI effectively, (c) critically assessing AI, and (d) ethical considerations of AI to be of primary focus in postsecondary teaching and learning environments (Castro et al., 2024). In this way, the UNESCO framework provided not only a conceptual backdrop but also a policy-aligned lens through which to examine how postsecondary education can cultivate informed, responsible, and reflective AI users.

This study explored the integration of GenAI in postsecondary education through the lens of experiential learning theory (ELT) to develop digital and AI literacies. In this postsecondary classroom context, learning was inquiry-based and in many ways experiential due to the nature of GenAI and digital technologies (Doolittle et al., 2023). Despite the rapid adoption of GenAI in higher education,

there is a dearth of information in the literature and research on how GenAI-specific courses can support domain-specific learning and AI literacy development in an authentic way. Therefore, the objective of this study was to examine how ELT can support the development of digital and AI literacies in postsecondary education through the integration of GenAI tools. This mixed-methods study provides a unique contribution with the integration of ELT with GenAI literacy. The nuanced look at students' literacy development contributes to an emerging area in this field.

To achieve this, the study leveraged ELT to understand how GenAI can be used to facilitate each stage of the learning cycle, including how students interact with GenAI case simulations, how students analyze and reflect on their interactions with GenAI, the theoretical insights students develop during their learning and reflection, and how students can apply their new knowledge in practical scenarios facilitated by AI tools. Understanding effective GenAI integration is vital for educators, policymakers, and AI developers, as it strengthens teaching practices, guides policy development, and enhances students' digital and AI literacies.

The course under study was a bachelor-level elective offered within a Canadian postsecondary institution focused on digital and AI literacy through the lens of innovation and entrepreneurship. The course was intentionally designed to integrate experiential learning processes with the use of GenAI tools, enabling students to engage directly with technologies, shaping professional and academic contexts. The overarching objectives of the course were to (a) build foundational knowledge of AI and its ethical implications, (b) develop digital and AI literacies through applied learning tasks, and (c) cultivate critical reflection, creativity, and problem-solving using GenAI in real-world scenarios.

Enrollment was open to students from undergraduate, graduate, and doctoral levels across multiple disciplines, including business, communication, education, computer science, and the social sciences. This interdisciplinary structure was deliberate, aligning with the university's emphasis on transdisciplinary learning and collaboration. The pedagogical design emphasized cross-disciplinary interaction, encouraging students to apply GenAI tools to authentic problems relevant to their own academic or professional domains.

Specifically, in this university context, a course was immersive to ensure course content was geared toward learning about GenAI tools and platforms, prompt engineering, and no-code coding nested in a business and innovation context. In the course, students had in-person and asynchronous learning through instructor-led exploration and an online discovery forum housed in the D2L (https://www.d2l.com/) shell. The weekly classes focused on prompt generation, no-code coding, image content creation, and investigating other GenAI tools used in industry and by entrepreneurs in various sectors, including fintech, medicine, and education services.

Additionally, weekly guest lecturers from education and industry extended the real-world context of AI and GenAI use. The course sequence started with a focus on learning the essentials of AI and using AI effectively, and then moved strategically to critically assessing AI and its ethical implications. Within this intentional flow, students had the opportunity to learn and practice prompt engineering with various large language models (LLMs), work through case-based studies of recent adoption cases, and fold in contextual facets of the guest lecturers' lived experiences.

Students had multiple opportunities to explore, engage in structured play, and bring back their ideas and feedback to each class or engage on the discovery forum, where class members, teacher assistants, and the instructor posted probative questions and real-time content updates. This discovery forum provided a space for everyone despite the range of familiarity with GenAI, coding, and the content touchpoints for the course that were directly related to the assessments and learning tasks to share and interact with each other in the spirit of discovery. For the final assessments, students completed a prompt validation exercise, curation of contributions and sharing within the discovery board, and a summative transdisciplinary project whereby a group of four students from different academic levels and disciplines explored a complex problem within their community that could be solved using some form of AI.

From an experiential learning lens, the authenticity of learning was heightened as students could learn in a way that helped them experience facets of the real-world approach and, in this case, digital and AI tools being used in industry (Lu et al., 2021; Matook et al., 2021). ELT provided the theoretical lens for this study, offering a framework to understand how students develop digital and AI literacies through stages of concrete experience, reflection, conceptualisation, and experimentation (Kolb, 1984; Kolb & Kolb, 2017).

Literature Review

GenAI in Education

GenAI has been increasingly recognized for its potential to transform educational practices. Artificial intelligence tools can provide personalized learning experiences, create dynamic educational content, and facilitate interactive learning environments (Holmes et al., 2019). Studies have shown that AI can support differentiated instruction, catering to individual student needs and learning paces (Kim & Adlof, 2024; Zawacki-Richter et al., 2019). Furthermore, AI-generated simulations and scenarios can offer immersive learning experiences, and enhance student engagement and understanding (Lu et al., 2018; Rasul et al., 2023).

GenAI can precipitate the creation of tailored educational content by adapting to individual student learning approaches, cadence, and engagement points (Qureshi, 2023). For example, in this course, the tasks afforded students the opportunity to take personalized approaches to prompt engineering and validation as well as targeted explanations to problem sets distinct to a student's interest areas (Thompson et al., 2023). Additionally, students who did not speak English as their primary language could use real-time language translations and attain simplified versions of complex materials in order to build their understanding in varied ways (Slimi, 2023). In this diverse postsecondary classroom setting, GenAI content, tools, and integration processes supported diverse learners at multiple stages of technological understanding (Turner et al., 2024).

From a competency or skill-based learning lens, learning about GenAI platforms and tools helped mitigate the digital divide and provide students with equitable access to tools and functions from a base (i.e., free) standing (Kim & Adlof, 2024). As Weng et al. (2024) asserted, it is unrealistic to

expect students to comprehend all aspects of AI literacy on their own; providing authentic and real-world contexts to which students can learn and apply their understanding is essential. As such, a curriculum dedicated to AI integration and literacy created intentional learning environments prioritizing the necessary learning and skills development to help postsecondary students navigate the rapid evolution of technology.

In the context of postsecondary education and learning, providing a course specific to GenAI created the conditions to discuss levels of AI literacy including creating transparency around the notion of the black box, creating student capacity related to algorithmic bias, positive skepticism and fact-checking of these tools' outputs, and the implications of attribution when using tools to write, edit, and ideate (Khlaif et al., 2024).

Experiential Learning Theory

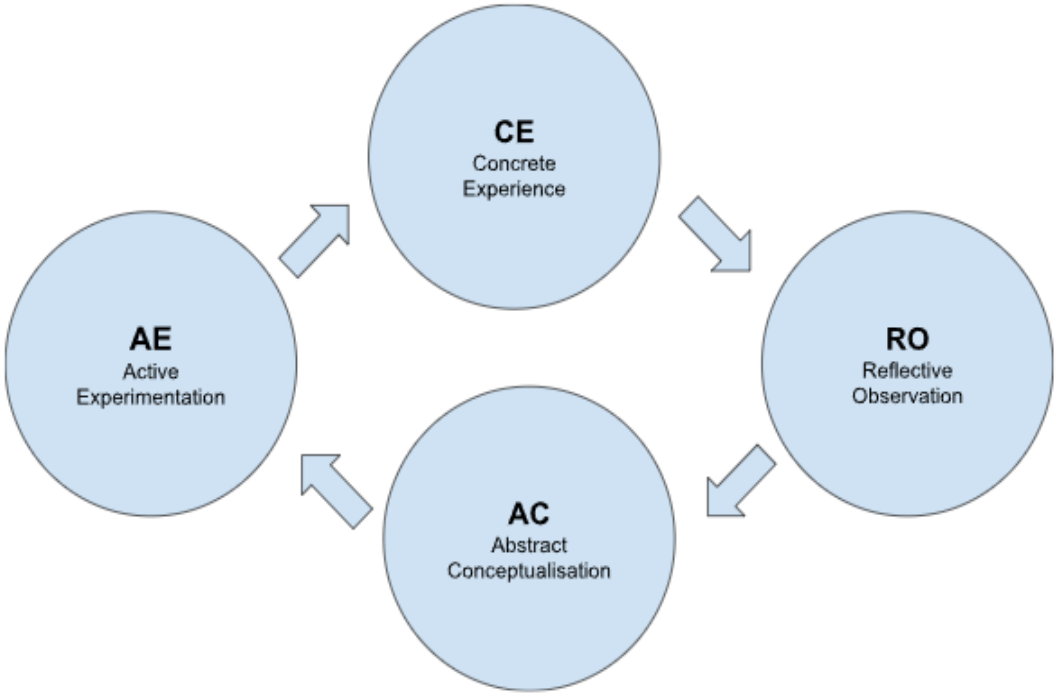
The ELT framework underpins this study (Kolb, 1984). ELT posits that learning is a process whereby knowledge is created in the transformation of experience (Kolb & Kolb, 2017). According to Kolb (1984), the stage of concrete experience in ELT involves direct, hands-on engagement in tasks within authentic learning environments. This phase allows learners to immerse themselves fully in practical activities, thereby facilitating a deeper understanding of real-world contexts and challenges. Reflective observation follows, requiring learners to systematically analyse and evaluate their experiences. During this phase, learners identify patterns, recognize underlying issues, and draw meaningful insights by critically examining both successes and failures. This reflective process is essential for bridging the gap between experience and learning. In the abstract conceptualisation stage, learners integrate newly acquired theoretical knowledge from academic coursework with their practical experiences.

This synthesis enables learners to formulate broader concepts, frameworks, and models that enhance their understanding of complex professional scenarios. By abstracting their experiences into generalized theories, students can develop a more sophisticated grasp of the principles underpinning their field. Finally, the active experimentation phase involves applying these conceptual understandings by testing the derived theories in real-world settings. This stage encourages learners to implement strategies, pilot innovative solutions, and refine their approaches based on empirical feedback. Through this iterative process of experimentation, learners not only validate theoretical models but also develop adaptive problem-solving skills that are critical for professional competence and lifelong learning.

This adapted cycle, shown in Figure 1, posits that learners gain knowledge through experiences, reflecting on these experiences, conceptualising the reflections into abstract ideas, and experimenting with these concepts in new situations. ELT has been widely adopted in various educational contexts, demonstrating its effectiveness in promoting deeper understanding and practical skills (Healey & Jenkins, 2000).

Figure 1

Experiential Learning Cycle



Note. Adapted from Kolb's Experiential Learning Model (1984) for this study.

Integration of GenAI With ELT

GenAI has been increasingly recognized for its potential to transform educational practices. Studies have shown that AI can support differentiated instruction, catering to individual student needs and learning paces through dynamic educational content and interactive learning environments (Holmes et al., 2019; Kim & Adlof, 2024; Thompson et al., 2023; Zawacki-Richter et al., 2019). Furthermore, AI-generated simulations and scenarios can offer immersive learning experiences, and enhance student engagement and understanding (Lu et al., 2018; Rasul et al., 2023).

Therefore, integrating GenAI with ELT presents a promising approach to enhancing learning outcomes and focusing on learning as a process whereby knowledge is created through the transformation of experience. For example, whether structured or unstructured, play with GenAI can facilitate each stage of the ELT cycle, providing concrete experiences through simulations, aiding reflective observation with data analytics and feedback, supporting abstract conceptualisation by generating insights and patterns, and enabling active experimentation through interactive and adaptive learning environments. Research indicates that such integration can improve student engagement, creativity, and critical thinking (Luckin et al., 2016). GenAI can simulate environments, provide feedback, and generate diverse content that can offer transformative possibilities for enhancing ELT (Kim & Adlof, 2024).

Challenges and Ethical Considerations

Despite potential benefits, using GenAI in education raises challenges and ethical concerns such as data privacy, algorithmic bias, and the digital divide. In classroom settings, these should be addressed to ensure equitable and ethical use of AI (Kim & Adlof, 2024; Williamson & Eynon, 2020). Additionally, there is a risk of cognitive overload if students are overwhelmed by the volume and complexity of AI-generated information (Campello de Souza et al., 2024). These challenges necessitate a careful and balanced approach to integrating AI in educational settings (Campello de Souza et al., 2024).

Xia et al. (2024) reinforced that the rapid evolution of GenAI is posing unique ethical dilemmas within postsecondary education; in addition to implications of copyright violation, students' ethical behaviour in academic settings when not properly supported to develop their digital literacy skills can be problematic. Many postsecondary environments lack appropriate policies and conduct codes to ensure students and instructors understand how best to implement GenAI and other tools (Sporrong et al., 2024). From an instructor perspective, the challenge of not being able to ascertain a student's skills and knowledge raises concerns about whether they have used GenAI to complete assignments without attributing it in their work (Lyanda et al., 2024).

To reiterate, equitable access is a further challenge linked to the digital divide that needs to be underscored, given the diverse student populations of postsecondary learning environments. Monetary affordability and access (i.e., equity and accessibility) need to be considered when these tools or platforms are implemented to support student learning (Anuyahong et al., 2023; Bekdemir, 2024). Furthermore, having an awareness of who owns the copyright of student inputs as well as how best to support students in navigating the inherent bias in LLMs necessitates higher degrees of digital and AI literacy for both students and instructors (Lacey & Smith, 2023).

From an instructor practical perspective, fair grading principles are important when using AI grading systems, as the same bias could result in skewed marking or further ethical dilemmas in assessment design and evaluation (Dimari et al., 2024). Validity and reliability in assessment design and implementation are key metrics to support fair practices in postsecondary education, with policies highlighting these important facets (Khlaif et al., 2024). Overall, there is a consistent message across much of the literature regarding the importance of providing professional development and learning opportunities for faculty and instructors to understand how best to integrate GenAI into assessment practices and policy that reflects the understanding of postsecondary higher administration to guide the pedagogical and contextual facets of GenAI (Slotnick & Boeing, 2025).

Methods

This study employed an explanatory sequential mixed-methods design (Creswell & Creswell, 2018), integrating quantitative and qualitative data to provide a comprehensive understanding of students' learning experiences with GenAI. In the first phase, quantitative data were collected through a structured survey designed to measure student engagement, critical thinking, and self-perceived gains in

digital and AI literacies. These results informed the development of the qualitative phase, where semi-structured interviews explored the patterns and tensions that emerged from the survey data. The sequential design enabled the use of quantitative findings as a foundation for qualitative inquiry, thereby deepening interpretation and validating emerging insights.

Data Sources

Participants were recruited through purposeful sampling, reflecting voluntary course enrollment and a shared interest in learning with GenAI. This approach was appropriate given the exploratory, mixed-methods design and the study's focus on capturing a range of perspectives across degree levels and specializations (Creswell & Creswell, 2018). Such diversity of experience enabled deeper analysis of how learners with different disciplinary and technological backgrounds developed digital and AI literacies through experiential engagement. Participants included students from undergraduate, graduate, and doctoral levels from various disciplines in the postsecondary institution. Participants were provided with clear information regarding the study's purpose and data use. This study received approval from the institutional research ethics board of the participating university. Participants were assured that their data would be kept confidential and that their participation was voluntary, with the right to withdraw at any time without penalty.

Data Collection and Analysis

Several participants were involved in both the quantitative and qualitative phases, as several students who completed the survey also volunteered for follow-up interviews. This overlap facilitated triangulation of findings and enhanced the credibility of the interpretations (Ponce & Pagán-Maldonado, 2015). The mixed-methods approach was selected to illuminate both the measurable outcomes of GenAI integration, such as engagement and literacy development, and the nuanced, experiential processes by which students constructed meaning from their interactions with AI tools. This methodological combination was well-suited to the study's exploratory purpose and its theoretical grounding in ELT, which emphasized the iterative interaction between experience, reflection, and conceptual understanding.

The methods included a survey ($N = 17$) that was completed by the course instructor and student participants, designed to integrate GenAI into the entrepreneur and innovation content and immerse students in the experiences of learning with GenAI in this domain. Then, interviews ($N = 16$) were completed, and qualitative data were collected from students and the instructor about their experiences and perspectives related to the study's purpose and objectives. The combination of these methods allowed for a robust examination of the efficacy of GenAI in enhancing experiential learning.

ELT served as the conceptual framework guiding both the design of the survey instruments and the analysis of qualitative data. The survey items were intentionally mapped to Kolb's (1984) four stages of experiential learning—concrete experience, reflective observation, abstract conceptualisation, and active experimentation—to capture how students engaged with GenAI across these dimensions. For instance, items related to *concrete experience* assessed students' hands-on use of AI tools, while items

aligned with *reflective observation* explored how students critically evaluated the accuracy and ethics of AI-generated content. Items associated with *abstract conceptualisation* measured students' ability to connect their experiences to theoretical or disciplinary knowledge, and *active experimentation* items examined how students applied new understandings of GenAI to real-world or project-based contexts.

Similarly, ELT informed the qualitative coding and thematic analysis of interview data. Student reflections and interview transcripts were coded deductively based on ELT's cyclical model, with inductive subcodes emerging within each stage to represent unique experiences (Braun & Clarke, 2022). This dual approach ensured theoretical alignment while allowing for emergent themes specific to learning with GenAI. By embedding ELT into both data collection and analysis, the study maintained conceptual coherence and provided a structured lens through which to interpret students' digital and AI literacy development.

The survey instrument was designed to examine how students experienced GenAI enhanced learning within the four stages of ELT. The survey comprised 21 items organized into three thematic areas: (a) student engagement and experiential learning, (b) digital and AI literacy development, and (c) ethical awareness and reflective practice. Items were constructed using a 5-point Likert scale ranging from *strongly disagree* to *strongly agree* and were reviewed by two experts in educational technology and assessment to ensure content validity and alignment with ELT constructs.

Descriptive statistics were used to summarize response distributions given the exploratory purpose and small sample size (Braun & Clarke, 2022). While all 21 items were analyzed, Table 2 presents the 6 most illustrative items that directly map onto ELT stages, offering a concise view of how students perceived their experiential learning progression within a GenAI context. The internal consistency of the overall instrument, assessed via Cronbach's alpha (.86), indicated acceptable reliability for an exploratory study. These data provided a quantitative foundation for the subsequent qualitative analysis, allowing patterns of engagement, reflection, and literacy development to be compared and contextualized across methods.

Results

As the class was interdisciplinary and multi-leveled, Table 1 includes the participant demographics to help contextualize the reality in this course.

Table 1

Interdisciplinary and Multi-Leveled Student Demographic Information

Participant	Degree level	Area of specialization
1	Bachelor	Communications
2	Bachelor	Business and Commerce
3	Bachelor	Computer Science
4	Bachelor	Nursing

Participant	Degree level	Area of specialization
5	Bachelor	Social Work
6	Bachelor	Marketing
7	Bachelor	Computer Science
8	Bachelor	Nursing
9	Bachelor	Marketing
10	Master	Arts
11	Master	Business Administration
12	Master	Communications
13	Master	Adult Education
14	PhD	Indigenous Studies Focus
15	PhD	Women's Studies
16	PhD	Business
17	PhD	Business

The initial baseline results presented in Table 2 revealed that most students entered the course at a GenAI use beginner level, characterized by low technical proficiency and limited critical awareness. Their engagement with AI tools prior to instruction was largely utilitarian, focused on everyday tasks such as organizing information, generating recipes, or conducting surface-level research. These findings suggest that initial encounters with GenAI were pragmatic rather than pedagogical, emphasizing convenience and curiosity over intentional learning. The low frequency of use and limited understanding of prompt design or ethical implications further underscored their novice status. In line with ELT, this baseline highlights the importance of providing structured opportunities for concrete experience and guided reflection, allowing students to transition from functional to conceptual and ethical forms of AI literacy. By establishing this initial point of reference, the study was able to trace how experiential engagement throughout the course supported the development of deeper critical and reflective capacities in students' digital and AI literacies.

Against this backdrop, and as shared in the instructors' qualitative survey responses, keeping up with the constant changes in the field proved challenging. As such, a concerted effort was made to cultivate a culture of deep learning and to shift the instructor's role from expert to facilitator, to co-learner. This was powerful for postsecondary students to understand the importance of equipping them with the necessary digital and AI literacies through experiential learning. The quantitative results reflect student perceptions and experiences within the course and the connections to the experiential learning frame.

Table 2

Students' Baseline Experiences With GenAI

Aspect of GenAI use	Illustrative student behaviours/examples	Frequency, %	Interpretation
Self-assessed proficiency	Most students described themselves as beginners in using GenAI (e.g., "I only used ChatGPT occasionally for small tasks").	88 (beginner) 12 (intermediate)	Indicates limited prior exposure to AI tools.
Primary purposes for use	Searching for recipes, organizing schedules or notes, light research assistance, summarizing online content.	76	Suggests pragmatic and surface-level engagement.
Technical skill awareness	Limited understanding of prompt engineering or model functionality; uncertainty about "how AI works."	70	Reflects a need for structured scaffolding and conceptual grounding.
Ethical and critical awareness	Minimal prior reflection on bias, intellectual property, or citation of AI-generated outputs.	64	Reveals early-stage critical literacy development.
Frequency of use prior to course	Occasional to rare (e.g., 1–2 times per month); mostly curiosity-driven or exploratory.	82	Confirms baseline novice familiarity and infrequent use.

Note. $N = 17$. GenAI = generative artificial intelligence.

The data in Table 3 illustrate strong alignment between students' learning experiences and the core dimensions of ELT—concrete experience, reflective observation, abstract conceptualisation, and active experimentation (Kolb, 1984). Across all indicators, student responses were overwhelmingly positive, demonstrating that the course design effectively supported iterative cycles of experience, reflection, conceptualisation, and application in relation to GenAI.

A significant majority of students (81.25%) strongly agreed that the course deepened their understanding of the utility of GenAI, with an additional 6.25% somewhat agreeing. This suggests that instructional design elements successfully facilitated conceptual synthesis, helping students move beyond tool familiarity toward articulating more abstract understandings of GenAI's pedagogical and practical value. The absence of disagreement indicates strong conceptual engagement across the cohort.

Similarly, 81.25% of respondents strongly agreed that learning tasks shaped how they applied critical thinking in their understanding of GenAI. This reflects the "doing" and "feeling" phases of experiential learning, where direct engagement with authentic, technology-rich tasks enabled students to construct personal meaning. Only a minimal proportion (6.25%) reported slight disagreement,

reinforcing that experiential immersion fostered cognitive engagement and self-directed inquiry. The students also reaffirmed that their learning resulted in increased critical thinking due to the prompt-engineering opportunities, using the AI tools to develop visual content, and the transdisciplinary approach to their final project, which was linked to human-centred design and finding solutions to their community's wicked problems (Schön, 1992). Overall, 93.75% (81.25% strongly agreeing and 12.5% somewhat agreeing) of student participants asserted that the learning scenarios they encountered enhanced their critical thinking and problem-solving abilities. However, it can be speculated that a few students (6.25%) did not believe their critical thought was advanced due to their surface level engagement with prompt engineering or the lack of engagement they may have felt in the prompt-validation assignment, peer engagement in the discovery board, and the final transdisciplinary project.

Table 3

Frequency of Student Survey Responses Linked to the Experiential Learning Theory

Student response	Strongly agree, %	Somewhat agree, %	Neither agree nor disagree, %	Somewhat disagree, %	Strongly disagree, %
The way the course was designed, and my learning experiences deepened my understanding of the utility of GenAI (i.e., abstract conceptualisation).	81.25	6.25	12.50	-	-
The course and learning tasks helped shape how I applied critical thinking in my understanding of GenAI (i.e., concrete experience).	81.25	12.50	-	6.25	-
The online discovery forum helped me steer my learning in the course (i.e., active experimentation).	50.00	43.75	6.25	-	-
The tools and platforms used in the course enhanced my experiences of learning and reflection on my learning (i.e., reflective observation).	75.00	25.00	-	-	
Prompting skills make a difference in how a person uses GenAI (i.e., active experimentation and reflective observation)	81.25	18.75	-	-	-
The learning experiences in this course have positively influenced my interest in pursuing further knowledge and skills related to GenAI (i.e., active experimentation and reflective observation).	80.00	13.33	6.67	-	-

Note. The dash (-) denotes a value of zero.

Given this finding, Anuyahong et al. (2023) asserted that not all use of GenAI results in critical thinking, particularly when learners do not understand how to constrain prompts and provide context for the LLM to refine its output. This perspective helps explain why a small proportion of students may not have perceived an increase in critical thinking. In contrast, many students demonstrated deeper engagement through tasks that required intentional planning, contextual reasoning, and iterative refinement. For instance, students used image-generator tools to create branding materials for a fictitious company, which involved applying branding principles and constructing prompts to generate image-based content with the GenAI tools. Additionally, students used the project deliverable as an opportunity to create authentic solutions using GenAI in areas such as increasing children's literacy with book creation tools, supporting wellness with a nutrition bot, and gamifying learning for middle school students in STEM courses. These tasks provided rich opportunities for experiential learning and reinforced the development of critical thinking and problem-solving skills.

Reflection emerged as a critical mediating process with 75% of participants strongly agreeing that the tools and platforms enhanced their reflection on learning, while the remaining 25% somewhat agreed. This uniform positivity underscores the intentional design of digital environments that support metacognitive awareness, encouraging students to evaluate both their learning processes and outcomes. Reflection also appeared integral in linking prompting skills to effective AI use, as evidenced by 100% agreement that prompting skills make a difference, bridging reflection and experimentation.

Students' engagement in active experimentation was evident in their perceptions of both the online discovery forum and their sustained interest in AI learning. Half of the cohort (50%) strongly agreed and 43.75% somewhat agreed that the discovery forum allowed them to steer their learning, demonstrating high levels of learner agency and iterative idea testing. Moreover, 93.33% of respondents agreed that their experiences enhanced their interest in further learning, highlighting the cyclical continuity of ELT wherein experimentation generates motivation for deeper future inquiry.

Results also reflected the challenges or constraints of learning with GenAI, such as the technical awareness of learning the tools and the essence of prompt engineering (Delanoy & Keyhani, 2025). Additionally, ethical concerns related to bias and the implications of the data that LLMs are trained on, as well as the creation of content and intellectual property presented further challenges. For example, students shared that once they understood the inner workings of LLMs, they were more critical of the outputs and developed an increased awareness of the models used for the training. Further, students shared that when they were beginners in using GenAI, they could recognize the dilemma of becoming over-reliant on the tool without first considering the task and its expectations, and then using GenAI to verify their decisions during exploration, problem-solving, or analysis.

Regarding the reception of experiential learning to the main themes, students said they experienced a more profound level of learning. This was evident as they transitioned from acquiring knowledge to transferring and applying what they learnt (Doolittle et al., 2023), effectively using the course content in practical situations. The constancy of iterative thinking was a fulsome theme for most students. Despite being provided with baseline settings and a website containing prompts from

individuals worldwide, participants still had to carefully analyse their objectives and choose which linguistic sequences (i.e., limitations) would provide the most favourable outcomes.

Findings from the instructor survey closely paralleled those of the students, suggesting strong alignment in perceptions of GenAI as a catalyst for engagement and critical inquiry. The instructor reported that GenAI supported active learning and critical thinking while requiring careful facilitation to address ethical and evaluative challenges. Like the students, the instructor expressed both optimism and caution, highlighting opportunities for authentic problem-solving and efficiency, alongside concerns about overreliance and accuracy of AI outputs. This convergence reinforces the experiential nature of the learning environment, where both instructors and students engaged in iterative cycles of exploration, reflection, and conceptual understanding consistent with the stages of ELT.

The student quotations presented in Table 4 were selected as representative exemplars of the major qualitative themes identified through the coding process. Each quote reflects a central idea that appeared across multiple participants and was chosen to illustrate both thematic depth and diversity of perspective. Approximately 6 of the 16 interview participants shared experiences consistent with each of these key themes, particularly around critical thinking, ethical reflection, and applied experimentation with GenAI. The inclusion of these excerpts ensures that student voices are foregrounded while maintaining coherence with the broader quantitative findings and theoretical alignment with ELT.

In the context of ELT from tables 3 and 4, postsecondary students were able to hone specific skills and competencies that were explicit in the course design such as prompt engineering or image creation; however, what was implicit was how the student quotes reflected the tacit development of cognitive ability and soft skills including communication, empathy, sharing, metacognition, and being inspired to continue their learning journey (Weng et al., 2024). While some competencies may not be directly linked to the use of GenAI, the use of experiential learning, which is learning by doing in both an individual and group context, needs to be underscored (Kolb & Kolb, 2017). Secondary benefits were apparent as students had to help each other to work with technology that they may not have used in such depth before. The ambiguity caused by the rapid evolution of the technology during the course resulted in students becoming comfortable with change.

Table 4

Student Quotes—Interview Responses Linked to Experiential Learning Theory

Experiential learning theory	Student quote
Critical contemplation	"I found myself constantly reflecting because of the ways this new technology works. I approached the learning tasks for prompt engineering and the final project in very critical ways and as an MBA student enrolled in the course, I needed to consider what I wanted out of my prompt designs and how best to work within a team with people of varying abilities in applying AI." (Student 5)

Experiential learning theory	Student quote
Collaboration and sharing	"Regardless of my technical skills going into the course, I needed to be able to collaborate in groups for certain tasks as we used AI tools and connect and share with others on the discovery board; I come from a computer science background and in this class level of sharing and working together based on the learning design helped me tremendously." (Student 8)
Focusing on the process	"When I started the course, I only used generative AI to find recipes and now I can engineer high-quality prompts with effective outputs which transfer readily to using Midjourney to create images, and I am now confident enough to help others. Process-driven approaches such as prompt engineering helped me with my critical thinking and problem-solving skills even as an existing PhD student." (Student 3)
Navigating uncertainty during a time of rapid change	"While I was taking this course, so much changed even from one week to another. The professor had to change course multiple times when new advancements happened with the tools we used. Living through this and watching the professor adapt quickly to change helped me be more comfortable within the changing field." (Student 2)
Insights of others	"I was in a group of bachelor, MBA, and PhD students for my final project. At first, I was intimidated but we all were working for the same goals, and everyone helped each other learn regardless of the level they were at. I felt like I learned from others continuously and gained a better appreciation of the wisdom everyone brought to our project." (Student 10)
Lifelong learning	"I considered myself very capable of using GenAI from my experiences in software development in my previous career. Yet, when I took this course, I found myself constantly learning and my critical thinking skills increased significantly. I internalized the ethical issues and dilemmas more deeply as a user and creator of content. Learning in this class influenced me to start taking Google micro-credentials to expand my learning as I consider going into law school. I am beyond curious about where else this learning can take me." (Student 12)

Furthermore, students who would have considered themselves beginner users learned more about the inner workings of GenAI and the ethical realities of algorithmic bias, stereotypical information, and the importance of attributing their work (Khlaif et al., 2024). Moreover, the students' prompt-engineering methods yielded direct gains, and sharing within the class inculcated a culture of deeper thinking and curiosity, and positively made the process more important than the product (Kolb & Kolb, 2017). Using GenAI in postsecondary contexts can elevate student learning when the appropriate digital and AI literacies are taught, modeled, and embedded in learning tasks, class discussions, and the discovery forum. In the context of ELT in a postsecondary learning environment, where the focus is on

developing digital and AI literacies, learning by doing can establish a rich foundation for student learning.

The integration of quantitative and qualitative findings revealed a consistent pattern demonstrating that students' engagement with GenAI supported the iterative processes of learning described in ELT. The survey data indicated high levels of agreement across ELT-aligned items, particularly those relating to critical thinking, active experimentation, and reflective observation. These numerical trends were reinforced by the qualitative findings, in which students described concrete experiences of using GenAI to explore ideas, refine prompts, and evaluate AI-generated outputs. Together, these results suggest that experiential interaction with GenAI contributed to students' emerging digital and AI literacies by situating learning within authentic, problem-based contexts.

Triangulation of both data strands also demonstrated convergence in student and instructor perceptions. Quantitatively, both groups emphasized the usefulness of GenAI for enhancing engagement and critical thinking, while qualitatively, they described a parallel process of reflection and adaptation that deepened conceptual understanding. Students who initially self-identified as beginners reported, through interviews, a growing confidence and ethical awareness by the end of the course findings mirrored by instructors' observations of students' increased independence and critical evaluation of AI tools. This convergence underscores the value of integrating experiential and reflective components in AI-focused learning design, reinforcing ELT's proposition that meaningful learning emerges through the cyclical interplay of experience, reflection, conceptualisation, and experimentation.

Taken together, these integrated findings highlight how experiential learning with GenAI can simultaneously foster technical proficiency, critical awareness, and ethical judgment. The convergence of evidence across data sources reinforces the central role of reflective and applied learning in shaping students' AI literacy trajectories. Building on these outcomes, the following discussion situates these results within broader conversations on assessment innovation, instructional design, and the evolving role of experiential pedagogy in digital and AI-enhanced learning environments.

Impact of Experiential Learning on Digital and AI Literacies

Students' engagement in experiential learning made a discernible difference in their development of both digital and AI literacies. Quantitative survey data indicated notable increases in self-reported confidence, ethical awareness, and the ability to critically evaluate GenAI outputs by the end of the course. Qualitative reflections reinforced these findings: students described progressing from functional use of AI tools for convenience tasks (e.g., organizing, searching, or summarizing information) toward more intentional and critical engagement. Through iterative cycles of exploration and reflection, learners began to recognize the affordances and limitations of GenAI, acknowledging its potential as both a creative collaborator and a subject of ethical scrutiny. These outcomes suggest that experiential engagement, learning through doing, reflecting, and refining, effectively scaffolded the transition from novice to more competent, reflective AI users.

Furthermore, students' narratives revealed how concrete experience and reflective observation, two central stages of ELT (Kolb, 1984; Kolb & Kolb, 2017), were particularly influential in this growth. Working with real-world prompts and evaluating AI-generated outputs created authentic learning contexts that deepened conceptual understanding and digital discernment. Students reported increased awareness of issues such as data bias, authorship, and appropriate citation of AI-assisted work, reflecting higher-order literacy competencies. This shift illustrates how experiential learning fosters both technical fluency and ethical mindfulness, positioning AI literacy not merely as a set of operational skills but as a reflective and responsible practice. These findings underscore the pedagogical value of embedding GenAI experiences within structured cycles of experience, reflection, conceptualisation, and experimentation to cultivate sustainable and critical digital literacies.

Discussion

The findings of this study reinforce that the integration of GenAI within an ELT framework can meaningfully advance students' digital and AI literacies. This study was motivated by a notable gap in the literature: despite the rapid uptake of GenAI in postsecondary education, little is known about how GenAI-specific courses can authentically support domain-specific learning and the development of digital and AI literacies. To address this gap, the study aimed to examine how ELT can support the development of digital and AI literacies in postsecondary education through the integration of GenAI tools.

Students' quantitative baseline data (Table 1) revealed limited prior exposure to GenAI tools, with most identifying as beginners who used AI primarily for simple, utilitarian tasks such as searching for recipes, organizing schedules, or summarizing information. This aligns with recent evidence that novice learners often engage with AI tools in pragmatic, low-stakes ways before formal instruction (Khlaif et al., 2024). Within the course, structured experiential opportunities helped students move from these functional applications toward conceptual and ethical engagement. Through guided practice, reflection, and iterative experimentation, learners began to perceive AI not merely as an assistive technology but as a cognitive partner that could extend creativity, reasoning, and self-regulation (Weng et al., 2024).

Quantitative results demonstrated strong alignment between students' experiences and ELT's cyclical stages. As shown in Table 2, the baseline experiences of students, more than 80% of students agreed that the course design deepened their understanding of GenAI's utility and supported critical thinking and reflection. These findings echo Doolittle et al. (2023), who emphasized that active learning and reflective observation increase metacognitive awareness and transfer of learning. Qualitative data extended these insights: student quotations presented in Table 3 capture the development of higher-order competencies such as collaboration, critical contemplation, and lifelong learning. Students described their transformation from hesitant users to confident, reflective practitioners, an evolution that mirrors Kolb's (1984) assertion that knowledge emerges through the transformation of experience and Kolb and Kolb's (2017) argument that learning requires recursive cycles of doing, reflecting, thinking, and applying.

The convergence between student and instructor perceptions further validates the course's experiential design. The instructor reported similar growth patterns, observing that students who engaged deeply with GenAI tasks demonstrated increased autonomy, ethical reasoning, and problem-solving capacity. Both groups highlighted the duality of GenAI as empowering yet demanding of discernment, a finding consistent with Anuyahong et al. (2023), who cautioned that AI use does not inherently promote critical thinking unless learners understand how to frame prompts and critically assess outputs. These aligned perspectives underscore the need for instructors to assume the role of facilitator and co-learner, adapting to rapid technological change while fostering student agency and reflective practice.

At a broader level, this study contributes to emerging conversations on AI literacy as an experiential and ethical construct. Students' reflections suggest that effective AI literacy extends beyond technical fluency to include awareness of algorithmic bias, data transparency, and intellectual property. As Kolb and Kolb (2017) and Schön (1992) contended, authentic learning arises when learners confront uncertainty and apply reflection-in-action to complex problems. Likewise, the course's design, emphasizing iterative experimentation and peer collaboration, cultivated comfort with ambiguity and adaptability, competencies essential for lifelong learning in rapidly evolving digital contexts (Qureshi, 2023).

Ultimately, the integration of GenAI within ELT's experiential framework fostered measurable and perceptible growth in students' digital and AI literacies. Learners progressed from basic tool use toward deeper ethical and conceptual understanding, demonstrating that learning by doing and reflecting remains a powerful pathway for cultivating critical digital competencies in higher education. These findings highlight that when experiential learning principles are intentionally embedded in AI-enhanced courses, GenAI can evolve from a technological novelty into a pedagogical catalyst for creativity, reflection, and innovation (Castro et al., 2024).

Limitations

Given the study's limitation of a smaller sample size of 33 participants (i.e., survey: $N = 16$ and interviews: $N = 17$), the results should be generalized with caution and may be representative of a certain population, that being students engaging in a postsecondary course focused on learning with GenAI within an experiential learning frame. Using a mixed-methods approach of both quantitative and qualitative data can mitigate the smaller sample size of student participants by also providing rich, deep, and contextual data to provide a greater understanding of the efficacy of GenAI in enhancing experiential learning. Regardless, the generalizability of the data should be attempted with caution.

Scholarly Significance of the Study

This study provides empirical evidence of how GenAI, when intentionally embedded within an ELT framework, can enhance digital and AI literacies in postsecondary education. By linking Kolb and Kolb's (2017) cyclical stages of experience, reflection, conceptualisation, and experimentation with

GenAI-mediated learning, the study demonstrates a replicable model for cultivating both technical proficiency and ethical awareness. The findings highlight that structured opportunities for guided reflection, collaborative problem-solving, and iterative prompt-engineering help students transition from functional users of AI to reflective, critical, and ethically aware learners. This evidence contributes to the growing body of research positioning AI literacy not as a discrete skill but as an iterative, human-centred learning process that integrates cognition, critical thinking, creativity, and ethics (Doolittle et al., 2023; Weng et al., 2024).

For educators and researchers seeking to replicate or extend this work, several recommendations emerge. First, AI-enhanced courses should be intentionally designed to align each learning outcome with the stages of ELT, ensuring that learners engage in authentic, hands-on exploration and reflective synthesis. Second, mixed-methods designs, combining descriptive and thematic analyses, are recommended to capture both the measurable shifts in learner confidence and the nuanced transformations in ethical reasoning and critical engagement. Replication studies could employ pre- and post-assessment measures of AI literacy, triangulated with reflective journals and design artifacts, to deepen understanding of literacy progression over time. Establishing clearer frameworks for evaluating how students learn with AI, rather than merely what they produce, would further enhance methodological robustness and comparability across contexts.

Future research should also explore longitudinal impacts of experiential AI learning, including how sustained engagement influences students' professional identity, ethical decision-making, and adaptability in rapidly evolving technological landscapes. Additionally, comparative studies across disciplines, such as education, business, and engineering, could reveal how GenAI integration interacts with disciplinary epistemologies and assessment practices. Investigating the instructor's evolving role as co-learner and facilitator in AI-enhanced environments would further illuminate the pedagogical shifts required for ethical and sustainable AI adoption in higher education (Khlaif et al., 2024).

The broader significance of this study lies in its contribution to both theory and practice at a critical juncture for digital education. It underscores that AI-enhanced experiential learning has the potential to transform classrooms into spaces of ethical inquiry, creative experimentation, and human-centred innovation. By offering a transparent framework for course design and research replication, this work invites educators and policymakers to take informed action, integrating GenAI not as an efficiency tool but as a catalyst for deeper learning, reflection, and social responsibility in the AI era.

Conclusion

This study demonstrates that integrating ELT with the use of GenAI can effectively strengthen students' digital and AI literacies in postsecondary education. Through the interplay of experience, reflection, conceptualisation, and experimentation, learners moved beyond basic tool use toward more reflective, ethical, and critical engagement with AI. The findings underscore that structured experiential approaches, where students actively use, critique, and adapt GenAI tools, create authentic opportunities for developing both technical competence and ethical judgment. This synthesis of theory and practice

offers a replicable model for educators seeking to embed AI literacy development within experiential and inquiry-based pedagogies. This mixed-methods study offers a distinctive contribution by integrating ELT with the development of GenAI literacy, providing a nuanced examination of how students cultivate AI-related competencies through experiential engagement.

For instructors and researchers aiming to replicate or extend this work, several key considerations emerge. Designing AI-enhanced courses should begin with explicit alignment between learning outcomes and ELT stages, ensuring opportunities for both concrete engagement with AI and guided reflection on its implications. Researchers are encouraged to adopt mixed methods designs to capture the nuanced relationship between students' experiential processes and their evolving literacies, while also including instructor perspectives to triangulate learning impact. The criticality and measured skepticism should be built into the learning sequences, whether in classes dedicated to an AI curriculum or whether the courses integrate AI literacy as a part of the learning in the domain.

Future research could examine longitudinal impacts of experiential AI learning on students' sustained literacy practices and professional readiness or explore discipline-specific adaptations of ELT frameworks for GenAI integration in fields such as teacher education, business, or engineering. Investigating how experiential engagement influences well-being, cognitive load, or ethical reasoning over time would also extend current findings and inform instructional design.

Overall, this study contributes to the growing body of research at the intersection of experiential pedagogy and AI literacy, demonstrating how GenAI can serve not only as a technological tool but as a catalyst for reflective, human-centred learning. By situating AI use within structured experiential cycles, educators can cultivate critical, ethical, and adaptive learners prepared to navigate rapidly evolving digital environments, thereby advancing both the scholarship and the practice of teaching and learning in the age of AI.

By positioning AI literacy as both a cognitive and experiential pursuit, this study illustrates how thoughtfully designed, theory-informed learning environments can transform GenAI from a technological novelty into a pedagogical catalyst for innovation, reflection, and ethical practice in postsecondary education. As AI continues to advance, postsecondary faculty and instructors with the lens of preparing students for the world beyond the degree need to consider their roles in not only fostering learning within the specialization in which they teach and research but also consider how AI can be an equalizer for students when framed within an ELT approach. As the state of knowledge building and transference evolves, so too does the need to use teaching and learning methods that are innovative and serve to provide value for postsecondary students and institutions as preparatory places for the world of work and to develop responsible, ethical citizens.

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