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Preface

Dear Readers,

It is my pleasure to introduce the *Journal of Applied Learning in Higher Education (JALHE)*, volume 12, 2026, published by Missouri Western State University. The fifteen articles gathered here come from authors at colleges, universities, and partner organizations in seven states and two other countries, including members of our own Missouri Western Community, and from disciplines as varied as plant science, emergency management, respiratory therapy, engineering technology, linguistics and education, psychology, histology, economic development, and the social sciences. What unites them is a shared conviction that students learn most deeply when they put knowledge to work through various applied learning initiatives, and a shared willingness to look closely at what actually happens when they do.

Several contributions take up the question of how to bring authentic, real-world problems into the courses students are already taking. Barat offers a five-stage, classroom-based experiential learning model in which students act as co-creators, identifying community partners, defining organizational problems, and testing their recommendations against stakeholder feedback, which offers an accessible alternative to resource-intensive placements. Aguilar Murillo and colleagues draw on three years of a community-engaged course in bilingual language acquisition and education to distill five transferable lessons, chief among them that meaningful partnerships rest on relationship-building and reciprocity rather than charity. Two articles examine the bridge from classroom to career. Vanderleeuw and colleagues surveyed county economic development directors across four Midwestern states, whose advice to students returns again and again to communication, networking, and engagement with others. Reed and colleagues find, in a survey of 365 undergraduates, that participation in even one career-focused high-impact practice within a major or minor is associated with greater confidence in career preparation and communication.

A second group of articles focuses on applied learning in professional preparation. Studying a full-scale sheltering exercise that brought together students, community volunteers, and emergency preparedness partners, Fisher, Lindquist, and Falk report that participants perceived strong gains in applying the *Incident Command System*, coordinating with others, and taking preparedness action, even where pre/post score changes were modest, a useful reminder of how difficult learning transfer is to measure. Fisher, Halkia, and Azemi show that structured online discussion can function as an applied learning environment in emergency education, provided that prompts and rubrics explicitly ask students to compare, critique, and ground principles in practice. McDaris and Northrop propose a conceptual framework for how reflective simulation and structured debriefing may build emotional intelligence and resilience among respiratory therapy students, and they position open-access institutions as vital pathways into a profession facing serious workforce shortages.

Other authors examine how learning environments themselves are designed. Barta, Svojanovsky, and Szekely trace how an eight-week Plant Physiology course-based undergraduate research experience investigating the allelopathic molecule L-DOPA grew into a research-centered learning ecosystem spanning courses, disciplines, and institutions in the United States and Romania. Avdan reports that giving engineering technology students the freedom to collaborate with peers or work independently on open-resource assignments created a workplace-like setting that most students valued. Morse, drawing on four applied learning courses in manufacturing and engineering technology, proposes a framework for formative

feedback that is distributed, time-decoupled, and multi-touch; although it emerged from *HyFlex* teaching, it applies well beyond hybrid classrooms.

It will surprise no reader that artificial intelligence runs through this issue. Kamali argues that AI, used with theoretical rigor and ethical awareness, can serve as an analytical scaffold that social science students interrogate, correct, and contextualize rather than simply accept. Belcher poses a larger question: if AI can support activity across every cognitive level, then education must shift its emphasis from "doing" to "becoming," toward the development of judgment, agency, reflection, ethical responsibility, and intellectual identity. Allen grounds the conversation in everyday practice, examining how histology students create and use flashcards, the role AI plays in that process, and how students' reflections opened classroom conversations about intentional study strategies.

Finally, two articles turn to the human relationships that sustain applied learning. Williamson and colleagues found that students receiving video feedback reported a greater sense of belonging and perceived more instructor care than with written comments, although they did not judge either format more useful or effective. Arnold and colleagues remind us that faculty need mentoring too; their needs assessment at a metropolitan university shows that what faculty seek from a mentor depends on their teaching experience and professional goals.

Reading these articles together, I am struck by how candid many of them are. Several are pilot studies, case studies, or conceptual frameworks, and their authors take care to distinguish students' perceptions from measured learning and to acknowledge the limits of small samples. That candor is a strength. Applied learning asks students to act under uncertainty, reflect on what happened, and try again. These authors bring the same disposition to their scholarship, and in doing so they offer a foundation that others can test, adapt, and build on.

I am grateful to Missouri Western State University for supporting this applied learning endeavor, to the authors for their work and their responsiveness throughout revision; our esteemed panel of reviewers, whose thoughtful critique strengthened every manuscript, and to the Griffon Office of Applied Learning (GOAL) administrative coordinator for help with the overall publication process. I hope these pages spark ideas you can carry into your own classrooms, programs, and partnerships.

Tilottama "Tilo" Roy, Ph.D.
Executive Editor (Editor-in-Chief)
Journal of Applied Learning in Higher Education (JALHE)
Missouri Western State University
October 2026

A Classroom-Based Experiential Learning Model for Applied Student Engagement

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Abstract

Experiential learning is widely recognized as an effective pedagogical approach for promoting student engagement and connecting theoretical knowledge to real-world applications. However, many experiential learning opportunities rely on internships, study abroad programs, service-learning placements, simulations, or other resource-intensive activities that may not be accessible across all institutional and student contexts. This paper proposes a scalable and replicable Classroom-Based Experiential Learning Model for Applied Student Engagement that integrates authentic organizational problem-solving directly into existing course structures. The model consists of five stages: preparation and orientation, community partner identification, collaborative problem identification, solution development and implementation planning, and validation, reflection, and assessment. A distinguishing feature of the model is the active role students assume throughout the experiential learning process, functioning as co-creators rather than passive participants in the learning experience. Preliminary survey findings indicate favorable student perceptions of conceptual understanding, learning effort, confidence, and workforce preparedness. Collectively, the model contributes to the experiential learning literature by providing educators with a practical framework for embedding authentic experiential learning opportunities within traditional classroom environments while promoting applied student engagement.

Introduction

Higher education institutions continue to face increasing pressure to prepare students for success beyond the classroom. While traditional instructional approaches remain effective for transmitting foundational knowledge, educators frequently encounter challenges in helping students connect theoretical concepts to authentic real-world situations. As a result, many students struggle to recognize the practical relevance of course content or to develop the confidence necessary to apply disciplinary knowledge in professional settings (Kuh, 2008; National Association of Colleges and Employers [NACE], 2024).

Experiential learning offers one way to help students connect academic concepts with practical situations. Grounded in the principle that learning develops through experience, reflection, and application, it asks students to engage actively with problems rather than receive knowledge passively (Kolb & Kolb, 2005). Prior research has associated experiential learning with student engagement, conceptual understanding, critical thinking, and deeper learning (Eyler, 2009; Kuh, 2008).

Common forms of experiential learning include internships, study-abroad programs, simulations, service-learning activities, and community-based projects. Although these experiences can be valuable, some require substantial financial, logistical, or institutional support and may not be available to every student. Integrating authentic organizational problems into an existing course offers another option and allows instructors to align experiential activities more closely with course objectives. Such projects are not free from constraints, however; their feasibility may still depend on partner availability, student schedules, transportation, faculty workload, and the surrounding community.

This paper proposes a five-stage classroom-based experiential learning model in which students participate in decision-making throughout the project rather than simply completing an experience designed by the instructor. Students help identify community partners, define organizational problems, determine appropriate courses of action, develop feasible solutions and implementation plans, and evaluate those recommendations through stakeholder feedback and reflection. The instructor provides guidance, monitors the partnerships, and ensures that projects remain aligned with course objectives, but students retain meaningful responsibility across all five stages. Although the individual practices incorporated in the model are not themselves new, organizing them around sustained student agency distinguishes the framework from more instructor-directed classroom projects. This involvement is expected to strengthen students' sense of ownership, responsibility, and commitment while exposing them to the ambiguity and decision-making demands of real organizational settings.

To illustrate how students experienced the model, this paper also reports aggregate findings from end-of-semester surveys administered in courses using the five-stage approach. The descriptive findings capture students' perceptions of their engagement, conceptual understanding, confidence, and workforce preparedness. They are

presented as preliminary evidence of how students perceived the experience rather than as direct measures of learning or evidence that the model caused these outcomes.

The following sections position the model within the experiential-learning literature, explain its five stages, describe the student-perception survey and findings, and discuss practical implications, limitations, and directions for future research.

Literature Review and Theoretical Foundation

Experiential Learning

Experiential learning has become one of the most influential approaches to teaching and learning in higher education. At its core, experiential learning emphasizes the idea that meaningful learning occurs through the transformation of experience into knowledge (Kolb, 1984). Rather than viewing students as passive recipients of information, experiential learning positions learners as active participants who construct understanding through engagement, application, reflection, and problem-solving.

The theoretical foundation of experiential learning is most commonly associated with Kolb's (1984) experiential learning theory, which conceptualizes learning as a cyclical process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation. According to this perspective, learning is enhanced when students have opportunities to apply knowledge in authentic contexts, reflect on their experiences, and use those insights to inform future actions. Experiential learning therefore extends beyond the acquisition of information by encouraging students to engage directly with situations that require critical thinking, decision making, and practical application.

An important characteristic of experiential learning is its emphasis on authenticity. Learning experiences are often designed to mirror the complexity and uncertainty of real-world situations, allowing students to encounter challenges that extend beyond traditional classroom exercises. Through engagement with authentic problems, students are encouraged to integrate disciplinary knowledge with communication, collaboration, and critical thinking skills. These experiences help learners appreciate the practical relevance of academic concepts while preparing them to navigate increasingly complex professional environments.

Reflection represents another essential component of experiential learning. Experience alone does not automatically produce learning; rather, learning occurs when individuals critically examine their experiences and connect them to existing knowledge and future actions (Ash & Clayton, 2009). Structured reflection activities encourage students to evaluate their decisions, consider alternative approaches, and develop a deeper understanding of both content and process (Ash & Clayton, 2009). Consequently, reflection serves as an important mechanism through which experiential learning contributes to intellectual and professional growth.

Given its emphasis on active participation, authentic engagement, and reflective practice, experiential learning provides an appropriate theoretical foundation for the Classroom-Based Experiential Learning Model proposed in this paper. The model builds upon established experiential learning principles while seeking to create structured opportunities for students to engage with real-world organizational challenges within a classroom-based environment.

Applied Student Engagement

Student engagement has long been recognized as an important contributor to learning and academic success in higher education (Kahu, 2013; Kuh, 2008; Trowler, 2010). Engaged students are generally more attentive, motivated, and invested in the learning process than their less engaged peers. Research has linked student engagement to a variety of positive outcomes, including improved academic performance, greater persistence, stronger learning outcomes, and increased satisfaction with educational experiences (Kahu, 2013).

Although engagement has been conceptualized in various ways, scholars commonly describe it as encompassing behavioral, cognitive, and affective dimensions (Fredricks et al., 2004; Kahu, 2013). Behavioral engagement refers to participation in learning activities, cognitive engagement reflects the investment of mental effort in learning tasks, and affective engagement relates to students' emotional connection to learning experiences. Together, these dimensions highlight the importance of active involvement in the educational process rather than passive exposure to instructional content.

Applied student engagement occurs when students actively connect disciplinary knowledge with real-world experiences and challenges. Rather than focusing solely on course completion or classroom participation, applied engagement emphasizes the meaningful use of knowledge in authentic situations. Students become active participants in the learning process by assuming responsibility for problem-solving, collaborating with stakeholders, and reflecting on the quality and feasibility of their recommendations. Consequently, engagement becomes both a learning process and a mechanism through which students develop a deeper understanding of course concepts (Ash & Clayton, 2009).

Authenticity plays an important role in fostering applied student engagement. Research suggests that students are more likely to become invested in learning activities when they perceive them as relevant and meaningful (Kahu, 2013). Engagement is strengthened when learners encounter real-world problems, interact with individuals outside the classroom, and recognize that their efforts have practical implications. These experiences encourage students to move beyond rote learning and engage more deeply with both course content and the broader context in which that knowledge is applied.

The Classroom-Based Experiential Learning Model proposed in this paper is grounded in the premise that authentic engagement with real-world organizational challenges can enhance learning by increasing student ownership, responsibility, and involvement. By

positioning applied student engagement as a central mechanism within the experiential learning process, the model seeks to create opportunities for students to connect theory with practice while developing skills and confidence that extend beyond traditional classroom learning.

Classroom-Based Experiential Learning

Many experiential learning approaches depend on opportunities that occur partially or entirely outside traditional classroom environments. For example, internships require organizational placements and ongoing supervision, study abroad programs often involve substantial financial and logistical commitments, and service-learning initiatives frequently depend upon extensive community partnerships and institutional support. While these experiences can be highly valuable, they may not be equally accessible to all students or feasible across all academic programs and institutional contexts.

By integrating authentic problems and stakeholder engagement directly into academic courses, classroom-based experiential learning creates opportunities for students to apply disciplinary knowledge without relying exclusively on external placement experiences (Brooks et al., 2010; Schwartzman & Bouas Henry, 2009). Such approaches allow instructors to maintain greater alignment between learning objectives, course content, and experiential activities while providing students with structured opportunities to engage in real-world problem-solving. In addition, classroom-based models may increase accessibility by reducing many of the logistical, financial, and geographic barriers associated with other forms of experiential learning.

Classroom-Based Experiential Learning Model for Applied Student Engagement

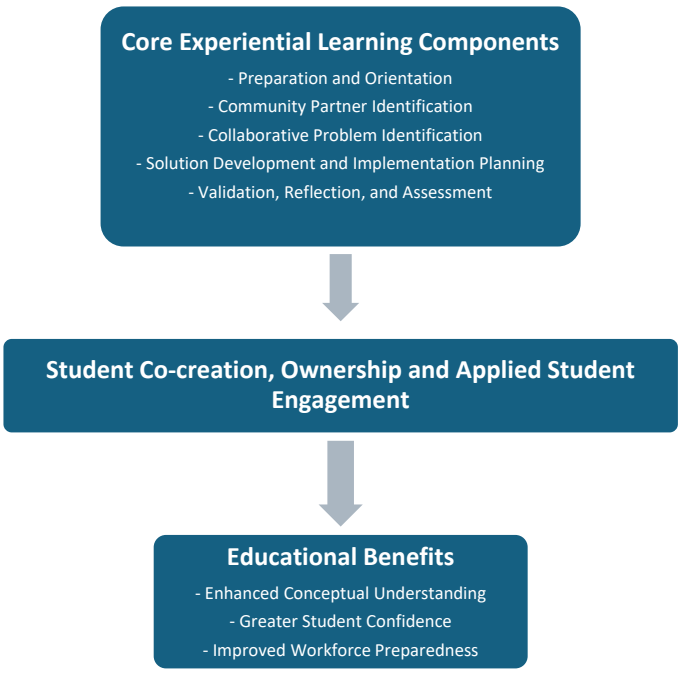


Figure 1: A scalable and replicable classroom-based experiential learning model that promotes applied student engagement through authentic organizational problem-solving.

As illustrated in Figure 1, the Classroom-Based Experiential Learning Model for Applied Student Engagement provides a structured framework for embedding authentic organizational problem-solving within existing course structures. The model consists of five stages: preparation and orientation, community partner identification, collaborative problem identification, solution development and implementation planning, and validation, reflection, and assessment. Together, these stages position students as active participants in the experiential learning process, enabling them to exercise greater ownership while connecting disciplinary knowledge with authentic organizational challenges.

Stage 1: Preparation and Orientation

The first stage of the Classroom-Based Experiential Learning Model focuses on student preparation and orientation. Prior to engaging with community partners, students are introduced to relevant course concepts, project expectations, professional communication standards, and the overall objectives of the experiential learning experience. This preparatory phase establishes the foundation upon which all subsequent learning activities are built. In practice, this stage may include orientation to the project process, discussion of potential community-partner contexts, clarification of expected deliverables and assessment criteria, and guidance on professional communication with external stakeholders.

Preparation serves a critical role within the model because many students enter experiential learning environments with limited experience applying classroom knowledge to authentic organizational challenges. Traditional coursework often emphasizes theoretical understanding, while experiential learning requires students to operate in less structured environments characterized by ambiguity, stakeholder expectations, and real-world constraints (Eyler, 2009). Consequently, students must be equipped not only with disciplinary knowledge but also with an understanding of how that knowledge can be applied in practice.

During this stage, students are encouraged to treat course content as a tool for addressing organizational problems. This orientation helps establish the conditions for applied student engagement by asking learners to assume greater responsibility for connecting theory to practice (Kahu, 2013).

Preparation activities also provide an opportunity for instructors to establish expectations regarding professionalism, collaboration, communication, and accountability. Because students will eventually interact with external stakeholders and organizations, early guidance helps reduce uncertainty while increasing confidence in their ability to participate effectively throughout the project. By creating a strong foundation for engagement, the preparation stage helps ensure that students enter subsequent phases of the model with a clear understanding of both the learning objectives and their role within the experiential learning process.

Stage 2: Community Partner Identification

The second stage of the model focuses on identifying and establishing relationships with appropriate community partners. Unlike traditional classroom assignments that rely on hypothetical scenarios or pre-constructed case studies, this stage introduces students to authentic organizational contexts where they can apply classroom knowledge to real-world challenges. Community partners may include businesses, nonprofit organizations, educational institutions, or other organizations seeking assistance with operational, strategic, or developmental issues.

A distinguishing feature of this stage is the intentional alignment between student learning objectives and community partner needs. Rather than relying exclusively on partners or projects selected in advance by the instructor, students take an active role in identifying potential organizations and exploring challenges that can be meaningfully addressed within the scope of the course. More specifically, instead of students working independently of faculty guidance, instructors can provide scaffolding by helping students identify appropriate types of organizations, assessing whether potential partnerships are feasible and aligned with course objectives, and facilitating initial communication when necessary. In this way, students retain meaningful ownership of partner identification while the instructor provides sufficient structure to support productive and realistic partnerships.

Community partner identification serves as the initial bridge between classroom learning and practical application. Students move beyond theoretical discussions and begin interacting with stakeholders who face authentic organizational challenges. Exposure to these real-world contexts helps students recognize the practical relevance of course concepts while encouraging them to consider how disciplinary knowledge can be applied outside traditional academic environments (Eyler, 2009).

The involvement of community partners also increases accountability throughout the experiential learning process. Because students are working with organizations that have genuine needs and expectations, they are encouraged to approach project activities with greater professionalism, responsibility, and commitment (Kahu, 2013; Kuh, 2008). At the same time, the instructor retains an important facilitative role by monitoring communication, helping address problems when either students or partners become unresponsive, and ensuring that expectations remain clear on both sides. This shared accountability helps protect the quality of the partnership while reinforcing the connection between student effort and real-world relevance.

The feasibility of this stage may vary across institutional and geographic contexts, particularly where the number of suitable community partners is limited. In such settings, instructors may need to rely more heavily on existing institutional relationships, repeat partnerships, or a smaller set of organizations serving multiple student teams. By establishing meaningful partnerships between students and community organizations, this stage creates the foundation for collaborative problem identification and subsequent solution development and implementation planning. More importantly, it transforms learning from an exclusively classroom-based activity into a shared process that

connects academic knowledge with practical experience, thereby strengthening applied student engagement.

Stage 3: Collaborative Problem Identification

Following the establishment of community partnerships, students engage in a collaborative process to identify and define the specific organizational challenges that will become the focus of their projects. Rather than receiving predetermined assignments from instructors, students work directly with community partners to understand organizational needs, explore contextual factors, and determine which issues can be realistically addressed within the scope of the course and semester timeline.

This stage represents a critical transition from passive learning to active engagement. Traditional classroom assignments frequently present students with clearly defined problems and established parameters. In contrast, authentic organizational environments are often characterized by ambiguity, competing priorities, and incomplete information. Students must therefore develop the ability to gather information, ask meaningful questions, evaluate stakeholder perspectives, and distinguish between symptoms and underlying causes of organizational challenges (Brooks et al., 2010).

The collaborative nature of problem identification encourages students to assume greater ownership of the learning process. Because students participate directly in defining project objectives, they become more invested in both the process and outcomes of their work. This heightened sense of ownership may contribute to stronger engagement and reinforce the practical relevance of classroom concepts (Kahu, 2013).

To ensure that projects remain manageable, educationally meaningful, and comparable across student teams, students work with both community partners and instructors to identify challenges that can be addressed through achievable and measurable objectives. Although the specific organizational problems may differ across teams, all projects are aligned with common course learning outcomes, expectations, and assessment criteria. Instructors can establish shared milestones and evaluation criteria while allowing teams flexibility in how they address the particular needs of their community partners. This structure preserves the authenticity of varied organizational challenges while supporting consistency and equitable assessment across projects.

By actively participating in problem identification, students move beyond the role of knowledge consumers and begin functioning as problem solvers. This shift represents an important component of applied student engagement because it requires learners to connect disciplinary knowledge with real-world decision making. As a result, students gain a deeper appreciation for the complexity of organizational challenges while developing skills that extend beyond traditional classroom learning (NACE, 2024).

Stage 4: Solution Development and Implementation Planning

The fourth stage of the model focuses on translating the collaboratively identified organizational problem into an actionable solution and implementation plan. Building upon the earlier stages, students develop recommendations that include specific objectives, proposed actions, measurable benchmarks, timelines, responsibilities, and other considerations necessary for implementation. Because actual organizational implementation may extend beyond the academic semester or involve logistical, financial, or operational constraints outside students' control, implementation of the proposed solution is not required as part of the course project. Instead, students are expected to develop a realistic and actionable plan that the community partner can evaluate and, where appropriate, implement subsequently.

Rather than limiting their involvement to abstract analysis, students translate disciplinary knowledge into concrete project activities, implementation plans, or actionable recommendations developed in collaboration with the community partner. This process requires students to apply disciplinary concepts while simultaneously navigating real-world constraints, stakeholder expectations, resource limitations, and evolving project conditions (Eyler, 2009).

A central feature of this stage is the use of structured and measurable objectives. Students work collaboratively with instructors and community partners to establish realistic goals and develop implementation plans that can be evaluated within the academic semester. Proposed actions, benchmarks, timelines, and responsibilities are reviewed and refined through feedback from instructors and community partners. This structured planning process helps students develop project management skills while reinforcing the importance of accountability and evidence-based decision making (Brooks et al., 2010; NACE, 2024).

The solution development and implementation planning stage is intended to strengthen applied student engagement by requiring students to take responsibility for developing recommendations that have practical relevance beyond the classroom. Because their work responds to authentic organizational needs, students must consider whether proposed solutions are feasible, evidence-based, and responsive to stakeholder priorities. This emphasis helps connect academic work with professional decision making and encourages students to view disciplinary knowledge as a tool for addressing real organizational problems rather than as information that exists solely within the classroom (Kolb & Kolb, 2005).

Throughout this stage, instructors serve as facilitators and mentors rather than traditional lecturers. Regular communication among students, instructors, and community partners helps ensure that proposed solutions and implementation plans remain aligned with organizational needs and course learning objectives. This ongoing support structure provides opportunities for feedback, clarification, and refinement while allowing students to retain responsibility for developing their recommendations.

By emphasizing solution development, accountability, and practical feasibility, this stage provides a mechanism through which experiential learning is translated into applied learning. Students move beyond theoretical understanding by developing actionable responses to authentic organizational problems while considering the constraints that shape real-world decision making. In this way, solution development and implementation planning strengthen the connection between classroom learning and professional problem-solving.

Stage 5: Validation, Reflection, and Assessment

The final stage of the Classroom-Based Experiential Learning Model focuses on validation, reflection, and assessment. Following solution development and implementation planning, students, community partners, and instructors collectively evaluate the proposed recommendations and assess the extent to which they are feasible, responsive to the identified organizational problem, and aligned with the project objectives. This stage also provides an opportunity for students to reflect on the learning that occurred throughout the experiential learning process.

A distinguishing characteristic of this stage is the inclusion of stakeholder validation. Community partners review the proposed recommendations and implementation plans and provide feedback on their relevance, feasibility, and responsiveness to the organizational problem identified earlier in the semester. This external perspective adds a layer of authenticity beyond traditional instructor-based assessment because students receive feedback from stakeholders who understand the practical context in which the proposed solutions would operate.

Reflection serves as a critical mechanism through which experience is transformed into learning. Within this framework, structured reflection can ask students to examine the decisions they made, challenges they encountered, feedback received from community partners, and ways in which course concepts informed their recommendations. Students may also consider what they would modify if the project were implemented, thereby connecting stakeholder feedback and practical constraints with future decision making. This process encourages learners to move beyond simply describing what occurred and instead critically evaluate how disciplinary knowledge shaped their problem-solving process and professional development (Ash & Clayton, 2009; Kolb, 1984).

Assessment within this stage extends beyond the evaluation of the final project deliverable. Instructors may consider the quality and feasibility of students' recommendations, their application of disciplinary knowledge, collaboration, professional communication, responsiveness to stakeholder feedback, and evidence of learning demonstrated through reflection. Using common assessment criteria across teams helps maintain consistency while allowing individual projects to address different organizational problems. Community-partner feedback can complement instructor assessment by providing an external perspective on the relevance and practicality of students' work (Ash & Clayton, 2009; NACE, 2024).

The validation, reflection, and assessment stage complete the experiential learning cycle by asking students to evaluate both the quality of their proposed solutions and the learning process that produced them. Through reflection and feedback from instructors and community partners, students consider how effectively they applied disciplinary knowledge, responded to stakeholder needs, and accounted for real-world constraints. In this way, the final stage is designed to reinforce applied student engagement while helping students identify lessons and skills that can inform future academic and professional experiences.

Preliminary Student Evidence

The experiential learning activities represented in the student survey involved semester-long collaborations with small, privately owned businesses located primarily in Latin America and other less-industrialized regions. A third-party service provider with access to a large repository of small businesses facilitated the initial partner-matching process. The instructor first supplied the service provider with relevant course and learning objectives, after which the provider identified businesses, whose current challenges were compatible with those objectives. Student teams reviewed the available opportunities and based on their interests and the requirements of the course, worked with the instructor to narrow the possibilities to two potential partners. The service provider then consulted with the identified businesses and finalized each match. Following the match, student teams worked directly with the business throughout the remainder of the semester to analyze an ongoing challenge and develop feasible strategies, recommendations, or business plans. Depending on the project, this work involved financial and operational analysis, sustainable solution design, cost-benefit and feasibility assessment, consideration of broader community impacts, and professional communication of recommendations. Participating organizations included family-owned businesses, food trucks, small farms, tea-growing operations, and other small enterprises.

To provide preliminary insight into students' perceptions of experiential learning, a paper-based survey was administered at the end of the semester to students enrolled in three undergraduate business courses: Principles of Marketing, International Business, and Global Marketing. All students enrolled in the participating course sections were invited to complete the survey. The analysis includes 100 usable survey responses. Participation was voluntary, and responses were collected anonymously. Since the survey was originally administered as a course-based evaluation and only aggregate, non-identifiable results are reported here, institutional HRPP guidance indicated that an IRB submission was not required. Students responded to survey items using a five-point scale ranging from "strongly disagree" to "strongly agree." Responses were summarized descriptively at the item level using percentages. Since some items included missing or unusable responses, percentages may not add up to 100%. The survey was intended to capture students' perceptions of their experiential learning experiences rather than to formally test the proposed model or establish causal effects.

Overall, students reported favorable perceptions of their experiential learning experiences. 79% strongly agreed and 10% moderately agreed that experiential

learning helped them better understand textual concepts, while 89% strongly agreed and eight percent moderately agreed that experiential learning settings helped them understand concepts better. Students also reported high levels of perceived engagement, with 90% strongly agreeing and 10% moderately agreeing that experiential learning stimulated their learning effort.

Students also reported favorable perceptions regarding workforce preparation and confidence. 82% strongly agreed and 15% moderately agreed that experiential learning made them feel better prepared for the workforce. In addition, 95% disagreed with the statement that experiential learning did not make them feel more confident. These responses reflect students' perceptions of their preparation and confidence rather than objective evidence of changes in either outcome.

Collectively, these descriptive findings indicate that students perceived their experiential learning experiences positively across conceptual understanding, learning effort, confidence, and workforce preparation. Because the survey relied on self-reported perceptions and was not designed to assess causal effects or objectively measured learning outcomes, the findings should be interpreted as preliminary descriptive evidence rather than as evidence of improvement attributable to experiential learning or the proposed model. Future research should incorporate additional measures, larger samples, and community-partner perspectives to evaluate the model more rigorously.

Table 1 summarizes the descriptive survey results, while the complete survey instrument is provided in Appendix A.

Table 1: Selected Student Perceptions of Experiential Learning

Outcome Area	Descriptive Survey Result
Conceptual understanding	79% strongly agreed; 10% moderately agreed
Conceptual understanding	89% strongly agreed; eight percent moderately agreed experiential learning settings helped better conceptual understanding
Engagement / learning effort	90% strongly agreed; 10% moderately agreed
Workforce preparedness	82% strongly agreed; 15% moderately agreed
Confidence	95% disagreed that experiential learning did not make them feel more confident

Note: Experiential Learning (EL). Survey responses were measured on a five-point scale ranging from strongly disagree to strongly agree. See Appendix A for the complete survey instrument.

Discussion and Implications

The contribution of the proposed model is that it organizes established experiential-learning principles into a structured classroom-based process in which students

participate actively in shaping the experience from partner identification and problem definition through solution development, implementation planning, and evaluation. It does not rest on introducing an entirely new form of experiential education. Rather, this emphasis on student co-creation distinguishes the model from classroom projects in which instructors largely define the problem, prescribe the process, and evaluate a predetermined deliverable. At the same time, the model retains faculty scaffolding and community-partner involvement, creating a balance between student ownership and the structure needed to maintain academic quality and project feasibility.

Within this structure, student ownership functions as an important mechanism of applied engagement. Because students participate in consequential decisions about partner selection, problem definition, solution development, and implementation planning, they assume greater responsibility for both the process and the quality of their work. This involvement may strengthen engagement by increasing students' sense of investment in the project and helping them recognize the practical relevance of disciplinary knowledge (Kahu, 2013; Kuh, 2008). At the same time, ownership is not treated as complete autonomy: instructor guidance, shared milestones, and stakeholder feedback provide the structure necessary to keep projects educationally meaningful and feasible. Applied student engagement in this model therefore reflects not simply participation in an authentic task, but sustained responsibility for decisions made across the experiential learning process.

While the proposed model shares important features with service-learning and community-engaged learning, it is not intended to represent a categorically separate form of experiential education. Service-learning commonly connects academic learning with community service and frequently emphasizes civic learning and reciprocal community benefit, while community-engaged learning places broader emphasis on collaboration and reciprocity between academic and community stakeholders (Bringle & Hatcher, 1996; Nguyen & Condry, 2023; Tijsma et al., 2023). The present model overlaps with these traditions through its use of authentic community partners and stakeholder feedback, but its organizing purpose is structured disciplinary problem-solving within an existing course. Internships typically place students within a workplace, where learning is shaped in part by workplace tasks and supervision (Hora et al., 2024). In contrast, the present model keeps the experience within the course while bringing authentic organizational problems and stakeholder feedback into that structure. Students participate in identifying partners, defining organizational problems, developing solutions and implementation plans, and evaluating the feasibility of their recommendations. Its contribution therefore lies less in establishing a separate pedagogical category than in providing a structured process that places sustained student co-creation and decision-making responsibility at the center of the experiential learning experience.

Like most other models of this nature, the author's model nevertheless is subject to practical constraints that may affect its implementation across different institutional settings. Its feasibility can depend on factors such as class size, instructor workload, access to suitable organizational partners or intermediary networks, scheduling,

communication across geographic and time-zone differences, and the willingness of participating businesses to remain engaged throughout the semester. Institutions without established partner networks or access to facilitating organizations may need to develop alternative mechanisms for identifying appropriate businesses and maintaining communication. The framework should therefore be viewed as adaptable rather than universally resource-free, with implementation strategies adjusted to the institutional and organizational context.

Conclusion

This paper presents a classroom-based experiential learning model designed to embed authentic organizational problem-solving within existing course structures while giving students a sustained role in shaping the learning experience. Taken together, the five stages provide a practical structure for sustaining student co-creation from partner identification through evaluation. The framework balances student ownership with the faculty guidance and stakeholder involvement needed to maintain academic rigor and project feasibility.

For instructors, the framework offers a practical approach for incorporating authentic organizational challenges without relying exclusively on internships or other placement-based experiences. Common learning outcomes, shared milestones, consistent assessment criteria, and structured partner feedback can help preserve comparability across projects while allowing students to address different organizational problems. The preliminary student data provides descriptive evidence that participants viewed these experiential learning experiences favorably in relation to conceptual understanding, learning effort, confidence, and workforce preparation, even though such findings represent self-reported perceptions and should not be interpreted as evidence of causal improvement.

Future research should evaluate the model across additional courses, disciplines, and institutional contexts and should incorporate objective learning measures, community-partner perspectives, larger samples, and longitudinal or comparative designs. Such work would help determine the conditions under which the model is most effective, the extent to which it can be adapted across different educational settings, and how sustained student participation in decision making influences applied engagement and learning over time.

References

Ash, S. L., & Clayton, P. H. (2009). Generating, deepening, and documenting learning: The power of critical reflection in applied learning. *Journal of Applied Learning in Higher Education, 1*(1), 25–48. https://doi.org/10.57186/jalhe_2009_v1a2p25-48

Bringle, R. G., & Hatcher, J. A. (1996). Implementing service learning in higher education. *The Journal of Higher Education, 67*(2), 221–239. https://doi.org/10.1080/00221546.1996.11780257

Brooks, E. L., Harris, C. R., & Clayton, P. H. (2010). Deepening applied learning: An enhanced case study approach using critical reflection. *Journal of Applied Learning in Higher Education, 2*, 55–76. https://doi.org/10.57186/jalhe_2010_v2a4p55-76

Eyler, J. (2009). The power of experiential education. *Liberal Education, 95*(4), 24–31.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Hora, M. T., Chen, Z., Wolfgram, M., Zhang, J., & Fischer, J. J. (2024). Designing effective internships: A mixed-methods exploration of the sociocultural aspects of intern satisfaction and development. *The Journal of Higher Education, 95*(5), 579–606. https://doi.org/10.1080/00221546.2023.2241330

Kahu, E. R. (2013). Framing student engagement in higher education. *Studies in Higher Education, 38*(5), 758–773. https://doi.org/10.1080/03075079.2011.598505

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education, 4*(2), 193–212. https://doi.org/10.5465/AMLE.2005.17268566

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Prentice Hall.

Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter.* Association of American Colleges and Universities.

National Association of Colleges and Employers. (2024). *Competencies for a career-ready workforce.* https://www.naceweb.org/docs/default-source/default-document-library/2024/resources/nace-career-readiness-competencies-revised-apr-2024.pdf

Nguyen, J. J., & Condry, D. L. J. (2023). Evaluating differences in community-engaged learning and service-learning via the context, input, process, and product model. *Frontiers in Education, 8*, 1289322. https://doi.org/10.3389/feduc.2023.1289322

Schwartzman, R., & Bouas Henry, K. (2009). From celebration to critical investigation: Charting the course of scholarship in applied learning. *Journal of Applied Learning in Higher Education, 1*(1), 3–23. https://doi.org/10.57186/jalhe_2009_v1a1p3-123

Tijsma, G., Urias, E., & Zweekhorst, M. (2023). Embedding engaged education through community service learning in HEI: A review. *Educational Research, 65*(2), 143–169. https://doi.org/10.1080/00131881.2023.2181202

Trowler, V. (2010). *Student engagement literature review.* The Higher Education Academy.

Appendix A

Student Survey Instrument

Instructions: What is your level of (dis)agreement with the following statements? Response scale: 1 = Strongly disagree; 2 = Moderately disagree; 3 = Neither agree nor disagree; 4 = Moderately agree; 5 = Strongly agree.

1. EL has helped me better understand textual concepts.
2. EL has NOT helped me overcome lack of real-world experience.
3. EL settings help me understand concepts better.
4. EL stimulates my learning effort.
5. EL does NOT help me better understand textual concepts.
6. EL makes me better prepared for the workforce.
7. EL does NOT make me feel more confident.
8. Without EL, my education would have been incomplete.
9. I prefer courses that have an EL component to those that do not.
10. An EL component makes learning process boring.
11. Learning is incomplete without an EL component.

Note. EL = experiential learning.

Advancing Your Career: Advice from County Economic Development Directors – Engage!

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Abstract

The focus of this paper is on the advice county-level economic development directors offer students looking to move forward with their career. Based on a 2024 survey of these practitioners across the states of Iowa, Kansas, Missouri and Nebraska, the offered advice speaks to skills necessary to pursue a successful career not only for those interested in economic development, but for students across numerous fields who anticipate a career with members of the public and other professionals. Findings also have relevance for those in higher education responsible for program and course development. The career advice from these professionals is heavily about the value of soft skills – communicating, networking and the relevance of work experience in acquiring these skills. Ultimately, the advice stresses the importance of engagement with others. Implications for students and the academic programs in higher education that serve them include the value of internships, collaborative projects and volunteerism.

Introduction

In recent years, employability has been a focal point in career development studies (Kertechian, 2024). While definitions of employability vary and evolve, recent dimensions of employability include social skills along with job competencies (Heijde & Heijden, 2006). Soft skills are consistently considered to be an important factor of employability. Soft skills are interpersonal behaviors that are both critical to organizational activity and help employees engage effectively and productively at work. These skills include communication, leadership, organization, and problem-solving skills. Different skills in these categories, however, are relevant in different contexts and roles. With movement in many work environments away from on-site work to working online from home, the result of the COVID-19 Pandemic, video conferencing, and collaboration through messaging became more prevalent and common-place. As a result, a shift in valued skills became apparent. Initiative-oriented soft skills became valued and remain so today (Fletcher & Thornton, 2023).

Other skills such as networking seem to stand the test of time, relating to career success defined by salary and career satisfaction (Wolff & Moser, 2009). Those who develop networking skills build mutually beneficial relationships within careers that enhance social capital. These lead to new ideas and information, career contacts, job opportunities, and social support internal and external to the organization (Janasz & Forret, 2008). The magic is in the individual's consistent ability to adapt to new skills. Those who are successful in honing networking skills are more likely to earn more and advance more quickly in their roles (Hosseinioun, et al., 2025).

It is possible that networking skills can be obtained later in career progression rather than being a precursor to career advancement (Wolff & Moser, 2009). Regarding other skills, employability frameworks repeatedly identify communication, collaboration and critical thinking as necessary skills for success in the modern workplace, and employers may hire candidates with these skills over candidates with superior technical skills, as the aforementioned soft skills can be harder to teach (Price & Magy, 2021).

While soft skills can be considered an aspect of job competencies, technical skills, specialized skills and job knowledge are also considerations of job competencies. These skills are derived from the educational and job experiences. Many academic public administration programs, for instance, emphasize "leading and managing in public governance; participating in and contributing to the policy process; analyzing, synthesizing, thinking critically, solving problems and making decisions; articulating and applying a public service perspective; and communicating and interacting productively with a diverse and changing workforce and citizenry" as five core competencies in public administration (Haupt et al., 2017).

In the past, public administration (PA) roles were less politicized and public facing, but today public administrators must balance political and administrative aspects of their roles with community interest and stakeholder engagement (Dougherty & Van Gelder,

2013). Academic experience is relevant for professional careers and career advancement. Regarding public administrators, Lee (2020) notes that "…local government managers generally perceive that PA is a professional home discipline and are satisfied with the quality of and usefulness of a PA education." In line with this, a study by Vanderleeuw et al (2015) finds that the salary of city managers with an advanced degree was higher compared to those without an advanced degree. Again, this suggests that advanced degrees are valued in public administration.

In addition to education, work experience is important. While academic experience is important to employability, most likely in early career stages, Dougherty and Van Gelder note that, "...training and education alone cannot replace experience" and "Minimum qualifications, which act as a primary screening device for applicants and hiring agencies, are based in part on assumptions of the value of education and experience, but those assumptions deserve more consideration given their role in agency staffing" (2013). Research supports the idea that managers perceive work experience to be valuable in career advancement. According to Dougherty & Van Gelder (2013), work experience affects the management perspective of candidate employability in the hiring process, although not all forms of experience are determinants of job success. Managers perceive that the candidates with public sector experience will better understand the organization and bureaucracy and be equipped to solve complex problems across agencies and sectors. Those with five or more years of public sector experience are thought to be more balanced in solving the complex problems in public sector jobs.

This current study draws from a survey of county-level economic development directors across a four-state region to explore what practitioners consider important for job success. Our primary focus is the importance of what are often referred to as soft skills – the ability to communicate, listen, interact and network. Most directly, what surveyed practitioners consider important regarding job success is relevant for college students aspiring to a career in public service, along with educators and educational programs in Public Administration and Political Science. However, findings will also inform higher education educators and programs in fields such as Business Administration, Communications and Nonprofit Management, among others, whose students anticipate a career that involves some meaningful aspect of dealing with other professionals and the general public.

Ultimately, our goal is not to identify the extant range of activities that higher educational institutions might establish, but to bring to mind some examples and considerations that point in a constructive direction. Practitioners with a wealth of experience have something to tell us about what is important for successful job performance. Employers seemingly continue to place a premium on entry-level employees having a college degree (VanDerziel, 2023) and today's college student wants preparation for a career – but Generation Z's attitudes about college exhibit growing doubt about the relevance of higher education (Degrees of Doubt, 2025). Continued relevance for newer generations may very well be about how the educational experience can best be connected with a

successful career – and these experiences may very well include experiences in the development of soft-skills.

Data and Methods

The study draws from a March through April 2024 survey of 49 county-level economic development directors across the states of Iowa, Kansas, Missouri and Nebraska. This survey received Institutional Review Board approval in January, 2024. For each state, counties were identified and for each county an economic development agency was identified along with email contact information for its director (the title a given agency accords to its top administrator varies, but throughout we will refer to our respondents as “directors” or “practitioners”). Most counties had an economic development agency, though some did not; the name and contact information for the agency director was available on the agency website in most cases, though in some cases the director’s name or contact information was not available.

This resulted in 317 county agency directors who were sent to via Survey Monkey (88 for Iowa, 78 for Kansas, 86 for Missouri and 65 for Nebraska). Survey Monkey was selected because of its familiarity to the researchers as well as presumed familiarity to survey recipients.

Of these, we received 49 completed surveys (15.5%) (19 for Iowa, 8 for Kansas, 16 for Missouri and 6 for Nebraska While the number of cases does not enable us to address interstate differences – the number of returned surveys was smaller than expected and we have no explanation for this at this point – aggregated, we believe the number of returned surveys is sufficient that findings can inform about what these directors consider important for success. Across the following tables and statistical displays, the number of responses may vary because some respondents did not answer all questions.

Results

To properly appreciate the career advice surveyed practitioners offer, it is important to build a context. Who are these practitioners? What are their job duties? What do they have to say about the value of their educational and prior work experience? Ultimately, answers to these questions will ensure a high level of confidence that the advice offered comes from accomplished, experienced professionals. We start first with some background on our surveyed administrators, then move into the advice they offer.

Demographic Characteristics and Education

As a group, surveyed practitioners were white, middle-aged, a mix of female and male, and had spent over half a decade in their current position. 84.7% of respondents classified themselves as Anglo/Caucasian/white and 2.2% as Asian American, with 13.0% who preferred not to say (N=46). 53.1% identified as female and 46.9% identified as male (N=49). The mean age of respondents was 52 (SD=12, range=32-84, N=45).

The mean number of years served in their current position was 6.2 years (SD=5.8, range=0-25, N=38).

Overall, descriptions of job activities and advice offered by our surveyed directors were provided by a group of highly educated, career-oriented professionals from varied educational backgrounds. Respondents were asked to identify the highest degree they earned and to provide the field of study associated with their highest earned degree. 91.6% had a college degree (N=48). 35.4% had a Master's Degree, 52.1% had a Bachelor's Degree and 4.1% had an Associate's degree. 8.3% had obtained a High School diploma.

Three fields of study comprised almost two-thirds of responses. Of the 45 who responded to this question, 28.9% reported a degree in Business Administration/Management, 17.8% reported a degree in Public Administration/Public Policy and 17.8% identified a degree in Communications/Public Relations. In addition, 8.9% reported a degree in Urban Studies/Community Development, with lesser numbers identifying fields in the social sciences (e.g., Political Science), liberal and performing arts, science and technology (e.g., agricultural studies), education, and theology. The most frequently identified areas of study point in the direction of training in management, communication and public policy. There is variation, though, across the full range of reported fields of study. This hints at an intriguing possibility. If surveyed practitioners offer similar advice regarding what they consider most important in their position, this consistency is likely due to similarities in the job experience rather than training in a particular educational field of study.

Job Roles and Duties

To provide context on what county-level economic development directors say about career success, we need insight into their job responsibilities. Borrowing from Ammons and Newell (1989), directors were asked how much of the work week they typically spent on either political concerns or policy issues or managerial duties. Political concerns included meeting with citizens on community issues but not partisan politics; policy issues included initiating, formulating or proposing policy; managerial duties included preparing budgets and dealing with personnel issues. Surveyed directors reported spending 28.0% of their time on political concerns (median=20.0, SD=22.8, range=2-100, N=42), 24.2% of their time on policy issues (median=20.0, SD=21.5, range=5-100, N=42) and 22.6% of their time on managerial duties (median=20.0, SD=21.2, range=5-100, N=43). Among these three categories, time spent on political concerns is the plurality. While these findings point to some activity or activities not captured by our framework, they indicate that political concerns – interaction and engagement with the community – are critical to these practitioner's role.

Respondents were asked a further, open-ended, question about their job duties, to provide enhanced specificity on what their job role entailed. Table 1 reports results, with the first two responses (if two or more answers were offered) coded and classified. We endeavored to code responses in a logical manner and believe our categorization

makes sense but acknowledge there may be other category schemes. Our purpose was not to produce the single best scheme, even if one could be identified, but to construct categories that connected logically with the various respondent comments.

Table 1: Key Job Duties (first two responses)

	#	%
Networking	12	17.6
Working with others	6	
Communication	3	
Leadership	1	
Represent/Serve as Face of Organization	2	
Business Attraction/Retention/Growth	8	11.8
Jobs	7	10.3
Job Growth/Retention	3	
Work Force/Build Skilled Work Force	4	
Projects	7	10.3
Project Coordination/Leadership	5	
Property Management/Site Development	2	
Development	6	8.8
Promote Development	1	
Community Development	1	
Develop Growth Strategies	1	
Tourism	2	
Industrial Park	1	
Support	6	8.8
Provide Information/Identify Resources	4	
Arrange Financing	1	
Educational Opportunities for Business	1	
Oversee/Manage Organizational Operations	6	8.8
Housing/Housing Services	5	7.4
Do It All	4	5.9
Increase Tax Base	1	1.5
Marketing	1	1.5
Child Care	1	1.5
Non-Classifiable/Other	4	5.9
N Responses=	68	

As can be seen in Table 1, responsibilities varied. Networking, though, tended to be a frequent job duty with nearly 18% of responses falling in this category, that included comments about working with others, communication, leadership and representing the agency to others. This supports observations about how directors allocate their work week – that these practitioners engage with community members as a major focus.

Other prominent job duty categories include growing, retaining and attracting business to the county, along with job growth, retention and workforce training, both garnering more than 10% of responses. These two categories are highly related – new and retained businesses, growing and retaining jobs. If we were to categorize these as one category, business and jobs, this would comprise the prevalent job duties, with over a fifth of all responses.

Engaging in projects along with development activities, such as engaging in and planning for economic growth, each comprises nearly 10% of responses, as does providing support for businesses. When we consider the top five most frequent response categories, a ready picture emerges. A primary job duty is to promote business and job growth. To do this, directors networked to promote development efforts and engage in projects designed to growth their county economies. Additional frequent comments were related to internal organizational operations, nearly 10% of responses. Less frequent responses included efforts related to housing, daycare, marketing, increasing the tax base, along with doing it all. Among these less frequent comments, marketing might be considered a sub-component of promoting development and increasing the tax base a sub-component of business attraction. In these cases, the importance of promoting development and business attraction is enhanced.

Discretion in Job Duties

To provide further context for practitioner advice, directors were asked two additional questions about their job duties. Both related to discretion. First, a question that asked whether they had discretion in how their agency provided support to local business. This was followed by an open-ended question that asked about what form this discretion took. Overwhelmingly directors reported having discretion in helping local businesses. 75.5% reported having discretion in how their agency provided support for local business (n=37), 12.2% reported they did not have discretion (n=12) and 12.2% were not sure (n=12).

Table 2 reports the coded and classified first two responses offered by respondents regarding the form their discretion took. Among these, financial support was mentioned most frequently, in over 20% of cases. This most frequently took the form of loans. Statements about having broad discretion and flexibility were also frequent, at about 18% of cases. Regarding specific areas, strategic planning as mentioned in 10% of responses. Beyond this, there were a few mentions of having limited discretion (a decided minority of responses), acting on a case-by-case basis, marketing, arranging for a business incubator and serving the agency's advisory board. In all, these directors had significant discretion in how they performed their job.

Table 2: Form Discretion Takes (first two responses)

	#	%
Financial	8	21.1
Loans General	5	
Minority Loans	1	

Grants	1	
Incentives	1	
Broad Support for Business	7	18.4
Flexible	7	18.4
Broad Discretion	5	
Communication	1	
Time	1	
Strategic Planning	4	10.5
Limited Discretion	4	10.5
Case-by-Case	3	7.9
Marketing	2	5.3
Incubator Arrangements (rent)	1	2.6
Job Creation	1	2.6
Advisory Board	1	2.6
N Responses	38	

Perspectives on Value of Their Education and Prior Work Experience

Directors were asked to assess the relative value of both their education as well as prior work experience on their success in their current position. As noted above, literature indicates that both shape career success. Though education and prior work experience were each rated as important, on average directors rated prior work experience as relatively more important to success in their current position. 77.5% of directors rated their education as being either important or very important to success in their current position (N=49). By contrast, 95.9% rated prior work experience as either important or very important to their success (N=49). We discuss the relevance of this difference in a following section.

Advice: What Makes for Successful Job Performance?

We turn now to the study's central focus – advice on successful job performance. Forty-four practitioners responded to our question asking for their advice with at least one piece of advice, and more than half offered addition advice. While the question wording asked about advice to graduate students, the offered advice has wide applicability to any college student seeking a career in a field with a public facing role and their respective academic program (Appendix A provides the specific list of questions used in this study). We categorized the first two pieces of advice offered. Though some respondents provided only one response and a few provided more than two, a sufficient number provided two responses that we thought it best to incorporate the first two responses to this question in order not to potentially disregard information. A review of the few cases where more than two responses were offered did not reveal advice beyond the set derived from the first two responses.

Taking the first two pieces of offered advice yielded 68 responses, of which two we could not classify. The remaining 66 responses were allocated into four categories: Soft Skills (27 responses), Experience (16 responses), Networking (14 responses) and Community Interest (9 responses). Each of these categories represents a distinct set of activities though, as we will argue, these categories are connected with one another. Figure 1 displays categorized responses as a percentage of total responses.

Examples of Soft Skills included *"learn to be a great communication and facilitator," "listen more, talk less," "sharpen your people skills…this job is all about the relationships you create"* and *"I could go on and on with advice. Because eco devo is so varied, any degree is relevant to the job. The most important thing is developing soft skills that can navigate the social and political complexities of eco devo. It's extremely challenging, but extremely rewarding... but challenging... and rewarding."*

Regarding Experience, the surveyed practitioners included internships, volunteering, and work experience in both the public sector and private sector as valuable. Examples were "*Internships or apprenticeships in advance are helpful," "Get involved! Be on a committee, volunteer, run for school board, do something to see how things work!" "Be willing to start small and gain experience. The experience I have from producing videos for 32 years for the state of Missouri is invaluable to my current position"* and *"Get involved w/ professional associations, i.e. PDI - Professional Developers of Iowa), attend Heartland Economic Development Course, attend / participate in as many professional development opportunities as your budget / time will allow."*

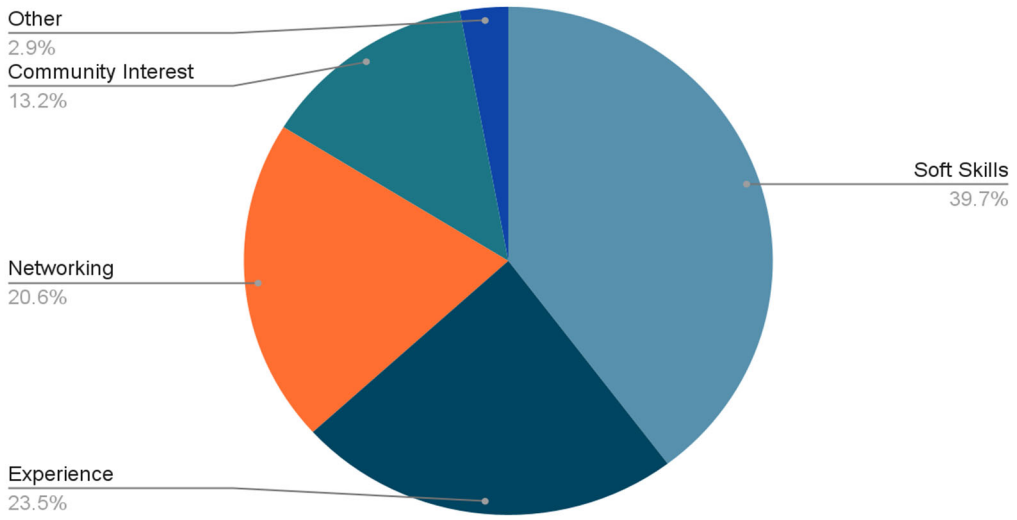
Practitioners who championed Networking (the building and maintaining of relationships, and the use of relationships to leverage career opportunities and success, Wolff & Moser, 2009), offered advice such as, *"learn how to develop relationships at all levels: local, regional, statewide, and nationwide. Relationships are the key to your success," "Networking, networking, networking!" "Network and continue learning,"* and *"Economic development is a process not an event! Networking and communication is key, be visible!"* Networking can very much be labeled as a soft-skill, and we talked about it as such earlier. This acknowledged, we distinguish networking as a distinct advice category for two reasons. First, conceptually networking can be viewed as the result of other soft-skills activities. As we will argue below, successful communication leads to the development of longer-term, i.e. institutionalized relationships. Second, we view networking as heavily, though not exclusively, involved in maintaining these institutionalized relationships. Here we make a distinction between the building of connections, that requires soft-skills such as the ability to listen as well as speak, and the maintaining of these connections as the institutionalized practice of networking – admittedly a not absolute distinction, with some overlap.

Though Community Interest was less frequently mentioned as the first piece of advice by practitioners, it was frequently mentioned by those who offered two or more pieces of advice as a second, supporting point, and was characterized by comments such as "*Be involved in your community," "If you are interested in this field, you need a high level of grit and determination with an underlying passion of serving your community,"* and *"Make sure you have a direct pulse with the community members and don't rely on leadership above to direct you, many of times they are not as engaged on the needs and desires of the community as they should be."*

It is important to note that the advice offered by surveyed practitioners, when we looked beyond the initial comment, often crossed our categories – as we posited above, these

categories are related. The comments by one particular director encapsulate the need for our understanding of how these practitioners viewed what they considered most essential to know in a wholistic manner. According to this practitioner, *"pursue internships, network and learn as much as possible. Your work ethic, pursuit of excellence (not perfection), and your ability to work well with others will open many doors!"* This level of overlapping commentary, along with the consistency of comments, ultimately suggests that any discrete piece of advice is best understood as reflecting the significance of one guiding principle – engagement. This principle is perhaps summed up via advice offered by one director, "*The job is what you make it. It would be easy to just sit back and check emails all day and get wrapped up in the day-to-day duties. It takes a self-starter to dream, cultivate and create projects that will positively impact the county and it's constituents."*

Figure 1: Career Advice



Discussion

Synthesis of Findings

Surveyed directors, of course, put their comments in the context of economic development – compatible with the nature of their specific positions and the survey itself. This said, it is obvious that their advice has general application well beyond this particular career field. Of course, the caveat here is that the application applies to jobs with a public facing component. Many jobs, though, do require some level of interaction with the public. As a fundamental guiding career principle, engagement with one's community and the larger environment, and all this this entails, is relevant for numerous career aspirations. The findings displayed in Figure 1 offer a graphic presentation of practitioner advice. Whether in terms of listening skills, or interacting with others, or

being involved in and knowledgeable about community affairs, the advice these directors offered was active and consistent engagement with others. In this sense, networking is a mutually beneficial relationship.

If the guiding principle is active and consistent engagement, then the emphasis on soft skills (the most frequently offered piece of advice at nearly 40%) makes conceptual sense. The ability to communicate, to listen as well as speak, is a prerequisite to engagement. Without the ability to effectively communicate, engagement will fail. Gently put by one practitioner, *"your ability to work well with others will open many doors!"* With soft skills established, the advice to network (slightly more than 20% of comments) becomes a recommendation to engage in an institutionalized manner. A network entails an established pattern of interactions that allows networked participants to routinely reach a large and varied audience over an elongated period of time. Advice about networking encompassed various participants, from professional colleagues, *"You will need a network of professionals you can refer clients to,"* to those who hold formal leadership position, *"spend time getting to know your local city councilmembers or aldermen."* Community interest (just over 13% of responses) entails knowledge of the larger community within which one engages. Conceptually, this acts as an as an important contextual consideration – an understanding of what is important if not vital to those being engaged.

The emphasis on experience (that comprised nearly 24% of responses) can serve to establish credibility among community members. As one respondent put it *"try to own or start a business first. You need some credibility."* At a minimum, prior experience provides the professional foundation from which one can draw to build relationships and engage. While experience can build a foundation of practical knowledge of the field, of critical importance it can also assist one in honing the skills necessary to engage. As one respondent put it, *"I am confident my diverse experiences has helped me grow, be more rounded, adapt to changes more easily, think outside the box, relate to all social levels and this are more compassionate to differences, and etc. Experience different things and become more rounded."*

In this respect it is perhaps worth noting that not one piece of practitioner advice mentioned obtaining a particular degree or a particular field of study or coursework. Obviously, as reported above, surveyed practitioners did consider education to be important in career success. However, they considered experience more important overall. As a conceptual framework: If the ability to engage is considered most critical for career success, and if prior experience is about learning to engage, then the role of education might be understood as relevant in opening the door to a career. Once the door is opened, the key to success in this field is active, sustained engagement. All of this is not to suggest education is a mere formality. Among other job-oriented aspects, one can argue that the process instills the ability to set and achieve a long-range goal and a level of discipline and focus valued by employees. This said, it is clear that surveyed directors valued practical lessons learned from job experience. Further, regarding education, it seems that at least for the field of local economic development, the particular degree may not be determinative. As one respondent put it, *"Because eco*

devo is so varied, any degree is relevant to the job. The most important thing is developing soft skills that can navigate the social and political complexities of eco devo." The fundamental advice, therefore, is to actively and consistently engage with members of one's community.

Implications for Students and Higher Education

Our surveyed directors valued both their educational and prior work experience, but placed a premium on experience. This related directly to the career advice they offered, that ultimately landed on the principle of engagement. The acquisition of soft skills is necessary to engage successfully with community members. Networking allows a deep, extensive and institutionalized engagement. Prior work experience provides an opportunity to develop soft skills, to perhaps begin network building, and to establish credibility as one engages.

What are the implications of these findings for academic programs and their students, particularly in higher education? One clear implication is the importance of internships. Institutions of higher education are excellently positioned to offer internships as part of a curricula. An emphasis on an internship is compatible with the value practitioners placed on experience, and in fact was specifically mentioned in some cases. An internship offers the opportunity to garner first-hand knowledge of real-world practices. Knowledge gained by students as a result of this experience can be applied throughout a career. Relatedly, students might seriously consider volunteerism, also mentioned by practitioners. Volunteering, that institutions of higher education are well positioned to coordinate for students, can serve both a way to give back to their community as well as a leg-up on student career goals. Critically, volunteering as well as internships can open doors to networking opportunities that potentially facilitate career opportunities and advancement. In all, career advice offered by surveyed directors goes far beyond what to put on a resume. Experience and networking opportunities garnered through internships and volunteerism can positively impact job performance and help ensure successful careers. Presumably, a critical goal for many if not most students and academic programs today.

The importance of networking was brought up by numerous directors. Many of the key job duties reported by practitioners, such as job growth and project coordination, rely on networking, and the ability to successfully network itself relies on skills such as communication. Relatedly, as discussed earlier, surveyed directors spent the majority of their workweek time either on political, policy or managerial concerns, each of which can entail networking and soft skills. While it may not be feasible for academic programs to incorporate into their curriculum a specific course or courses devoted solely to soft skills, various components of existing coursework may be adapted. For instance, group projects are consistent with the value surveyed practitioners placed on skills associated with communication, listening as well as speaking, and working cooperatively and collaboratively to achieve outcomes. Opportunities for class discussions also fits this mold. Whether in the traditional face-to-face or online learning environments, group projects can be established, as can oral presentations and class

discussions that hone an important communication skill. At the end of the day, these skills come back to networking, key to engagement.

In addition to implications for curriculum development, findings regarding director's background provide some insights that higher education might take note of. Over fifty percent of surveyed directors were women. Not too long ago these positions were male dominated. Over time this field has opened to women and women have expressed an interest. Across the board, fields that were once mainly for males have opened up, with perhaps marketing implications for higher education. Another finding involved education, specifically the field of study. No one field was a majority, but rather surveyed directors reflected a broad range of fields including Business Administration, Public Administration, Urban Studies, Political Science and even Performing Arts and Education. Given a diverse educational background, practitioner advice was remarkably similar. We might say that education provides the essential skills needed to learn and job experience provides the learning opportunities for career success. Higher education may encourage students to think broadly about the types of careers a given educational program might prepare them for. Many colleges and universities undoubtedly understand changing trends, or are in the process of doing so, and these findings confirm the importance of this understanding.

Conclusion

The purpose of this study was to seek the advice those working in county-level economic development have to share with students. Findings have direct application to Public Administration but are also relevant to a broader range of fields, students and academic programs. Summed up, a key takeaway is the guiding principle of engagement. Students can engage in academic and nonacademic opportunities to learn soft skills instrumental in successful engagement, and ultimately successful careers.

References

Ammons, D., & Newell, C. (1989). *City Executives: Leadership Roles, Work Characteristics, and Time Management*. SUNY Press.

Degrees of Doubt: Gen Z's Changing View of Higher Education. (2025, Nov. 5). *Cengage*. https://www.cengagegroup.com/news/perspectives/2025/three-factors-changing-gen-zs-view-of-higher-education/

Dougherty, G., & Van Gelder, M. (2013). Public Agency Hiring, Minimum Qualifications, and Experience. *Review of Public Personnel Administration*. 1-24. 10.1177/0734371X13506228.

Fletcher, S., & Thornton, K. R. V. (2023). The Top 10 Soft Skills in Business Today Compared to 2012. *Business & Professional Communication Quarterly*, 86(4), 411–426. https://doi.org/10.1177/23294906221148453

Heijde, C., & Heijden, B. (2006). A Competence-Based and Multidimensional Operationalization and Measurement of Employability. *Human Resource Management*. 45 (3), 449-476.

Haupt, B., & Kapucu, N., & Hu, Q. (2017). Core Competencies in Master of Public Administration Programs: Perspectives from Local Government Managers. *Journal of Public Affairs Education.* 23. 611-624. 10.1080/15236803.2017.12002272.

Hosseinion, M., Neffke, F., Youn, H., & Zhang, L. (2025). Soft skills matter now more than ever, according to new research. *Harvard Business Review.* August 26, 2025.

Janasz, S. & Forret, M. (2008). Learning the art of networking: a critical skill for enhancing social capital and career success. *Journal of Management Education.* 32(5) 629-6510.

Kertechian, Sevan, and El-Farr. (2024). Dissecting the Paradox of Progress: The Socioeconomic Implications of Artificial Intelligence. In: El-Farr, H., Ed., *The Changing Landscape of Workplace and Workforce*, IntechOpen. https://doi.org/10.5772/intechopen.1004872

Lee, S. (2020). Role of MPA Education as a Professional Hub: Views from Local Government Managers. *Studies in the Social Sciences* (West Georgia College). 1. 23-41.

Price, D., & Magy, R. (2021). Filling the Soft Skills Gap. *COABE Journal: The Resource for Adult Education,* 10(1), 90–107.

Vanderleeuw, J., Sides, J., & Williams, B. (2015). An Advanced Degree in Public Administration — Is It Valued by City Councils? *Public Administration Quarterly*, 39(3), 453–483.

VanDerziel, S. (2023). Employers and Students Say the College Degree is Worth It. *NACE Journal*, Fall. https://www.naceweb.org/talent-acquisition/trends-and-predictions/the-value-of-higher-education

Wolff, H., & Moser, K. (2009). Effects of Networking on Career Success: A Longitudinal Study. *The Journal of Applied Psychology.* 94. 196-206. 10.1037/a0013350.

Appendix A

Survey Questions Used in this Study

Are you?
- Female
- Male
- Prefer not to say

Are you?
- African American
- Anglo
- Asian American
- Hispanic
- Other (please identify) *Open ended*
- Prefer not to say

What is your age? *Open-ended*

How many years have you been in your current position? *Open ended*

What percentage of your work schedule do you spend on:

- Managerial duties (e.g., preparing budgets; dealing with personnel issues, etc.) _____%
- Policy issues (e.g., initiating, formulating, or proposing policy, etc.) _____%
- Political Concerns (e.g., meeting with citizens on issues) _____%

What are your key job duties? *Open ended*

Do you have discretion in how your agency provides support for local business?
- Yes
- No
- Not sure

If you have discretion in how your agency provides support for local business, can you elaborate on what form this discretion takes? *Open ended*

How important has your education been in being successful in your current position?
- Very important
- Important
- Neither important nor unimportant
- Unimportant
- Not important at all

How important has your prior work experience been in being successful in your current position?

Very important
Important
Neither important nor unimportant
Unimportant
Not important at all

Do you have any advice to offer students, particularly graduate students, who aspire to a county-level position in economic development? *Open ended*

Beyond the Algorithm: Integrating AI into Applied Learning Pedagogy—A Critical Inquiry

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Abstract

This paper examines how artificial intelligence (AI) can strengthen applied learning in the social sciences by transforming raw information into analyzable material that students actively interpret, evaluate, and convert into disciplinary knowledge. It argues that AI, when guided by theoretical rigor and ethical awareness, enhances critical pedagogy by supporting qualitative interpretation, computational analysis, simulation-based inquiry, and independent reasoning. Rather than replacing instruction, AI functions as an analytical scaffold that students interrogate, correct, and contextualize, enabling deeper engagement with social structures, patterned behavior, and institutional dynamics.

Keywords: applied learning, artificial intelligence (AI), critical pedagogy, social sciences, simulation-based teaching

Introduction

Similar to its preceding technological predecessor, artificial intelligence (AI) has become a pervasive factor in academia, changing institutional allocation of resources, management strategies, and policymaking based on evidence and data. Social science education is not exempt from the impact that AI is bringing to higher education. Hence, this paper aims to introduce social science faculty to practical strategies for integrating AI into applied learning environments. Its central objective is to demonstrate how AI can transform raw information into analyzable material that students actively interpret, evaluate, and convert into disciplinary knowledge. By outlining concrete, theory-aligned applications, the paper equips instructors with the tools needed to embed AI directly into hands-on, inquiry-driven social science pedagogy.

Similar to the past, there are two opposing, but equally problematic, orientations in education regarding AI. These are: celebratory technophilia and reflexive technophobia (Castillo, 2022; Rehman, Mahmood, Bashir, & Iqbal, 2024). Granted that utilizing AI in teaching has certain utilitarian opportunities (e.g., fast access to information); it poses certain challenges (e.g., accuracy and reliability of the data)—thus, constituting a paradox. AI can be used as an analytical tool corresponding with the objectives of the social science disciplines in terms of its practical application (i.e., applied learning) for scrutinizing human development, transactions, social institutions, and social relationships. However, AI's unusually versatile domain (e.g., text analysis, mapping, or simulation) positions it far above the older technology for critically analyzing the pedagogical system designed based on a sociotechnical system within which AI is conceived, developed, and employed (Boyd & Crawford, 2012; Eubanks, 2018).

The leading question explored in this paper is whether using AI as an analytical tool allows for the cultivation of a critical pedagogy reflective of applied learning. This question relates to both educators and students and examines the power structure that shapes learning (Freire, 2000; Brookfield, 2017; Giroux, 2011; Hooks, 1994). For a successful applied learning pedagogy, ideally, this matrix must show how instructional input and student agency are weighted symmetrically.

Grounded in the foregoing question, this paper rests on the assumption that employing AI in teaching advances applied learning pedagogy. In other words, applied learning activities are more productive when aided by AI, and that AI-assisted teaching can be beneficial if it is firmly guided by a discipline's commitment to its theoretical rigor, methodological diversity, and ethical concerns (Arosio, 2025). This assumption further suggests that AI-assisted applied learning pedagogy in social sciences must situate its outputs within an academic discipline's framework. Given the vast repository of information stored in contemporary institutions, AI becomes an effective tool to teach students how to discover new research findings, policy interventions, and evidence-based strategies.

Given the above, the guiding orientation in this paper is to provide useful hints for adequately employing AI as a tool for teaching applied learning, analytical reasoning, as a pedagogical assistant for conceptual understanding, and, most crucially, how to

access a living archive of the social conditions that underwrite its design and usage (Noble, 2018; Pasquale, 2015; Zuboff, 2019). Although this approach is valuable across both the hard and social sciences, this paper specifically invites social scientists at all levels to examine how AI can serve as a powerful applied-learning tool for enabling students to critically investigate how social institutions operate and reproduce patterns of power, inequality, and social organization.

1. AI and Constructing Knowledge Through Applied Learning

In the social sciences, AI should be perceived less as an algorithmic construct and more as a mechanism for generating applied learning knowledge that supports problem-solving. Social science disciplines train students to question commonsense and the status quo through empiricism, rationalism, and skepticism, and in its core constructivist inquiries is fundamentally a problem-solving enterprise. Within critically reflective pedagogy, applied learning requires providing the machine with the foundational assumptions of a discipline so that students can interrogate, challenge, and validate them—particularly the premises that shape our understanding of society, social structure, and social interactions. For example, when examining a topic such as “class warfare,” we can instruct students to prompt AI with the assumption that the classroom operates as a social stage in which instructors and students are interacting through power dynamics surrounded by their statuses, and further shaped by intersectional dimensions of class, race, gender, age, sexual preferences, technology, and a host of other variables. Rather than relying solely on traditional instructional methods (i.e., transmission of information by lecturing), modern reflective pedagogy—augmented by AI—becomes a reconstructive learning process that cultivates environments where knowledge is actively built from the information provided to the machine. AI can rapidly synthesize actors’ lived experiences and cultural contexts as valued intellectual resources (Nayir, Sari, & Bozkurt, 2024) and compare them with diverse perspectives. Consequently, constructing appropriate and effective prompts (i.e., inquiry or research questions) becomes central to applied learning with AI: through well-designed inquiries, the machine requires the contextual knowledge necessary to generate analytically relevant and pedagogically meaningful discourse about social institutions and the structures that sustain them.

1.1. Qualitative Interpretation

Effective prompt engineering, within an applied learning framework, requires the skillful orchestration of asking the right question(s). Because AI is capable of learning the information it is given (LeCun, Bengio, & Hinton, 2015; Mitchell, 1997), instructors are obligated to examine how responsibly students are constructing the prompts. This responsibility includes evaluating methods and assessments that ensure classicism, sexism, racism, ageism, and other forms of structural inequality are not reproduced or normalized through AI-generated outputs. Through such reflective practices, the core of applied learning (i.e., students’ active engagement with the social world) empowers students to act as originators of knowledge versus passive recipients. Consequently, critically informed student participation must accompany a pedagogical model that neither embraces technophilia nor succumbs to technophobia.

Before advocating the use of AI in applied learning, instructors must first align AI with the established pedagogical goals of the discipline so that technology does not dictate pedagogy (Riel, 2025). That is, the user must provide AI with disciplinary jargon, premises, and assumptions. Since applied learning in the social sciences centers on an independent understanding of social contexts—an inherently abstract domain—and its consequences**,** students must engage directly with situations, data, and simulations that translate those abstractions into observable patterns of action and interaction**.** Through these hands-on engagement, learners test assumptions, witness how structures shape behavior, and develop the analytical judgment needed to connect theoretical concepts to real social processes.

The modalities to be employed can include text mining and natural language processing (e.g., sentiment analysis, topic modeling, automated qualitative coding); machine-learning analysis (predictive modeling, classification, clustering to identify social patterns); social network analysis (mapping relationships, influence, and structural positions); agent-based modeling and simulations (modeling interactions, diffusion processes, inequality mechanisms, or policy outcomes); computational ethnography and digital-trace analysis (examining behavioral data from social media or digital platforms); geospatial and GIS-based analysis (integrating spatial, demographic, and behavioral data to study neighborhoods, segregation, or mobility); computer-assisted social research (analyzing images or video to study human dynamics or public-space usage); and large-scale data scraping and database analysis (e.g., Reddit corpora, Twitter/X datasets, administrative records), among others (Conte & Paolucci, 2014; Fischbach, Marx, & Weitzel, 2021).

Within an applied-learning framework, the challenge is not merely technical proficiency but determining how these computational modalities contribute to theory building and model construction in modern social science. As these approaches expand the analytical horizon, they increasingly render older statistical modeling traditions (e.g., Arthur, 1994; Schelling, 1969) insufficient for capturing the complexity and scale of contemporary social phenomena. Any of the models referenced above can become a tool that situates AI-enabled methods within authentic problem-solving contexts, ensuring that students learn *why* these tools matter for understanding social institutions—not simply *how* to operate them.

2. AI's Pedagogical Utilities in Applied Learning

Given the above, the pedagogical utility of AI in applied learning—i.e., analytical reasoning, independent learning, and knowledge production—emerges when employed in the following domains:

2.1. Content Analysis

AI is an indispensable analytical tool across document-driven social science disciplines (e.g., anthropology, communication studies, political science, public policy, sociology) because it can systematically process large textual corpora, identify contextual patterns, and reveal interpretive frames that are often obscured in manual analysis. Applied

learning, in this sense, emerges when students use AI to interrogate the content of documents—and even policy texts—to extract patterns and trends that illuminate underlying issues and potential responses. Information fed into the system is processed, and AI fills analytical gaps based on available data, generating new insights that students can critically evaluate. Students can verify the trends generated by AI by juxtaposing patterns, repeated occurrences, and routinized practices. While this approach is already well established in health care, social scientists can adopt similar strategies since content and documentary analysis have long been central to their methodological repertoire. Consider natural language processing (NLP) as an example. Through NLP, students can engage directly with large bodies of material (e.g., news articles, legislative debates, or social media posts) and verify emergent patterns in the data. The pedagogical aim is to enable students to *apply* analytical techniques to observe how frames evolve and how metaphors form over time (Kitchin, 2014).

2.2. Network Analysis

AI is a useful tool across the social sciences when the intent is to research and visualize the spatial structure of action strategies and community organizational behavior (e.g., mass marches, communication networks, messaging structures, strikes, to name a few). Consider crowd behavior and mass communication as examples. With proper prompting, AI enables students to operationalize applied learning by mapping how crowds form, identifying the demographic background of participants, tracing information dissemination, locating gaps in communication, and outlining leadership structures (Tufekci, 2017). Once AI generates this preliminary landscape, the applied learning aspect of this assignment is reflected in the students' endeavor to organize, interpret, and transform the raw data into a structured analytic metric that aligns with their disciplinary understanding of the issue. This is where applied learning becomes explicit: AI provides the empirical scaffolding, and students actively convert that scaffolding into knowledge through interpretation, critique, and theoretical integration.

It should be noted that for any viable, discipline-oriented knowledge generation, the information fed into the machine must be grounded in discipline-specific theories in order to convert mechanically generated patterns into meaningful knowledge capable of interpreting social reality. This distinction marks a critical departure from older quantitative approaches, and moves toward a theory-centered inquiry into the social construction of knowledge about the dynamics of collective behavior, political mobilization, or public communication. When AI is employed in this manner, it facilitates a pedagogical shift from a purely mathematical or quantitative interpretive mode to an applied learning framework, where the emphasis rests on students' active engagement in constructing knowledge to understand complex social processes.

2.3. Beyond Quantification

Contrary to the past assumption that computer programs are useful only for number-crunching, AI is not a mere quantitative instrument for processing data. In applied learning, the aim is to elevate methodological and conceptual complexity by showing students that quantitative analysis alone can narrow the scope of inquiry

(Matheson, 2023), and that number-crunching without valid theoretical grounding becomes pedagogically hollow because reductive quantification often overlooks communicative processes, affective dynamics, and intentional behavior patterns. Numerical outputs frequently fail to capture relational, cultural, and symbolically embedded cues that shape social action. As discussed earlier, meaningful interpretation must extend beyond numerical scrutiny and focus on how people interact, why particular patterns emerge, and what outcomes those interactions produce. In this regard, AI becomes an applied-learning instrument: it generates structured information that students actively interpret, contextualize, and transform into disciplinary knowledge.

2.4. Evaluating Information

In the context of applied learning, students can evaluate the consistency of information generated by AI, and identify the nature and appropriateness of guidance it offers. Within an applied-learning framework, such analyses help students interrogate communicative patterns that shape the effectiveness of teaching and learning processes, especially when AI-generated recommendations are used as a starting point for deeper inquiry. Yet AI systems commonly employ “sentiment models”—rule-based interpretive mechanisms grounded in machine learning, deep learning, or hybrid approaches—that aim for neutrality but often flatten meaning by oversimplifying subtle linguistic cues. As a result, AI struggles with sarcasm, emotional nuance, and ambiguity (Gupta, Ranjan, & Singh, 2024), producing interpretive inaccuracies. For instance, the machine may mistakenly treat the frequency of a word as evidence of its salience (Barocas & Selbst, 2016). Applied learning offsets these limitations: by providing clear instructions, we are also teaching students how to evaluate AI’s misreading, correct aberrations, and apply disciplinary reasoning to transform AI-generated outputs into meaningful, contextually grounded knowledge. Applied learning in this sense means teaching students not to rely on any information generated by AI since it can hallucinate **(**Alansari & Luqman, 2026). The power of applied learning is now reflected in its ability to correct AI’s limitations through students’ interpretation, theory, and disciplinary judgment.

Awareness of the above issues may only partially help eradicate the technological trap. The overarching implication is: AI is not an end in itself. Beyond analysis, AI must serve as an instrument that facilitates conceptual learning, understanding theoretical complexities, and fostering critical thinking. Many students struggle with abstraction required to track micro-structural concepts that create theoretical explanations. The depth associated with social science concepts (e.g., positivism, etc.) is even confusing for trained and seasoned social scientists, which requires multiple levels of register to grapple the contextual scaffolding of the applicability of these concepts to contemporary analysis and understanding. For example, AI can provide the “… historical example tied to industrialization…; Weber’s rationalization of…”bureaucracy and that which is permeating contemporary organizational life” (Zuboff, 2019); or Marx’s class conflict through verifying the existence of class warfare either in its historical or contemporary contexts, but the pedagogical value emerges only when students actively interpret this AI-generated information, connect them to disciplinary theories, and translate them into applied knowledge. In this way, AI supplies the empirical scaffolding—identifying

structures, patterns, and contradictions—while applied learning requires students to evaluate, contextualize, and theorize those outputs to understand how social processes unfold across time and institutional settings.

A recent article in The Chronicle of Higher Education, McMurtrie (2026) echoed: “AI had joined the faculty”. More and more instructors are using AI to teach. However, the widespread use of AI is not to trump or relinquish the instructor’s responsibilities to artificial intelligence; rather, the suggestion is to incorporate AI as a co-scientist, an instructional assistant to aid an instructor to guide students through, often contested, analysis. This approach is most effective when students are positioned as critical evaluators—challenging AI’s explanations and demanding more rigorous analyses. In this sense, a fundamental principle for using AI in the scholarship of teaching is the systematic interrogation (prompts) of its outputs. Even when engaging with established textbooks, the task of social science is not to passively consume information, but the continual production of evolving interpretations, refinement, and expansion of analytical precision and theoretical complexity.

3. Simulation-Based Teaching-Learning

Simulation-based learning is another core dimension of applied learning in which AI can significantly enrich the teaching of social science topics. Contemporary social sciences increasingly aim to elevate theory and research by focusing on “actors” (human agency) rather than abstract variables or static factors (Macy & Willer, 2002), which shifts attention toward studying the *capabilities* of actors—their choices, strategies, and adaptive behaviors. In this context, simulation is not a mere methodological tool, but an applied learning strategy that allows students to examine *how and why* actors behave as they do by experimenting with different conditions and observing the resulting patterns. Learning in simulation is intentional since the student is taking the initiative in their own learning. Through simulation, AI can model the consequences of those choices and map out emergent outcomes. For example, in studying theories of social interaction, or crowd behavior, AI-driven simulations enable students to construct and test scenarios of collective behavior, using background information to generate new interactional patterns. This transforms simulation into applied learning: students actively manipulate inputs, interpret outputs, and connect those results to disciplinary theories to understand how social processes unfold.

What distinguishes AI from previous computer modeling methods is its ability to engage in role playing in dramaturgical subtleties—a concretization of abstract social nuances. For example, from the perspective of human agency, a simulation exposing students to observe changes in an actor placed in the context of, say, a difficult decision-making situation will give the learner the background information to theorize how an actor is deciding, or coordinating his/her actions. Taken to a higher level—for example, at the organizational scale (an orchestrated demonstration), AI can simulate and juxtapose roles, decision-making contexts, and authority structures, allowing students to *actively analyze* how institutional policies emerge from patterned interactions. This means students do not merely observe organizational behavior; through simulation, they can manipulate scenarios, test alternative conditions, and interpret how different

configurations of actors and authority produce different institutional outcomes. Through this process, AI-supported simulation becomes a practical laboratory in which students construct knowledge by examining how organizational dynamics unfold in real time.

A few useful software programs that are widely used in social sciences include, but not limited to: the Epidemic & Public Health Policy Simulator, suited for anthropology, models cultural and community responses to disease outbreaks using SEIR dynamics and policy interventions. SimCapitol, used in the field of political science, immerses students in legislative and executive decision-making through simulations built on real U.S. government data. Psych Case Files, designed for psychology, places students in applied diagnostic scenarios where they interpret behavior and make evidence-based decisions. The Simulation Lab's Build-A-City, grounded in sociology, lets learners experiment with social structures and observe how individual choices shape collective outcomes. Finally, the Monetary Policy Simulator, used in economics, allows students to adjust interest rates and fiscal variables to see how macroeconomic indicators respond in real time. Before going any further, we should recognize the following ground rules:

3.1. Circumspect and Skepticism

AI simulations do not predict perfect word events, they are trained on historical data that reflect past events, choices, and outcomes. They present analogy of a sort since the exact event cannot be predicted, and since the environment within which actions/interactions are taking place is different. However, they can illuminate the centrality of application to theory and methods by providing enough information that one can use and justify one's interpretation of abstract scenarios, and predict rational choices. Since AI assumes neutrality, it reflects that AI simulations are patterned-based and probabilistic. For this reason, it may be argued that individuals follow patterned rules, not probabilistic events. However, simulations are structured activities that allow students to note how patterned behavior emerges; and how institutional rules and structural boundaries determine patterned behavior. For example, for students to analyze the dynamics of an organization, they can interrogate its boundaries, investigate how it hardens, examine how authorities are involved. This means setting the stage (prompting) for AI to predict the outcomes. What matters pedagogically in this process is the students' ability to think wholistically despite the specificity of some background information.

3.2. Methodological Triangulation

Complex theoretical texts and extensive methodological debates are not well suited for cultivating critical thinking, given the diversity of students' educational backgrounds, and level of their educational preparedness. AI simulations can help students by generating replacements for concepts, rephrasing statements, defining key terms into a simpler and more comprehensible format, providing an analytical conclusion, and recommend intervention. Too often, computational methods are treated as technically ineffective. Adages such as "garbage in, garbage out" dilute the necessary analytical relevance of the neutrality of computational methods. This is suggesting that we cannot separate the "human agent" from "human agency". For example, NLP (Natural Language Processing), network analysis, automated coding, or any of the host of other mapping

and analysis endeavors mentioned earlier in this article, can be employed to focus solely on human actors for the purpose of identifying patterns in behavior that allow us to reflect on the epistemological framework, associative structure, and explanatory causal pathways. By using AI to focus on any of these points in simulations that employ ethnography, archival work, computational analysis, or any other methodologically sound procedures for data collection, instructors can help students recognize the value of methodological pluralism in strengthening theory and widening the scope of inquires precisely for the reason that each renders the social world in a different light.

4. AI, Social Sciences, and Public Discourse

Although some AI applications require paid subscriptions for advanced access to data, most offer free versions downloadable on mobile devices, laptops, and desktop computers. Even free AI applications can access vast amounts of information within seconds. When employed across disciplines, AI facilitates a form of democratized access to information. While information alone does not constitute knowledge, it provides the foundation for students from which knowledge can be constructed. For example, the statement that “an X percent of the U.S. population living in poverty are women”—the feminization of poverty—represents information (data); the applied learning aspect of this information is to independently understand “why” this phenomenon occurs and “how” it might be addressed by critically analyzing that data. In this sense, the utility of AI is embedded in its ability to apply knowledge to a specific scenario and illustrate the “why” and the “how” of the situation, transcending mere number-crunching.

Furthermore, such engagements enable students to connect their lived experiences with broader structural and historical contexts by interrogating how information circulates in the media, policy debates, and popular narratives. The purpose of applied learning in this context is to allow students to move beyond passive consumption of data, participate in informed public discourse, generate knowledge, thereby contribute to more critical understandings of social events and how they are framed. However, having access to information carries with it the broader ethical issue when it involves data usage through interacting with AI. In this case, creating norms that value transparency and critical assessment of AI becomes an essential output (Boyd & Crawford, 2012; Kitchin, 2014). Thus, students must be made aware of their institutional responsibilities, observe privacy rules and regulations, and think beyond familiar individual-level moral boundaries.

According to Lindsted and Naurin (2010), “Just making information available will not prevent corruption if conditions for accountability are weak”. Critical inquiries require asking critical research questions (prompting), and seeking alternative methodological approaches and measures. For example, if a defining criterion of a social action (behavior) is its capacity to produce psychological harm and social disarray to a particular group, then AI can offer a meaningful opportunity to model public discourse, analogous to the ways in which other professionals in fields such as health care or engineering apply specialized knowledge to address consequential issues. In social sciences, the attention must shift toward “socially” consequential issues—affordability,

definition of family, debt crisis, employment, safety and security, and a host of other social issues. Students can then conceptualize and operationalize this feed into AI, and translate their analyses and findings into forms comprehensible to audiences such as civic society organizations, advocacy interest groups, educational institutions and public intellectuals, legal and regulatory bodies, think tanks, the general public, and translate the information into knowledge for social action.

Discussion and Conclusion

The aim of this paper was to show that artificial intelligence can deepen social science pedagogies when it is harnessed to each discipline's core intellectual and ethical commitments; that AI provides scaffolds for interpreting difficult texts, materializing abstraction through simulation; and, offers a dense object for applied learning. It was also suggested that critical, independent inquiries require vigilant reflexivity about how knowledge is produced, for what ends, about whom, and how students can use this skill to propose institutions that honor justice and human flourishing. If social sciences are to equip students to better understand the world that is increasingly mediated by AI, they must embrace both the promises and the problems of computational tools, and cultivate independent thinkers. The resulting pedagogy is not a capitulation to technological determinism but an affirmation of what the sociologist C. W. Mills called "the sociological imagination:" a commitment to seeing the interplay of biography and history, agency and structure, and, in our era, data and power as echoed in contemporary data studies such as in Boyd & Crawford, 2012; Zuboff, 2019).

The idea behind incorporating AI in applied learning is to provide students with an opportunity to enrich their epistemological and methodological exposure. This effort is not free of risk: students may be exposed to privacy risks (e.g., electronic surveillance such as key strokes, websites visited, location tracking, microphone or camera access, facial recognition, and a host of other recognition techniques) when monitoring software. In addition, integrating search engines into coursework may inadvertently normalize desensitizing students to the risks associated with how such technology is used. While learning critical awareness through hands-on experiences is important in social sciences, the potential harm associated with its application is undeniable.

Undoubtedly, using data analytics in the classroom helps students to critically examine social patterns. However, the instructor must also recognize forms of suppression that AI tools may impose on students' thinking. For example, when a student is studying a subject, the effective technology must not harm the pedagogy by setting the agenda, and possibly harness the foreground for risks that may suppress the educational gains; or, even remotely encourage identifying the participants.

Given the above, there are both advantages and disadvantages to utilizing AI while engaging students in applied learning. First, a major issue can be the verification of the pedagogical approaches in social science studies, and how AI can broaden the methodological and epistemological options available to students. Social Scientists are aware that "evidence-based" practices and "data-driven" decision making processes have become the core of policy analysis and policy making. However, a shift into the

quantitative realm may narrow the scope and definition of applied learning. As educators, Castillo (2022) suggests, we must reach a balanced perspective that neither uncritically embraces technology nor rejects it out of fear. As the technology becomes more pervasive, which has already happened, contemporary veteran social scientists must address the tension between methodological pluralism and analytical reductionism while training future social scientists. It is hoped that the next generation of social science students will master AI in order to create the foundations of newer social science theory and praxis. AI fluency, similar to its predecessor (computer literacy), will drive the momentum of this teaching-learning revolution in social studies.

References

Alansari, A., & Luqman, H. (2026). *Large language models hallucination: A comprehensivesurvey*. arXiv**.** https://arxiv.org/abs/2510.06265

Arosio, L. (2025). Generative AI as a teaching tool for social research methodology: Addressingchallenges in higher education. *Societies,* 15(6), 157 https://doi.org/10.3390/soc15060157

Arthur, W. B. (1994) Inductive reasoning and bounded rationality. American Economic Review, 84(2): 406–411.

Barocas, S., Hardt, M., & Narayanan, A. (2019). Fairness and machine learning. http://www.fairmlbook.org. Accessed January 2026.

Barocas, S., & Selbst, A. D. (2016). Big data's disparate impact. California Law Review, 104(3), 671–732. https://doi.org/10.2139/ssrn.2477899

Boyd, d., & Crawford, K. (2012). Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. Information, Communication & Society, 15(5), 662–679. https://doi.org/10.1080/1369118X.2012.678878

Brookfield, S. D. (2017). Becoming a critically reflective teacher (2nd ed.). Jossey-Bass.

Castillo, P. (2022). Technophilia or technophobia for the XXI century education. In The Book of Abstracts: 8th International Conference on Education (ICEDU 2022). https://philarchive.org/rec/CASTOT-5

Conte, R., & Paolucci, M. (2014). On agent-based modeling and computational social science.

Frontiers in Psychology, 5, 668. https://doi.org/10.3389/fpsyg.2014.00668.

Gupta, S., Ranjan, R., & Singh, S. N. (2024). Comprehensive study on sentiment analysis: From rule-based to modern LLM-based systems. Cornell University. arXiv. https://arxiv.org/pdf/2409.09989.

Eubanks, V. (2018). Automating inequality: How high-tech tools profile, police, and punish the poor. St. Martin's Press.

Fischbach, K., Marx, J., & Weitzel, T. (2021). Agent-based modeling in social sciences. Journal of Business Economics, 91, 1263–1270. https://doi.org/10.1007/s11573-021-01070-9.

Freire, P. (2000). Pedagogy of the oppressed (30th anniversary ed.). *Continuum.*

Giroux, H. A. (2011). On critical pedagogy. Bloomsbury.

Hooks, B. (1994). *Teaching to transgress: Education as the practice of freedom*. Routledge.

Hutson, J. & Plate, D. (2024). The Algorithm of Fear: Unpacking Prejudice Against AI and the Mistrust of Technology. *Journal of Innovation and technology*, 2024(38). https://iuojs.intimal.edu.my/index.php/joit/article/view/625/626. Accessed January 2026.

Kitchin, R. (2014). The data revolution: Big data, open data, data infrastructures & their consequences. Sage.

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436–444. https://doi.org/10.1038/nature14539

Lindstedt, C., & Naurin, D. (2010). Transparency is not enough: Making transparency effective in reducing corruption. *International Political Science Review*, 31(3), 301–322. https://doi.org/10.1177/0192512110377602

Macy, M. W., & Willer, R. (2002). From factors to actors: Computational sociology and agent-based modeling. *Annual Review of Sociology*, 28, 143–166. https://doi.org/10.1146/annurev.soc.28.110601.141117

Matheson, D. (2023). Discourse analysis after the computational turn: A mixed bag. Communication Research and Practice, 9(1), 3–15. https://doi.org/10.1080/22041451.2023.2190531.

McMurtrie, B. (2026). AI Joined the Faculty. *The Chronicle of Higher Education*. https://www.chronicle.com/article/ai-has-joined-the-facuty.

Mills, C. W. (1959). The sociological imagination. *Oxford University Press*.

Mitchell, T. M. (1997). Machine learning. McGraw-Hill.

Nayır, F., Sarı, T., & Bozkurt, A. (2024). Reimagining education: Bridging artificial intelligence, transhumanism, and critical pedagogy. *Journal of Educational Technology & Online Learning*, 7(1), 102–115

Noble, S. U. (2018). Algorithms of oppression: How search engines reinforce racism. *NYU Press.*

Pasquale, F. (2015). The black box society: The secret algorithms that control money and Information. *Harvard University Press*.

Rehman, A. U., Mahmood, A., Bashir, S., & Iqbal, M. (2024). Technophobia as technology inhibitor for digital learning in education: A systematic literature review. *Journal of Educators Online*, 21(2), Article 3. https://doi.org/10.9743/JEO.2024.21.2.3.

Riel, S. (2025). Pedagogy first: Frameworks for integrating technology and AI with purpose in ELT. *Bridge Universe*. https://bridge.edu/tefl/blog/frameworks-integrating-technology- ai-elt/. Accessed December 2025.

Schelling, T. C. (1969) Models of segregation. American Economic Review 59(2):488–493

Tufekci, Z. (2017). Twitter and tear gas: The power and fragility of networked protest. Yale *University Press*.

Wilensky, U., & Rand, W. (2015). An introduction to agent-based modeling: Modeling natural, social, and engineered complex systems with NetLogo*. MIT Press.*

Zuboff, S. (2019). The age of surveillance capitalism: The fight for a human future at the new frontier of power. *Public Affairs*.

Cultivating Discovery: Building a Research-Centered Learning Ecosystem Through Authentic Undergraduate Applied Research in Plant Science

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Keywords: course-based undergraduate research experience (CURE); Research-Based Learning Ecosystem; applied learning; undergraduate research; plant physiology; plant science education; experiential learning; hormesis; interdisciplinary collaboration; scientific identity; primarily undergraduate institution (PUI)

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Abstract

Course-Based Undergraduate Research Experiences (CUREs) emerged as powerful approaches for promoting student engagement, scientific literacy, workforce preparation and applied learning. However, despite the increasing adoption across different Science, Technology, Engineering, and Mathematics (STEM) disciplines, comparatively few published examples describe organismal and plant science CUREs, particularly at primarily undergraduate institutions (PUIs). This reflective case study describes the development and evolution of an eight-week-long Plant Physiology (BIO 440) CURE at Missouri Western State University (MWSU), centered on investigating the effects of the allelopathic molecule L-3,4-dihydroxyphenylalanine (L-DOPA) on plant growth and development.

The project initially was designed to provide students with an authentic research experience examining plant responses to naturally occurring secondary metabolites. Students participated in all the stages of the research process including the design and construction of a small-scale hydroponic growth system, experimental planning, plant propagation, physiological measurements, microscopy, pigment analyses, chlorophyll fluorescence assessments, data interpretation and finally, the communication of the findings. During the investigation the students documented unexpected concentration-dependent responses to L-DOPA which ultimately introduced them to the concept of hormesis and provided opportunities to engage in authentic scientific discovery.

As the project evolved, its educational impact extended well beyond the original research team. The scientific questions generated through the experimental work created additional opportunities for participation by students enrolled in Biochemistry II (CHE 470) at MWSU through literature-based investigations, scientific writing and poster presentations. Components of the project were subsequently also adapted for use in an advanced online Plant Ecophysiology course at Babeș-Bolyai University in Cluj-Napoca, Romania, extending the learning experience across institutional, disciplinary and national boundaries.

Student participation supported the development of competencies in scientific reasoning, experimental design, systems thinking, quantitative analysis, communication, collaboration and scientific identity. More broadly, the project also demonstrated how a single authentic research question can serve as a catalyst for building a research-centered Learning Ecosystem which integrates undergraduate research, applied learning, scholarly communication, interdisciplinary collaboration and international engagement.

This case study also highlights the largely underutilized potential of organismal plant science as a platform for authentic undergraduate research and suggests that research questions emerging from faculty scholarship can provide powerful foundations for

collaborative Learning Ecosystems that simultaneously advance student learning and scholarly activity.

Introduction

Higher education increasingly emphasizes the importance of developing graduates who can think critically, can solve complex problems and communicate effectively, work collaboratively across disciplinary boundaries and adapt to rapidly changing professional and scientific landscapes. While traditional lectures and laboratory instruction remain still important components of undergraduate education, many of the competencies required for long-term professional success are developed most effectively through authentic experiential learning opportunities which allow students to actively apply knowledge rather than simply just acquire it (Kolb, 1984; Kuh, 2008). In the biological sciences, where students are expected to interpret complex datasets, design experiments, evaluate evidence, communicate findings, and make decisions in the face of uncertainty, the opportunities to engage directly in the process of scientific inquiry have become ever more important.

Applied learning experiences have received considerable attention owing to their demonstrated ability to promote student engagement, retention, deeper learning and workforce readiness. Within biology education, the AAAS *Vision and Change* initiative emphasized the importance of developing competencies which extend beyond disciplinary content knowledge, including the ability to apply the process of science, use quantitative reasoning, engage in interdisciplinary thinking, communicate effectively, collaborate and understand biological systems across multiple levels of organization (Brewer and Smith, 2011).

Authentic undergraduate research and CUREs

From among the various forms of applied learning, undergraduate research experiences emerged as one of the most effective approaches for fostering these competencies and participation in authentic research has been associated with gains in scientific reasoning, scientific identity and self-confidence, as well as persistence in STEM disciplines (Seymour et al., 2004; Lopatto, 2007; Russell et al., 2007; Linn et al., 2015). However, the traditional apprenticeship-style research opportunities remain constrained by mentoring capacity and available resources. In response, Course-based Undergraduate Research Experiences (CUREs) emerged as an important mechanism for expanding access to authentic research by embedding scientific inquiry directly into the curriculum (Auchincloss et al., 2014; Bangera and Brownell, 2014).

Unlike traditional laboratory exercises centered on the “verification” of known concepts, CUREs engage students in projects where the outcomes are uncertain, novel discoveries are possible and findings can contribute to a broader scientific understanding. Consistent with the framework proposed by Auchincloss et al. (2014), successful CUREs are characterized by authenticity, discovery, iteration, collaboration and relevance.

Although both the traditional apprenticeship-style research experiences and the CUREs provide opportunities for authentic scientific inquiry, the two approaches differ substantially in accessibility, scale, educational structure and their potential impacts on student participation and learning outcomes (Table 1).

Characteristic	Traditional Apprenticeship Research Model	Course-based Undergraduate Research Experience (CURE) Model
Student access	Limited to a relatively small number of students selected for research positions	Embedded into coursework, allowing participation by larger numbers of students
Educational setting	Typically conducted outside formal coursework	Integrated directly into the curriculum
Primary goal	Advancement of faculty research with student participation	Simultaneous advancement of student learning and authentic research
Research questions	Determined primarily by faculty research agendas	Integrated with course learning objectives
Scalability	Generally limited by mentoring capacity, laboratory space and funding	Scalable across courses and institutions
Inclusivity	Participation often limited to students who actively seek opportunities or meet selection criteria	Broadens participation by reducing barriers to research involvement
Student engagement in the research process	Variable and dependent on project needs	Intentionally structured to engage students throughout the research process
Development of scientific identity	Often strong for participating students	Provides scientific identity development opportunities for a larger student population
Collaboration	Typically within individual laboratories or research groups	Frequently involves peer collaboration within course-based teams
Alignment with learning outcomes	May be indirect	Explicitly aligned with course outcomes and competency development
Alignment with Vision and Change competencies	Variable	Often intentionally designed to support scientific reasoning, quantitative literacy, communication, collaboration and systems thinking
Potential educational impact	Limited by participant numbers	High due to curriculum integration and broad participation

Table 1: *Comparison between traditional apprenticeship-style undergraduate research experiences and Course-based Undergraduate Research Experiences (CUREs).*

Both approaches provide opportunities for authentic scientific inquiry but differ in accessibility, scalability, educational structure, integration with coursework and potential educational impact. The characteristics summarized here are adapted from the broader

undergraduate research and CURE literature (Seymour et al., 2004; Lopatto, 2007; Auchincloss et al., 2014; Bangera and Brownell, 2014; Corwin et al., 2015; Linn et al., 2015).

CUREs at primarily undergraduate institutions

The educational value of CUREs may be particularly important at primarily undergraduate institutions (PUIs), where the undergraduate students often represent the primary research workforce and faculty balance substantial teaching responsibilities with active scholarly programs. In these settings, research questions emerging from faculty scholarship can become the foundation for applied learning opportunities which simultaneously advance student learning and faculty research goals. Such integration creates synergies between teaching and scholarship while broadening students' participation in undergraduate research beyond the traditional apprenticeship models (Bangera and Brownell, 2014, Brownell and Kloser, 2015).

Plant-focused and organismal CUREs

Published CUREs span a broad range of STEM fields and biological subdisciplines, but organismal and plant-focused implementations remain a comparatively less visible part of the literature than molecular, microbiological and biomedical examples. A recent systematic review identified 242 CURE curricula across STEM and emphasized substantial variation in the scientific practices incorporated into CUREs (Buchanan and Fisher, 2022). At the same time, recent plant-focused models demonstrate a growing range of approaches including field-based restoration ecology, low-cost plant physiology investigations and multi-institutional digital plant CUREs (Stanfield et al., 2022; Mata, 2024; Murren et al., 2026). Thus, rather than representing an absent area, plant science is an expanding but still particularly useful context in which to examine how authentic research can be integrated with organismal observation, quantitative analysis and systems thinking.

The continued development of plant-focused CUREs is especially relevant given challenges related to food security, climate resilience, biodiversity conservation and sustainable agriculture (National Research Council, 2009). Plant systems provide powerful educational platforms because they integrate physiology, development, ecology, genetics and environmental science within a single experimental framework, while allowing students to observe biological change through time. Recent plant CUREs further demonstrate that these systems can support quantitative reasoning, scientific communication, systems thinking and participation across a range of institutional contexts (Stanfield et al., 2022; Murren et al., 2026).

From authentic research to a research-centered Learning Ecosystem

Authentic research experiences also provide opportunities for collaboration which increasingly reflects the realities of contemporary scientific practice. Modern research is interdisciplinary, collaborative and frequently international in scope. Preparing students for future careers therefore requires opportunities to engage with diverse perspectives and forms of expertise. Multi-institutional and international collaborations can broaden students' perspectives, strengthen intercultural competence and reinforce the

increasingly global nature of scientific inquiry (NASEM, 2018). Such environments may function as communities of practice in which students move from learners toward active participants in knowledge creation through shared inquiry and collaboration (Wenger, 1998).

Learning Ecosystems (or Learning Ecologies) have been described as interconnected networks of people, activities, resources and learning opportunities which support knowledge development across multiple contexts rather than within a single course or educational experience (Jackson, 2013; Siemens, 2005; González-Sanmamed et al., 2019). In higher education, Learning Ecosystems frequently emerge when research, teaching, collaboration and scholarly communication become linked through shared problems, goals and sustained participation in authentic inquiry. Such ecosystems may provide multiple entry points for participation while supporting learning which extends across disciplinary, institutional and geographic boundaries.

This case study examines how a plant science CURE initially developed for the Plant Physiology (BIO 440) laboratory at Missouri Western State University (MWSU) evolved into a broader research-centered Learning Ecosystem, involving undergraduate researchers, students enrolled in Biochemistry II (CHE 470, MWSU), scientific dissemination activities and an international Plant Ecophysiology course at Babeș-Bolyai University in Romania. Over six consecutive offerings of Plant Physiology (BIO 440) at between 2020 and 2026, the project engaged approximately 145 students through Plant Physiology, Biochemistry II, and an international Plant Ecophysiology course, providing a very unique opportunity to examine how a single research question can support learning across multiple educational contexts. Through this evolution, the project created interconnected opportunities for participation, scholarship and professional development across courses, disciplines, institutions and continents. This case study explores how an authentic research question served as a catalyst for applied learning while illustrating the potential of organismal plant biology to integrate research, teaching, scientific communication and collaboration. In doing so, it provides an example of how faculty scholarship can simultaneously advance undergraduate research, applied learning, interdisciplinary collaboration and international engagement within a primarily undergraduate institution (PUI).

Methods

Case-study design and educational contexts

This manuscript uses a retrospective, descriptive case-study approach to document the development of a research-centered Learning Ecosystem that emerged from an eight-week Plant Physiology CURE. The purpose is not to test a causal educational intervention but to describe the instructional design, evolution, student participation pathways and recurring educational outcomes observed as the project expanded across courses and institutions. The case spans six offerings of BIO 440 Plant Physiology between 2020 and 2026 (approximately 90 students), an additional approximately 15 students in Biochemistry II (CHE 470) at MWSU and approximately 40 students

participating through an advanced online Plant Ecophysiology course at Babeș-Bolyai University.

Evidence sources and analytic approach

Evidence used for the educational interpretation consisted of course and project records, student-generated scholarly products, documented participation in research and dissemination activities, faculty observations accumulated across repeated implementations and de-identified anonymous comments from routine course feedback where available. Because these materials were not collected prospectively using a common research instrument, they were not treated as a quantitative dataset and no inferential claims about learning gains were made. Instead, the authors retrospectively compared the available evidence across offerings and organized recurring observations into descriptive themes: ownership and investment in research; scientific inquiry and response to uncertainty; communication, confidence and scientific identity; and professional growth and career preparation. Student comments were used only as contextual support for these recurring themes. Because the comments available to the authors had previously been edited or paraphrased for instructional reflection they are presented in this manuscript as paraphrased feedback rather than as verbatim quotations or individually attributable statements.

Ethical considerations

No new student data were collected for the preparation of this manuscript. The educational activities described here occurred within a broader institutional context in which MWSU maintained IRB protocols addressing the evaluation of teaching strategies and applied-learning research projects (IRB #2095, PI Barta) and subsequently, short CUREs and student self-efficacy and retention (IRB #79, PI Grantham; co-PI Barta). These protocols were not designed specifically for the present retrospective case study and are therefore not presented as prospective approval of the analysis reported here. To minimize ethical and privacy concerns, the manuscript relies on aggregate course information, documented scholarly activities, faculty observations and de-identified anonymous course feedback; no student, course section or individual respondent is identified and paraphrased feedback is not linked to a specific student or offering.

BIO 440 Plant Physiology Cure: Instructional Design

The educational foundation for this broader ecosystem was an eight-week CURE module developed within the Plant Physiology (BIO 440) laboratory at MWSU. Across six offerings, the broad instructional framework remained centered on authentic investigation of naturally occurring plant secondary metabolites involved in plant-plant communication and allelopathic interactions, while specific experimental questions, concentrations, protocols and follow-up directions were refined as prior observations generated new questions. Students therefore worked within a shared research program rather than completing unrelated individual projects. They participated in literature-informed hypothesis development, experimental planning, construction and refinement of the research system, treatment implementation, data collection, analysis and interpretation. Among the compounds examined was L-3,4-dihydroxyphenylalanine (L-DOPA), a biologically active non-protein amino acid abundant in velvet beans (*Mucuna*

pruriens) and widely recognized for its role in allelopathic interactions between plant species (Fujii, 2003; Soares et al., 2014).

Unlike the traditional laboratory exercises centered on the verification of established concepts, the outcomes of this investigation were unknown at the outset. Hypothesis development was introduced through guided examination of the primary literature and discussion of what was known, what remained uncertain and which predictions could be tested within the available plant system. Students then participated in experimental planning, system design, plant propagation, treatment application, data collection, physiological analyses and interpretation. Morphometric measurements, microscopy, pigment analyses, chlorophyll fluorescence assessments and evaluations of plant health were integrated to evaluate the responses to the tested molecules. The instructor established safety, feasibility and shared experimental constraints, while students contributed to decisions about system design, troubleshooting, measurements and interpretation. This balance preserved a common research question and comparable datasets while retaining meaningful student agency.

The eight-week module was intentionally structured to engage the students in multiple stages of the scientific process while progressively building technical, analytical and professional competencies. These competencies were aligned with course goals in scientific reasoning, experimental design, quantitative analysis, plant physiological measurement, communication and collaborative problem-solving; Table 2 summarizes how specific activities supported those outcomes.

Module Phase	Student Activities	Scientific Focus	Competencies Developed
Introduction and experimental planning (Week 1)	Introduction to allelopathy, plant secondary metabolites, literature review, development of research questions and hypotheses	Plant-plant interactions and allelochemical effects	Scientific literacy, literature evaluation, hypothesis development, critical thinking
Research infrastructure development (Weeks 1–2)	Design and construction of hydroponic growth systems, selection of materials, system testing and refinement	Development of a controlled experimental platform	Systems thinking, teamwork, engineering design, problem solving, project planning
Experimental design and setup (Weeks 2–3)	Selection of the treatments and concentrations, development of protocols, establishment of experimental plants	Experimental design and implementation	Experimental design, quantitative reasoning, replication and controls
Plant propagation and treatment application (Weeks 2–8)	Plant cultivation, system maintenance, treatment administration, monitoring of the environmental conditions	Plant growth responses to allelochemicals	Plant propagation, resource management, technical skills, responsibility
Morphological and developmental assessments (Weeks 3–8)	Measurement of growth and developmental traits, visual evaluations of plant health	Whole-plant responses to treatment	Quantitative data collection, observation, data management
Physiological analyses (Weeks 4–8)	Pigment analyses, chlorophyll fluorescence measurements, assessment of plant stress responses	Plant physiological responses to allelochemicals	Plant physiology, instrumentation, analytical skills
Microscopy and cellular observations (Weeks 5–8)	Microscopic evaluation of tissues and treatment-induced responses	Cellular effects of secondary metabolites	Microscopy, cell biology, interpretation of biological structure-function relationships
Data analysis and interpretation (Weeks 6–8)	Statistical analyses, interpretation of experimental outcomes, evaluation of unexpected results	Concentration-dependent responses and hormesis	Data analysis, scientific reasoning, evidence-based decision making
Communication and reflection (Week 8)	Presentation and discussion of findings, reflection on outcomes and future directions	Scientific communication and dissemination	Written and oral communication, teamwork, scientific identity
Extended learning opportunities (Post-CURE)	Biochemistry II (CHE 470) literature investigations, poster development, international course adaptation	Broader biochemical and ecological context of L-DOPA	Interdisciplinary thinking, scholarly communication, collaboration, global awareness

Table 2: *The structure and the educational design of the eight-week BIO 440 Plant Physiology Course-based Undergraduate Research Experience (CURE).*

Students investigated the effects of naturally occurring plant secondary metabolites involved in plant-plant communication and allelopathic interactions, including L-3,4-

dihydroxyphenylalanine (L-DOPA). The module integrated authentic research, experimental design, systems development, physiological analyses and scientific communication while intentionally fostering technical, analytical, professional and collaborative competencies.

The module was intentionally structured to expose students to authentic scientific inquiry and while the original goal was to investigate the physiological responses to plant secondary metabolites, the implementation of the module quickly revealed an additional challenge. Before any treatments could be applied, a suitable experimental platform first had to be designed, constructed and maintained. What initially appeared to be a practical necessity soon became one of the most important educational components of the entire experience.

Results and Outcomes

Building the research platform

Although the scientific focus of the BIO 440 CURE centered on evaluating the effects of naturally occurring allelopathic molecules on plant growth and development, the successful implementation of the project first required the development of a suitable experimental platform. Because commercially available systems exceeded the available budget and did not fully meet the needs of the project, the students were challenged to design, construct and operate a small-scale hydroponic growth system capable of supporting controlled experimentation throughout the semester.

Rather than entering into a fully operational research environment, the students became the active participants in creating the research infrastructure itself. They evaluated potential system designs, identified materials, assembled growth units and established procedures for operation and maintenance. Decisions regarding water circulation, aeration, nutrient delivery, environmental monitoring, plant support structures and experimental layout required the integration of concepts from plant physiology, ecology, environmental science and basic engineering.

The infrastructure-building phase also introduced students to systems thinking, a competency increasingly emphasized in contemporary biology education. Students quickly discovered that modifications to one component of the system frequently influenced others in unexpected ways: changes in water flow affected root development, alterations in support structures influenced maintenance procedures and sampling accessibility and fluctuations in environmental conditions altered growth rates and experimental timelines. These interactions reinforced the interconnected nature of biological and physical systems and parallel recent CURE work showing that authentic organismal and ecological research can explicitly develop systems-thinking skills (Stanfield et al., 2022).

As it is often the case in authentic research, the first design was far from perfect. Components occasionally failed, environmental conditions fluctuated and the maintenance procedures required continual refinement. Water quality had to be

monitored and adjusted, support structures were redesigned and experimental layouts were modified as students gained experience with the system. These challenges became some of the most valuable learning opportunities within the project. Students experienced firsthand that troubleshooting is an essential, often major component of the research process. Failures became sources of information which informed the subsequent decisions.

Because students helped create the conditions under which the research could occur, the process also fostered a strong sense of ownership. As a result, students became deeply invested in both the success of the project and the quality of the data generated. Collaboration, peer mentoring and shared problem solving became central features of the research culture that emerged around the project.

Perhaps most importantly, the experience transformed the students' perceptions of scientific research itself. Many entered the project expecting research to consist primarily of measurements, collecting data and analyzing results. Instead, they discovered that research begins much earlier, with developing systems capable of addressing the scientific questions and continually refining the approaches as new challenges emerge. These experiences proved invaluable as the project transitioned from infrastructure development to experimental investigation and ultimately to the unexpected discovery of the hormetic plant responses to L-DOPA.

From hypothesis to discovery: learning through unexpected results

With the hydroponic platform operational and the experimental protocols established, the students began investigating the effects of L-3,4-dihydroxyphenylalanine (L-DOPA) on plant growth and development. Based on the published literature many expected a relatively straightforward response. L-DOPA has been frequently described as an allelopathic molecule able to suppress plant growth and to influence plant-plant interactions, leading students to predict progressively stronger inhibitory effects with increasing concentrations (Fujii, 2003; Soares et al., 2014).

The initial observations appeared consistent with these expectations, with higher treatment concentrations reducing growth, inducing developmental abnormalities and producing visible signs of physiological stress in both the roots and the aerial parts of the plant body. As additional experiments were conducted to increase the resolution of the concentration dependent responses, however, a much more complex pattern emerged: rather than producing uniformly negative responses, the lower concentrations of L-DOPA stimulated growth and development with some of the treated plants outperforming untreated controls (Barta et al., *personal communication, manuscript in preparation*).

These observations generated considerable discussion and a debate between the students. Initial explanations included experimental errors, natural variations between plants or inconsistencies in the treatment application. Yet, the repeated experiments continued to reveal similar trends. Instead of dismissing the observations, students were

encouraged to investigate them further and explore the possible mechanisms underlying the detected responses.

The emerging data ultimately introduced students to the concept of hormesis, a biological phenomenon characterized by growth stimulation at low doses and inhibition at higher doses, a response increasingly recognized in plant interactions involving secondary metabolites and allelochemicals (Calabrese and Baldwin, 2002; Calabrese, 2004; Bondy, 2023). The possibility that a molecule widely associated with growth inhibition might also promote growth under certain conditions challenged many students' assumptions and became one of the most influential educational moments of the project.

Perhaps more important than the discovery itself was the process through which the discovery emerged. Students experienced firsthand that scientific investigations do not always confirm the initial expectations and that unexpected observations often become the starting point(s) for new lines of inquiry.

The discovery also highlighted the value of integrating multiple approaches within a single investigation. Morphological observations were complemented by microscopy, pigment analyses, chlorophyll fluorescence measurements and assessments of plant health and stress responses. Together, these measurements provided a more complete understanding of plant responses than any individual dataset could offer.

As evidence supporting hormetic responses accumulated, the students increasingly recognized that they were participating in the generation of knowledge rather than simply reproducing established concepts. The observations were not known in advance by either the students or the instructor and the emerging results suggested that the project could contribute to broader discussions regarding the biological activity of L-DOPA and its potential applications.

Equally importantly, the students experienced one of the central realities of scientific discovery: progress often emerges not from confirming existing assumptions but from investigating observations which challenge them. These experiences laid the foundation for subsequent physiological investigations and the broader educational collaborations which emerged from the project.

Development of Student Competencies

One of the most significant outcomes of the project was the breadth of competencies that the students developed through their participation in the authentic research experience. Although the project originated as an investigation of L-DOPA effects on plant growth and development, the educational outcomes extended far beyond the scientific questions themselves. Students were immersed in an environment which required them to integrate technical skills, scientific reasoning, communication, collaboration and problem solving during working toward a shared research goal. The project supported several of the core competencies emphasized by the *Vision and Change* recommendations for undergraduate biology education, including scientific

reasoning, quantitative literacy, systems thinking, communication and collaboration (Brewer and Smith, 2011). The major competency domains which emerged during the project are summarized in Table 3.

Competency Domain	Examples from the Project	Educational Significance
Scientific reasoning	Hypothesis development, interpretation of unexpected results, evaluation of hormetic responses	Understanding science as an iterative process of inquiry
Experimental design	Treatment selection, controls, replication, protocol refinement	Development of evidence-based decision making
Technical skills	Plant propagation, hydroponics management, microscopy, pigment analyses, chlorophyll fluorescence	Exposure to authentic plant science research methodologies
Quantitative reasoning	Morphometric measurements, data collection, interpretation of physiological responses	Development of analytical and data literacy skills
Systems thinking	Integration of cellular, physiological, developmental and whole-plant responses	Understanding interactions among biological processes
Problem solving and adaptability	System redesign, troubleshooting, protocol modification	Development of resilience and adaptive thinking
Communication	Discussions, poster preparation, presentations, scientific writing	Ability to communicate scientific information to diverse audiences
Collaboration	Team-based system construction, data interpretation, peer mentoring	Experience working within collaborative scientific environments
Scientific identity	Ownership of research, participation in discovery, contribution to dissemination	Recognition of oneself as a contributor to scientific knowledge
Global and interdisciplinary awareness	Integration with Biochemistry II and Babeș-Bolyai collaborations	Appreciation of science as interdisciplinary and international

Table 3: *Major competency domains developed through participation in the BIO440 Plant Physiology CURE.*

Competencies emerged through engagement in authentic scientific inquiry and extended beyond disciplinary content knowledge to include technical, analytical, professional, collaborative and global skills commonly associated with contemporary scientific practice and workforce preparation.

A defining characteristic of the experience was that the students encountered the research process as an interconnected whole rather than as a collection of isolated techniques. Experimental design, system development, plant cultivation, physiological analyses, data interpretation and communication of findings were all integrated within a

single investigation. As a result, the students developed a more holistic understanding of how scientific knowledge is generated and refined stepwise.

Scientific reasoning was strengthened through participation in hypothesis development, experimental design, data interpretation and evaluation of unexpected results. The discovery of concentration-dependent and hormetic responses required students to revisit their assumptions, consider alternative explanations and refine their interpretations in response to evidence. At the same time, students gained experience with plant propagation, microscopy, pigment analyses, chlorophyll fluorescence measurements and other techniques commonly used in plant science research. Because these methods were applied within the context of an authentic investigation, students were able to connect the technical procedures to broader biological questions and experimental objectives.

The project also fostered systems thinking and a variety of professional competencies extending beyond the disciplinary knowledge alone. Students learned to integrate observations across multiple levels of biological organization, from cellular responses observed through microscopy to physiological measurements and whole-plant growth responses. Construction and operation of the hydroponic platform further required collaboration, communication, adaptability and collective problem solving, providing opportunities to develop skills closely aligned with professional scientific practice (Lopatto, 2007; NASEM, 2017).

Perhaps most importantly, their participation in the project contributed to the development of their scientific identity and ownership. Because students participated in all stages of the investigation, from system development and experimental design to data interpretation and dissemination, they increasingly viewed themselves as contributors to scientific knowledge rather than simply consumers of it. The realization that their observations might contribute to a broader scientific conversation transformed the project from a course activity into a meaningful scholarly endeavor.

Extending Learning Beyond the Original Research Group

One of the most unexpected outcomes of the project was the extent to which its educational impact expanded beyond the students directly involved in the experimental research. As new questions emerged regarding the biological activity of L-DOPA and the mechanisms underlying the observed responses, the project naturally created opportunities for engagement beyond the original Plant Physiology CURE.

A particularly valuable extension occurred through integration of the project into a Biochemistry II (CHE 470) course at MWSU taught by a faculty collaborator. Rather than participating directly in greenhouse experiments, these students engaged with the project through literature-based investigations exploring the biochemical and physiological context of L-DOPA. The CHE 470 students evaluated primary literature, synthesized information across studies, identified knowledge gaps and developed written summaries of their findings. Importantly, these activities were connected to an

active research project rather than functioning as isolated classroom exercises, providing the students with an authentic context for scholarly inquiry.

The project also created opportunities for scientific communication and dissemination. Students translated complex scientific concepts into accessible formats through poster development and presentation activities, culminating in presentations at Missouri Western's Multidisciplinary Research Days (MRD, Spring 2026). These experiences required students to communicate scientific information effectively to broader audiences.

The project generated a variety of scholarly products including literature-based posters, research presentations and contributions to the development of a manuscript intended for publication (Figure 1). These activities provided opportunities for scientific communication while reinforcing the students' roles as contributors to scholarly inquiry rather than as passive recipients of information.

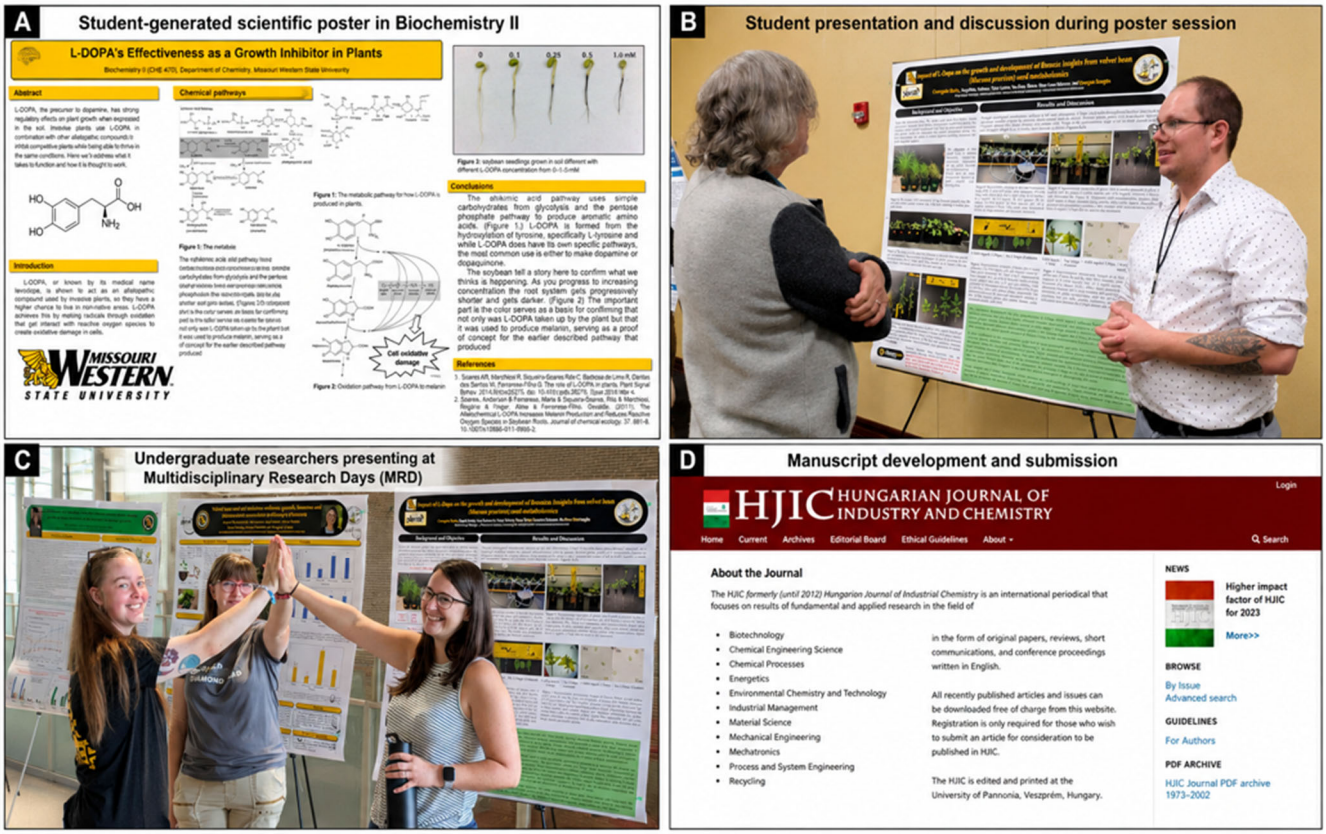


Figure 1: *Scholarly dissemination and educational products generated through the research-centered Learning Ecosystem. Examples of student scholarly outputs arising from the L-DOPA research project,* including (A) literature-based poster presentations developed in Biochemistry II (CHE 470); (B, C) dissemination of experimental findings at Multidisciplinary Research Days and other research symposia, student engagement in scientific communication with faculty and peers, and (D) ongoing manuscript development for submission to the Hungarian Journal of Industry and Chemistry. Together, these products illustrate how authentic undergraduate research can extend beyond just data collection to include literature synthesis, scientific communication, professional development and contributions to scholarly dissemination. *(Photographs by C. Barta. Student photographs reproduced with permission.)*

The integration of Biochemistry II (CHE 470) students demonstrated how a single authentic research question can support diverse forms of scholarly engagement. While some students participated in experimental design, data collection and physiological analyses, others contributed through literature synthesis, scientific communication, poster development and manuscript preparation. Together, these activities broadened participation in undergraduate research while exposing students to the interdisciplinary nature of scientific inquiry.

From an educational perspective, the project evolved from a single undergraduate research experience into a broader collaborative Learning Ecosystem linking experimental research, literature-based scholarship, scientific communication and public dissemination. This expansion established a foundation for collaborations extending beyond the home institution.

Extending Learning Beyond Institutional and Geographic Boundaries

While the integration of the project into Biochemistry II demonstrated its ability to cross disciplinary boundaries, an equally important outcome involved its extension beyond the home institution. As the research evolved, components of the project were adapted for use in an advanced online Plant Ecophysiology course at Babeș-Bolyai University in Cluj-Napoca, Romania. What began as a local undergraduate research initiative therefore expanded into an international educational collaboration.

Although students enrolled in the Romanian course did not participate directly in the greenhouse experiments, they engaged with the scientific questions, methodologies and findings generated through the project. Instructional materials included authentic project datasets, experimental protocols, photographs and research context selected and organized by the collaborating instructors for educational use. Thus students were not simply given an unfiltered archive of all raw course data, rather, faculty curated datasets that retained authentic variability and uncertainty while being sufficiently documented for interpretation in an online course. Students used these materials to evaluate patterns, discuss possible mechanisms and connect the experimental findings to broader plant ecophysiological concepts.

One of the most valuable aspects of this adaptation was the opportunity to expose students to the complexity of authentic scientific data. Unlike typical textbook examples which often present clear conclusions, ongoing research contains variability, uncertainty and many unanswered questions. Students were therefore required to engage in interpretation, discussion and critical evaluation rather than simply identifying correct answers.

The international collaboration also exposed students to different educational perspectives while reinforcing the increasingly global nature of contemporary science. Discussions frequently connected the project to broader challenges in sustainable agriculture and environmental resilience. Although students participated from different institutions and in different ways, they were united by a shared scientific question and a common process of evaluating evidence and constructing understanding.

From an educational perspective, this adaptation demonstrated that authentic research experiences need not be limited to students with direct access to laboratory facilities or specialized equipment. Research-generated datasets, experimental protocols and preliminary findings can themselves become powerful educational resources capable of extending the impact of a project far beyond the original research group or a course. Together with the integration of Biochemistry II students, the collaboration transformed the project into a broader Learning Ecosystem characterized by interconnected opportunities for research, scholarship, communication and participation across multiple educational contexts (Jackson, 2013; Wenger, 1998).

The evolution of the project from a single research question into a broader research-centered Learning Ecosystem involving multiple courses, dissemination activities and international collaborations is summarized in Figure 2.

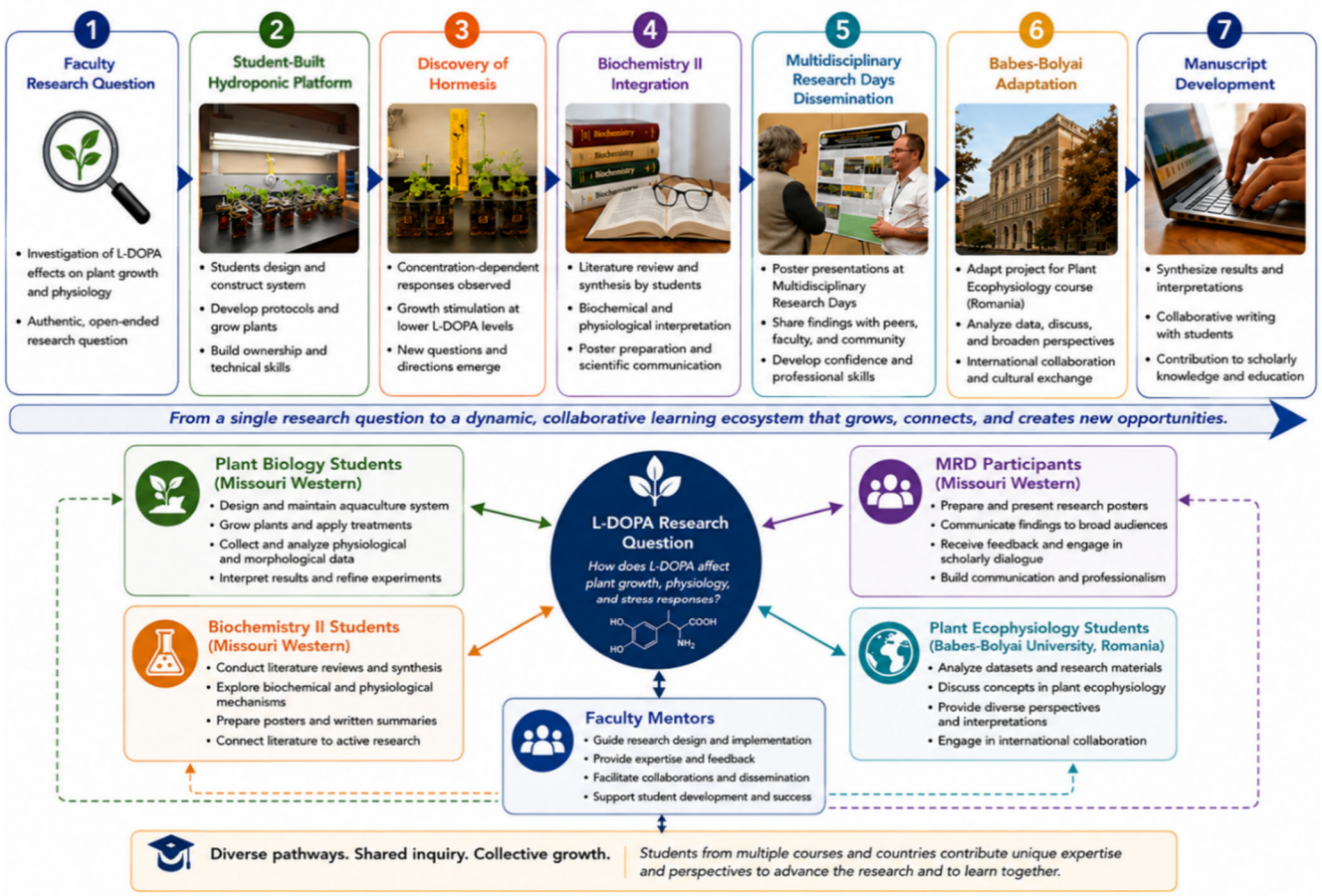


Figure 2: *The evolution of a research-centered Learning Ecosystem from a single undergraduate research question initiated through an undergraduate investigation of L-3,4-dihydroxyphenylalanine (L-DOPA) effects on plant growth and physiology.* The upper portion of the figure illustrates the progression of the project from an authentic faculty research question through student construction of a hydroponic platform, discovery of concentration-dependent responses and hormesis, integration into Biochemistry II coursework, dissemination through Multidisciplinary Research Days, adaptation within an international Plant Ecophysiology course at Babeș-Bolyai University and collaborative manuscript development. The lower portion depicts the broader Learning Ecosystem which emerged around the project, highlighting the multiple pathways for student participation through experimental research, literature synthesis, scientific

communication, interdisciplinary collaboration and international engagement. Together, these interconnected activities demonstrate how a single authentic research question can evolve into a collaborative, multi-course and multi-institutional learning environment which supports scientific inquiry, professional development and student ownership of the research process. *(Photographs by C. Barta. Student photographs reproduced with permission.)*

The evolution of the project and the relationships between its major activities are summarized in Figure 2, while the connections between project activities, competency development and student outcomes are presented conceptually in Figure 3.

Student Feedback and Evidence of Educational Impact

Across the six BIO 440 offerings the available evidence revealed recurring patterns in student engagement and professional development. These patterns were triangulated descriptively across all routine teaching interactions, de-identified anonymous course feedback, continued student involvement, student-generated scholarly products and participation in the dissemination activities. Because the evidence sources were heterogeneous and were not collected using a common prospective assessment instrument, the themes below should be interpreted as descriptive outcomes of this case rather than quantified learning gains.

The broader Learning Ecosystem involved approximately 90 BIO 440 students, approximately 15 CHE 470 students and approximately 40 students in the advanced online Plant Ecophysiology course at Babeș-Bolyai University. Anonymous course feedback was not available in an equivalent form for every participant or every educational context; consequently, the reflections below are not intended to represent all approximately 145 students. Instead, they summarize recurring themes supported by the subset of de-identified feedback available to the authors together with documented participation and faculty observations. The illustrative statements are paraphrases of actual anonymous comments and are intentionally not linked to a course, section, year or student.

Ownership and investment in research. One of the most consistently emerging themes was student ownership. Because students participated in designing the experimental platform, implementing treatments, collecting and analyzing data and interpreting findings, they often described the work as meaningfully different from a traditional laboratory exercise. Paraphrased anonymous feedback emphasized that conducting 'actual research,' creating graphs, interpreting results and contributing to a manuscript initially felt challenging but ultimately made meaningful scientific research seem achievable. Students also described feeling invested in the project's success because they had helped build it from the beginning. These observations are consistent with evidence that direct engagement with one's own CURE data can strengthen emotional ownership and scientific identity (Cooper et al., 2020).

Scientific inquiry and discovery. A second recurring theme concerned responses to uncertainty and unexpected findings. The concentration-dependent and potentially hormetic responses challenged initial expectations and required students to consider experimental error, biological variation and alternative mechanisms before refining their

interpretations. Paraphrased course feedback described this as a shift from simply completing an experiment toward understanding that research is driven by discovery and by new questions emerging from data. This pattern aligns with the emphasis in the CURE literature on iteration, authentic uncertainty and student engagement in scientific practices beyond following a predetermined protocol (Auchincloss et al., 2014; Buchanan and Fisher, 2022).

Communication, confidence and scientific identity. Communication and scientific confidence also emerged repeatedly. Students prepared posters, presented findings, contributed to manuscript development and discussed results with peers and faculty. Paraphrased anonymous feedback described growth in presentation confidence, including among students who initially experienced anxiety about speaking with others, and linked these experiences to seeing themselves as capable contributors to scientific knowledge. The observation is consistent with prior CURE research connecting authentic participation, data ownership and research communication with scientific identity development (Cooper et al., 2020; Stanfield et al., 2022).

Professional growth and career preparation. Students also described the value of research experiences extending beyond laboratory technique. Paraphrased feedback highlighted laboratory and field experience, research presentations, proposal development, scientific writing and manuscript preparation as preparation for graduate study and science-related careers. Continued engagement after the formal course - including participation in data analysis, literature review, presentation development and related research activities - provided an additional observable indicator that the project created pathways for students to remain involved in scholarship beyond a single semester.

Faculty observations provided a complementary but explicitly interpretive source of evidence. One recurring observation was the increasing sophistication of student questions as projects progressed. Early discussions typically focused on procedures, data collection and expected outcomes, whereas later conversations more frequently addressed mechanisms, experimental limitations, interpretation of complex datasets and future research directions. Because these observations were not scored with a validated instrument, they cannot establish the magnitude or universality of learning gains; however, they provide contextual evidence consistent with the student feedback and scholarly products described above.

Taken together, the converging evidence supports a cautious conclusion that the research-centered approach created opportunities for development in ownership, scientific reasoning, communication, professional confidence and scholarly engagement. The evidence does not demonstrate that every student experienced each outcome, nor does it establish causation. Rather, it documents recurring patterns across a sustained case and shows how authentic research activities can generate multiple, observable pathways for student participation and development.

The relationships among the project activities, competency domains and resulting student outcomes are conceptually summarized in Figure 3.

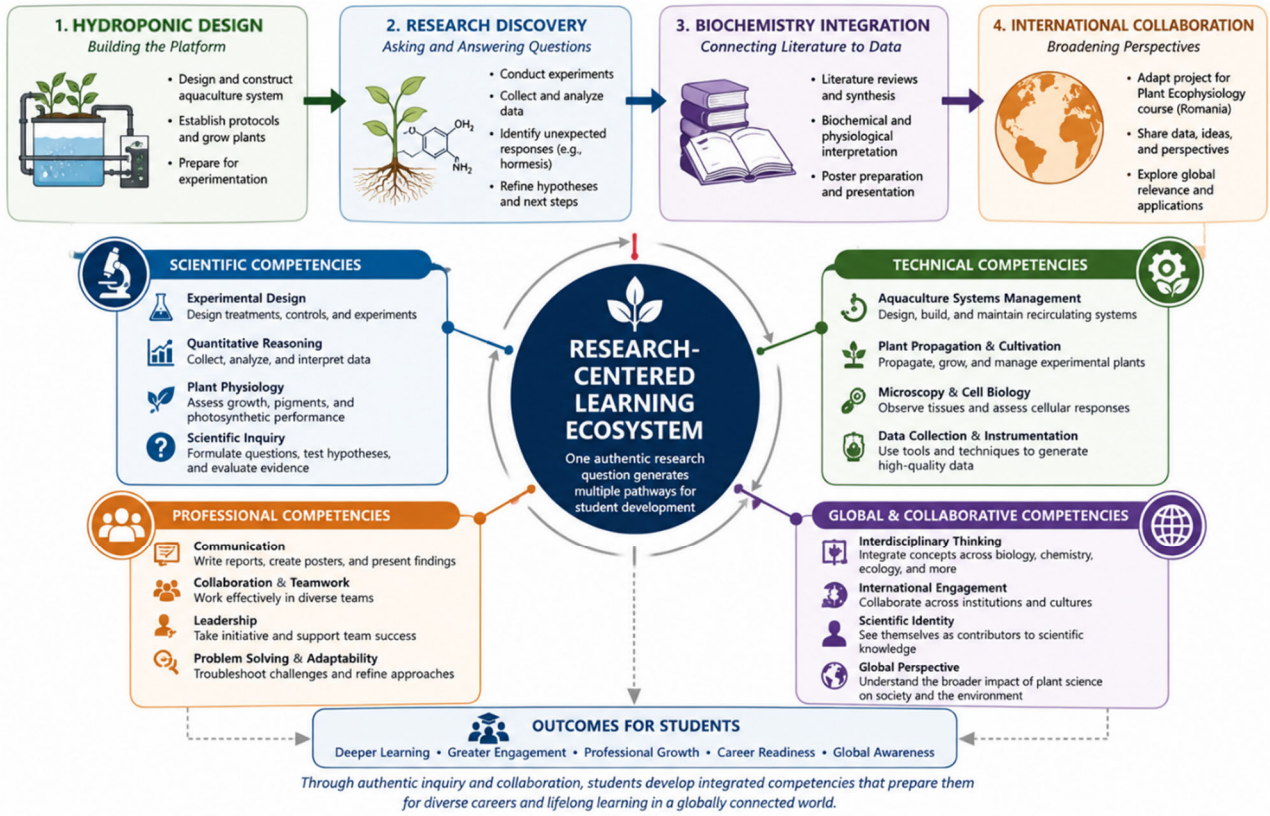


Figure 3: *Research-centered Learning Ecosystem: One authentic plant science question, multiple pathways for student development. Conceptual model illustrating how a single plant science research question generated interconnected opportunities for student learning and professional growth.* The upper portion of the figure depicts the progression of the L-DOPA project through four stages: development of a student-built hydroponic platform, experimental discovery and hypothesis refinement, integration of literature-based inquiry through Biochemistry II coursework, and expansion through collaboration with an international Plant Ecophysiology course at Babeș-Bolyai University. Together, these experiences fostered development of scientific, technical, professional, and global competencies. The integration of experimental research, literature-based scholarship, scientific communication and international collaboration contributed to student outcomes including deeper learning, increased engagement, professional growth, career readiness and overall global awareness. The model illustrates how authentic undergraduate research can serve as a framework for connecting research, teaching, collaboration and scholarly dissemination across disciplinary, curricular, institutional and geographic boundaries.

Discussion

Limitations and interpretive boundaries. Several limitations should be acknowledged. First, the project was not originally designed as a prospective educational research study and therefore did not incorporate a common pre/post assessment, validated survey instrument, comparison group or systematic longitudinal tracking across all participating cohorts. The available anonymous course feedback was collected routinely and was not equivalent across all courses, years or institutions. This manuscript therefore uses the feedback descriptively rather than as a representative

sample of all participants. Second, faculty observations are inherently subject to interpretive bias and continued participation or dissemination activity may disproportionately reflect students who were more highly engaged. Third, the approximately 145 students participated through different educational contexts and levels of involvement, so outcomes should not be assumed to be uniform across the entire Learning Ecosystem. Finally, this is a single institutional case with one international partner course. The findings should therefore be interpreted as illustrative and hypothesis-generating rather than causal or broadly generalizable. Future work using prospective, validated measures, systematic qualitative coding, longitudinal follow-up and multi-institutional comparison would allow stronger evaluation of the educational effects suggested here.

Lessons Learned, Connections to the Literature and Recommendations

As the project evolved from a relatively modest undergraduate research experience into a broader interdisciplinary and international Learning Ecosystem, several lessons emerged that may be relevant for educators interested in integrating authentic research into organismal and plant science courses.

Authenticity drives engagement

Perhaps the most important lesson was that educational value appeared to derive less from methodological complexity than from authenticity. Students were working with questions whose outcomes were genuinely uncertain and whose results could inform subsequent experiments and scholarly products. This interpretation is consistent with the defining CURE features of discovery, relevance, iteration and collaboration (Auchincloss et al., 2014) and with systematic evidence that CUREs vary widely in implementation but are strongest when students engage directly in scientific practices rather than simply follow procedures (Buchanan and Fisher, 2022). For instructors seeking to replicate the broader approach, a feasible authentic question connected to an active faculty research program may therefore be more important than access to highly specialized instrumentation.

Infrastructure can be educational

A second lesson involved the educational value of research infrastructure. What began as a practical necessity – the construction of a hydroponic growth system - became an opportunity for systems thinking, troubleshooting and collaborative design. Recent field-based CURE work similarly demonstrates that authentic organismal problems can be used explicitly to develop systems thinking and scientific reasoning (Stanfield et al., 2022). For faculty with limited resources, involving students in building, testing and refining modest experimental systems may therefore serve both logistical and pedagogical goals rather than being treated only as preparation for the 'real' experiment.

Organismal plant science represents an underutilized opportunity for CUREs

The project also highlighted the educational potential of organismal plant science. Recent publications now provide additional plant-focused CURE models, including low-cost bean physiology projects, restoration ecology research and a multi-institutional digital Arabidopsis CURE (Stanfield et al., 2022; Mata, 2024; Murren et al., 2026). Together with the present case, these examples show that plant systems can support visible longitudinal change, quantitative analysis, experimental iteration and communication while being adaptable to institutions with different levels of infrastructure. The implication is not that plant CUREs are absent, but that plant science remains a fertile area for expanding the diversity of authentic research models represented in the CURE literature.

Collaboration expands participation

One of the most unexpected outcomes was the extent to which a single research question created opportunities across courses, disciplines and institutions. The ecosystem was built incrementally rather than through a predetermined multi-course program: experimental findings generated biochemical questions; those questions created literature-based work in CHE 470; student-generated results and scholarly products supported dissemination; and curated authentic datasets later provided material for international Plant Ecophysiology instruction. For other faculty, the most transferable strategy may be to identify adjacent collaborators whose courses can contribute a complementary form of expertise - literature synthesis, data analysis, communication or disciplinary interpretation - rather than attempting to reproduce the entire ecosystem at once. Shared research questions and appropriately curated datasets can then provide the connective tissue across those experiences.

Research questions can become learning ecosystems

Perhaps the most significant lesson is that authentic research questions can function as organizing frameworks for broader educational innovation. The evolution of this project resembles a community of practice in which students participated in increasingly sophisticated forms of inquiry through shared activities, mentorship, collaboration and scholarly communication (Wenger, 1998). Importantly, faculty organization remained necessary: instructors established feasible boundaries, curated datasets for use across courses, coordinated collaborators and created dissemination opportunities. Student agency operated within that structure through experimental decisions, troubleshooting, interpretation, communication and follow-up questions. This balance between faculty scaffolding and meaningful student contribution may be central to making a Learning Ecosystem both authentic and sustainable.

What began as a single plant physiology CURE ultimately evolved into a network of interconnected learning opportunities spanning research, coursework, dissemination activities and international collaboration. Rather than viewing undergraduate research solely as an activity conducted within a particular course or laboratory, educators may

benefit from viewing authentic research questions as anchors around which broader learning ecosystems can emerge.

The experiences described here do not represent a model that should be replicated exactly. Rather, they illustrate how authentic scientific inquiry can serve as a catalyst for educational growth when students are given opportunities to contribute meaningfully to questions whose answers remain unknown. Although the specific research questions may differ among institutions and disciplines, the underlying principle remains remarkably consistent: when students participate in the process of discovery, learning often extends far beyond disciplinary content knowledge alone.

Conclusions

The experiences described in this case study illustrate the educational potential of organismal plant science as a foundation for undergraduate inquiry. Although the project began as an eight-week investigation of plant responses to L-3,4-dihydroxyphenylalanine (L-DOPA), its most lasting contributions extended well beyond the original experimental objectives. Rather than simply generating data, the project created opportunities for students to engage with science as a dynamic process involving observation, experimentation, interpretation, communication and continual refinement of ideas.

One of the most important observations was that meaningful learning opportunities emerged from the same uncertainty that drives scientific discovery. Unexpected results challenged assumptions, generated new questions and required students to move beyond predetermined answers toward evaluating evidence and constructing explanations. The descriptive evidence presented here cannot quantify the magnitude of those learning effects, but it illustrates how uncertainty can become an instructional resource when students are supported in interpreting authentic data.

The project further demonstrated that a single research question can serve as a powerful educational catalyst. What began as a course-based investigation ultimately connected students, courses, scholarly products and international collaborations through a shared process of inquiry. Students participated in different ways and at different levels, yet remained connected through a common scientific problem and a collective effort to better understand it.

More broadly, this case study suggests that undergraduate research may be most impactful when viewed not simply as an educational activity but as a framework capable of connecting teaching, scholarship and collaboration, an approach for which organismal plant systems are particularly well suited.

Plant science offers particularly unique advantages as a platform for authentic undergraduate research. Unlike many experimental systems, plants allow students to directly observe biological change over time while integrating concepts from physiology, ecology, development, genetics and environmental science within a single organism. Many plant-based investigations can also be conducted with relatively modest infrastructure and cost, making them highly accessible for primarily undergraduate

institutions with limited research resources. At the same time, the questions explored through plant science are closely connected to many of society's most pressing challenges, including sustainable agriculture, food security, climate resilience and biodiversity conservation. These characteristics make plant systems exceptionally well suited for creating authentic research experiences which simultaneously develop scientific competencies while also highlighting the broader societal relevance of biological research.

While the specific details of this project are unique, the broader design principle is transferable: an authentic research question can provide a common anchor for experimentation, literature inquiry, communication and collaboration across multiple educational contexts. In this case, student feedback, scholarly products, continued engagement and faculty observations collectively suggest opportunities for growth in confidence, reasoning and participation in science. Prospective assessment will be needed to determine the magnitude and generalizability of these outcomes, but the case demonstrates a practical pathway by which plant science research can connect teaching, scholarship and collaboration at a primarily undergraduate institution.

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References

Auchincloss, L. C., Laursen, S. L., Branchaw, J. L., Eagan, K., Graham, M., Hanauer, D. I., Lawrie, G., McLinn, C. M., Pelaez, N., Rowland, S., Towns, M., Trautmann, N. M., Varma-Nelson, P., Weston, T. J., and Dolan, E. L. (2014). Assessment of course-based undergraduate research experiences: A meeting report. *CBE—Life Sciences Education, 13*(1), 29–40. https://doi.org/10.1187/cbe.14-01-0004

Bangera, G., and Brownell, S. E. (2014). Course-based undergraduate research experiences can make scientific research more inclusive. *CBE—Life Sciences Education, 13*(4), 602–606. https://doi.org/10.1187/cbe.14-06-0099

Bondy, S. C. (2023). The hormesis concept: Strengths and shortcomings. *Biomolecules, 13*(10), 1512. https://doi.org/10.3390/biom13101512

Calabrese, E. J. (2004). Hormesis: A revolution in toxicology, risk assessment and medicine. *EMBO Reports, 5*(Suppl. 1), S37–S40. https://doi.org/10.1038/sj.embor.7400222

Brewer, C. A., and Smith, D. (Eds.). (2011). *Vision and change in undergraduate biology education: A call to action*. American Association for the Advancement of Science.

Brownell, S. E., and Kloser, M. J. (2015). Toward a conceptual framework for measuring the effectiveness of course-based undergraduate research experiences in undergraduate biology. *Studies in Higher Education, 40*(3), 525–544. https://doi.org/10.1080/03075079.2015.1004234

Buchanan, A. J., and Fisher, G. R. (2022). Current status and implementation of science practices in course-based undergraduate research experiences (CUREs): A systematic literature review. CBE—Life Sciences Education, 21(4), ar83. https://doi.org/10.1187/cbe.22-04-0069

Calabrese, E. J., and Baldwin, L. A. (2002). Defining hormesis. *Human and Experimental Toxicology, 21*(2), 91–97. https://doi.org/10.1191/0960327102ht217oa

Cooper, K. M., Knope, M. L., Munstermann, M. J., and Brownell, S. E. (2020). Students who analyze their own data in a course-based undergraduate research experience (CURE) show gains in scientific identity and emotional ownership of research. Journal of Microbiology & Biology Education, 21(3). https://doi.org/10.1128/jmbe.v21i3.2157

Corwin, L. A., Graham, M. J., and Dolan, E. L. (2015). Modeling course-based undergraduate research experiences: An agenda for future research and evaluation. *CBE—Life Sciences Education, 14*(1), es1. https://doi.org/10.1187/cbe.14-10-0167

Fujii, Y. (2003). Allelopathy in the natural and agricultural ecosystems and isolation of potent allelochemicals from velvet bean (*Mucuna pruriens*) and hairy vetch (*Vicia villosa*). *Biological Sciences in Space, 17*(1), 6–13. https://doi.org/10.2187/bss.17.6

González-Sanmamed, M., Sangrà, A., Souto-Seijo, A., and Estévez, I. (2019). Key components of learning ecologies: A Delphi assessment. *British Journal of Educational Technology, 50*(4), 1639–1655. https://doi.org/10.1111/bjet.12805

Jackson, N. J. (2013). The concept of learning ecologies. In N. J. Jackson and G. B. Cooper (Eds.), *Lifewide learning, education and personal development* (Chapter

A5). Lifewide Education. https://www.normanjackson.co.uk/uploads/1/0/8/4/10842717/chapter_a5.pdf

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. Association of American Colleges and Universities.

Linn, M. C., Palmer, E., Baranger, A., Gerard, E., and Stone, E. (2015). Undergraduate research experiences: Impacts and opportunities. *Science, 347*(6222), 1261757. https://doi.org/10.1126/science.1261757

Lopatto, D. (2007). Undergraduate research experiences support science career decisions and active learning. *CBE—Life Sciences Education, 6*(4), 297–306. https://doi.org/10.1187/cbe.07-06-0039

Mata, C. (2024). Back to basics: The Plant Research CURE. Advances in Biology Laboratory Education, 44, Article 34. https://doi.org/10.37590/able.v44.art34

Murren, C. J., Jensen-Ryan, D., Bisner, A., Chang, C. C., Callahan, H. S., Disbrow, C. M., Enders, T., Geary, M., Lopez, L., Lowe, L. L., Martin, B., Weng, M.-L., Wolyniak, M. J., Wyse, S. A., Rutter, M. T., and Strand, A. E. (2026). Quantitative digital course-based undergraduate research experience in plant biology. Journal of Microbiology & Biology Education, 27, e00141-25. https://doi.org/10.1128/jmbe.00141-25

National Academies of Sciences, Engineering, and Medicine. (2017). *Undergraduate research experiences for STEM students: Successes, challenges, and opportunities*. National Academies Press. https://doi.org/10.17226/24622

National Academies of Sciences, Engineering, and Medicine. (2018). *Indicators for monitoring undergraduate STEM education*. National Academies Press. https://doi.org/10.17226/24943

National Research Council. (2009). *A new biology for the 21st century*. National Academies Press. https://doi.org/10.17226/12764

Russell, S. H., Hancock, M. P., and McCullough, J. (2007). Benefits of undergraduate research experiences. *Science, 316*(5824), 548–549. https://doi.org/10.1126/science.1140384

Seymour, E., Hunter, A.-B., Laursen, S. L., and DeAntoni, T. (2004). Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education, 88*(4), 493–534. https://doi.org/10.1002/sce.10131

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2*(1), 3–10. Retrieved from http://www.itdl.org/Journal/Jan_05/article01.htm

Soares, A. R., Marchiosi, R., Siqueira-Soares, R. C., Barbosa de Lima, R., Dantas dos Santos, W., and Ferrarese-Filho, O. (2014). The role of L-DOPA in plants. *Plant Signaling and Behavior, 9*(4), e28275. https://doi.org/10.4161/psb.28275

Stanfield, E., Slown, C. D., Sedlacek, Q., and Worcester, S. E. (2022). A course-based undergraduate research experience (CURE) in biology: Developing systems thinking through field experiences in restoration ecology. CBE—Life Sciences Education, 21(2), ar20. https://doi.org/10.1187/cbe.20-12-0300

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press. https://doi.org/10.1017/CBO9780511803932

Developing Emotional Intelligence and Resilience in Respiratory Therapy Education: An Open-Access Perspective

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Abstract

This conceptual paper examines the role of open-access higher education institutions in addressing the critical healthcare workforce shortage in the United States, particularly in high-demand specialties such as respiratory therapy. Drawing on literature related to open-access education, emotional intelligence, resilience, simulation-based learning, and workforce development, this paper proposes a conceptual framework explaining how reflective simulation experiences and structured debriefing may foster emotional intelligence and resilience among respiratory therapy students. By expanding access to education for both traditional and nontraditional learners, open-access institutions can create more inclusive pathways into healthcare professions. The proposed framework suggests that intentional development of emotional intelligence through reflective educational experiences may enhance adaptability, persistence, workforce readiness, and long-term professional engagement. Aligning curriculum design with workforce needs while emphasizing both cognitive and affective skill development may produce competent, resilient, and workforce-ready graduates. This conceptual paper offers a foundation for future empirical research and presents a potential strategy for strengthening workforce retention and addressing ongoing respiratory therapy workforce shortages.

Developing Emotional Intelligence and Resilience in Respiratory Therapy Education: An Open-Access Perspective

The growing shortage of healthcare professionals in the United States presents a significant challenge to healthcare delivery, particularly in high-demand specialties such as respiratory therapy. Increasing healthcare needs associated with aging populations and chronic disease, along with respiratory therapy replacement-driven openings—about 8,600 per year—continue to outpace the pipeline of new graduates. Most vacancies arise from therapists who retire, change careers, or just exit clinical practice (American Association for Respiratory Care [AARC], 2026). Although efforts to address these shortages often focus on increasing program enrollment and graduation rates, successful workforce development requires more than expanding access to educational opportunities. Graduates of healthcare programs must be prepared to meet both the cognitive and emotional demands of clinical practice to achieve long-term professional success and retention.

Open-access higher education institutions are uniquely positioned to contribute to workforce development by reducing barriers to entry and creating opportunities for both traditional and nontraditional learners. These institutions increase educational access for students from diverse academic, socioeconomic, and cultural backgrounds, thereby expanding the pool of individuals who may enter healthcare professions. As shortages continue to affect respiratory therapy and other healthcare disciplines, open-access universities represent an important mechanism for strengthening the educational pipeline and increasing workforce capacity. However, expanding access alone does not guarantee professional readiness or long-term career sustainability.
Respiratory therapists routinely practice in environments characterized by high clinical acuity, rapidly changing patient conditions, and significant emotional demands. Daily responsibilities frequently include managing critically ill patients, participating in emergency airway procedures, providing ventilator support, and caring for patients experiencing life-threatening respiratory failure. In addition to these technical responsibilities, respiratory therapists regularly encounter emotionally challenging situations including end-of-life care, family distress, and poor clinical outcomes. Exposure to these stressors' places healthcare professionals at increased risk for burnout, compassion fatigue, moral distress, and secondary traumatic stress. Consequently, preparation for professional practice must extend beyond technical competence to include development of the emotional and psychological resources necessary to thrive in the demanding field of respiratory therapy.

Emotional intelligence represents one potential avenue for strengthening such preparation. Salovey and Mayer (1990) define emotional intelligence as the ability to perceive, understand, manage, and utilize emotions in oneself and others. Subsequent work by Goleman (1996) and Cherniss et al. (1998) further emphasized the importance of self-awareness, self-regulation, motivation, empathy, and social skills in professional effectiveness. Within healthcare settings, these competencies support communication,

teamwork, decision-making, and patient-centered care. Research also suggests that emotional intelligence may serve as a protective factor against stress and burnout while contributing to resilience, adaptability, and professional well-being. As healthcare systems increasingly emphasize collaborative practice and workforce retention, emotional intelligence has emerged as an important attribute for healthcare professionals.

Resilience is similarly recognized as a critical competency for healthcare providers facing persistent occupational stressors. Resilience enables individuals to adapt to adversity, recover from challenging experiences, and maintain psychological well-being in demanding environments. For respiratory therapists and other frontline healthcare professionals, resilience may be particularly important given the frequency with which they encounter critical illness, patient loss, and emotionally charged clinical situations. Developing resilience during professional education may therefore improve graduates' ability to navigate workplace challenges while promoting long-term professional engagement.

Simulation-based education offers a promising strategy for intentionally developing emotional intelligence and resilience within healthcare curricula. High-fidelity simulation provides students with opportunities to engage in realistic clinical experiences within a psychologically safe learning environment. When combined with structured reflection and facilitated debriefing, simulation may promote self-awareness, emotional regulation, critical thinking, and adaptive coping skills. Prior research in nursing and other healthcare disciplines has demonstrated that reflective debriefing following stressful simulation experiences can improve coping behaviors, emotional processing, and resilience. These findings suggest that similar approaches may hold value within respiratory therapy education.

Although the literature has independently examined open-access education, emotional intelligence, resilience, simulation-based learning, and healthcare workforce development, limited attention has been given to how these concepts may interact within respiratory therapy programs, particularly those operating within an open-access educational model. Furthermore, little scholarship has explored how intentional development of emotional intelligence and resilience through reflective simulation experiences may contribute to workforce readiness among diverse student populations preparing to enter respiratory therapy practice.

Accordingly, this manuscript is presented as a **conceptual paper** that synthesizes literature related to open-access higher education, emotional intelligence, resilience, simulation-based learning, and healthcare workforce development. The purpose of this paper is to propose a conceptual framework explaining how reflective simulation experiences may foster emotional intelligence and resilience among respiratory therapy students attending open-access institutions. The framework further suggests that development of these competencies may enhance workforce readiness, professional persistence, and long-term contributions to the respiratory therapy workforce. By connecting these previously separate areas of scholarship, this conceptual paper offers

a foundation for future empirical investigation and educational innovation aimed at addressing ongoing healthcare workforce shortages.

Emotional Intelligence and Resilience in Respiratory Therapy

Emotional intelligence is increasingly recognized as a critical competency for healthcare professionals and an important component of student preparation for the emotional demands of clinical practice. Salovey and Mayer (1990) define emotional intelligence as the ability to monitor and manage one's own and others' emotions and use this information to guide thinking and actions. Goleman (1996) and Cherniss et al. (1998) further identify key components of emotional intelligence, including self-awareness, self-regulation, motivation, empathy, and social skills.

Closely related to emotional intelligence and increasingly recognized as an essential competency for healthcare professionals is resilience. The American Association of Colleges of Nursing (AACN) defines resilience as "a dynamic process that encompasses the capacity of individuals, teams, organizations, and systems to resist, adapt to, recover, or grow from a challenge" (AACN, n.d.).

Within healthcare education, resilience supports students' ability to navigate academic demands, emotionally challenging clinical experiences, and workplace stressors while maintaining professional commitment and well-being.

Emotional intelligence and resilience are distinct but closely interconnected constructs. Individuals with higher levels of emotional intelligence are generally better able to recognize, understand, and regulate emotional responses to challenging situations. These competencies may facilitate adaptive coping strategies, thereby strengthening resilience when confronting academic, clinical, and professional stressors. Consequently, emotional intelligence may serve as a foundational mechanism through which resilience is developed and sustained among healthcare professionals, enabling individuals to more effectively cope with adversity and recover from stressful clinical experiences.

The importance of emotional intelligence and resilience becomes particularly evident when considering the psychological challenges commonly encountered in respiratory therapy practice.

Respiratory therapists frequently encounter high-acuity clinical situations that may expose them to second-victim experiences. Scott et al. (2009) defined second victims as "health care providers who are involved in an unanticipated adverse patient event, medical error, and/or a patient-related injury and become victimized in the sense that the provider is traumatized by the event" (p. 326). The vulnerability of future respiratory therapists may emerge well before entry into professional practice. Eitel et al. (2024) reported that 35% of respiratory therapy students experienced moderate burnout and 50% reported mild anxiety and depression prior to clinical rotations. These findings suggest that psychological stressors may already be present during professional

education and highlight the need for proactive strategies that support emotional well-being, resilience, and emotional intelligence development.

Emotional responses associated with second-victim experiences may include guilt, shame, anxiety, self-doubt, intrusive thoughts, and loss of professional confidence. When unresolved, these experiences can contribute to burnout, compassion fatigue, and diminished psychological well-being among healthcare professionals. In high-stakes healthcare environments such as respiratory care, emotional intelligence and resilience are therefore critical competencies rather than desirable attributes. Emotional intelligence supports effective stress management, communication, emotional regulation, and patient-centered care, while resilience enables individuals to adapt, recover, and grow in response to adversity. Research has demonstrated that emotional intelligence can buffer stress and reduce burnout among healthcare professionals, thereby strengthening resilience and supporting overall workforce well-being (Iqbal et al., 2025).

Given the frequency with which respiratory therapists encounter emotionally challenging clinical situations, educational programs should move beyond an exclusive emphasis on technical competence and intentionally cultivate emotional intelligence and resilience before students enter professional practice. Preparing students in these domains may better equip them to navigate second-victim experiences, mitigate burnout and compassion fatigue, and develop the adaptive coping skills necessary for workforce readiness, professional persistence, and long-term career success. Therefore, educational strategies that intentionally foster emotional intelligence and resilience warrant further consideration within respiratory therapy curricula. Therefore, educational strategies that intentionally foster emotional intelligence and resilience warrant further consideration within respiratory therapy curricula. Simulation-based learning and reflective practice may represent particularly promising approaches for developing these competencies prior to professional entry.

Open-Access Universities and Healthcare Workforce Development

Open-access universities operate on the principle that higher education should be broadly accessible; admitting students who meet basic eligibility requirements rather than filtering applicants through restrictive academic criteria. Missouri Western State University exemplifies this model by providing accessible educational pathways that support workforce development while serving a diverse population of traditional and nontraditional learners. This approach expands the healthcare pipeline by allowing individuals from diverse academic, socioeconomic, and cultural backgrounds to enter high-demand programs such as respiratory therapy. Although healthcare programs commonly evaluate academic readiness through prerequisite coursework and admission criteria, these measures may not fully capture the emotional competencies needed for success in demanding healthcare environments. Consequently, intentional educational strategies aimed at fostering emotional intelligence and resilience may represent an important complement to traditional indicators of student preparedness.

The populations served by open-access institutions are often characterized by considerable diversity in age, educational background, socioeconomic status, and life experience. These learners often bring valuable perspectives and experiences that enrich healthcare education and contribute to workforce diversity. At the same time, students may enter healthcare programs with varying levels of emotional preparedness, coping abilities, and exposure to adversity. As a result, educational approaches that intentionally foster emotional intelligence and resilience may be particularly beneficial in helping students successfully navigate the academic, clinical, and emotional demands of healthcare training.

The importance of expanding educational access is particularly evident in respiratory therapy, where workforce shortages continue to challenge healthcare systems nationwide.

The U.S. Bureau of Labor Statistics (BLS, 2025) reports approximately 139,600 respiratory therapists employed nationwide, with projected growth of 16,800 jobs between 2024 and 2034. Associate degree programs remain the primary entry pathway, emphasizing the importance of accessible institutions in meeting workforce needs.

Addressing respiratory therapy workforce shortages requires more than simply increasing enrollment capacity. Educational programs must also ensure that students possess the emotional competencies necessary to succeed in demanding clinical environments. Open-access institutions are uniquely positioned to make meaningful contributions to workforce development by combining expanded educational opportunity with intentional strategies that promote emotional intelligence, resilience, and professional readiness. Rather than representing a limitation, the diversity inherent within open-access institutions may provide a unique opportunity to strengthen the healthcare workforce by identifying and developing talented students who might otherwise be excluded from professional education pathways. Consequently, identifying effective educational methods for cultivating these competencies represents an important priority for respiratory therapy education.

Reflective Simulation as a Mechanism for Development

While emotional intelligence and resilience are increasingly recognized as critical competencies for healthcare professionals, educators must identify effective methods for fostering these attributes within respiratory therapy curricula. Simulation-based learning represents a promising educational strategy because it allows students to encounter realistic clinical and emotional challenges in a controlled and psychologically safe environment. When coupled with structured reflection and facilitated debriefing, simulation may provide a mechanism through which emotional intelligence and resilience can be intentionally developed while promoting self-awareness and professional growth.

High-fidelity simulation alone may be insufficient to promote emotional growth. The educational value of simulation is enhanced when learners engage in structured reflection and facilitated debriefing. These activities encourage students to examine

emotional responses, evaluate decision-making processes, identify strengths and areas for improvement, and develop adaptive coping strategies for future clinical situations. Through this process, students may cultivate foundational components of emotional intelligence, including self-awareness, emotional regulation, empathy, effective communication, and resilience.

TeamSTEPPS provides a complementary framework emphasizing communication, leadership, mutual support, and situation monitoring (Agency for Healthcare Research and Quality [AHRQ] & Department of Defense [DoD], 2023). This framework closely aligns with key dimensions of emotional intelligence and support students' ability to function effectively within interdisciplinary healthcare teams, particularly during high-stress clinical situations.

Building upon these principles, a reflective simulation model is proposed in which students participate in emotionally challenging, high-fidelity clinical scenarios designed to mirror the pressures encountered in professional respiratory therapy practice. Prior to simulation, students engage in self-assessment activities intended to promote self-awareness. Following participation in the scenario, students complete structured reflection exercises and faculty-led debriefing focused on emotional responses, communication, decision-making, resilience strategies, and recognition of second-victim experiences. Collectively, these activities are intended to foster emotional intelligence and resilience while enhancing preparedness for future clinical practice.

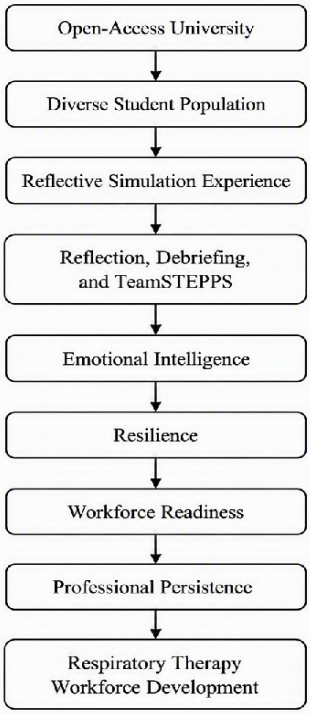
By intentionally integrating simulation, reflection, and debriefing, educators may create meaningful opportunities for students to develop emotional intelligence and resilience before entering professional practice. This proposed process serves as the foundation for the conceptual framework presented in the following section.

Proposed Conceptual Framework

The preceding literature suggests that open-access institutions are uniquely positioned to contribute to healthcare workforce development by preparing diverse student populations for the emotional and technical demands of respiratory therapy practice. Building upon these concepts, a conceptual framework is proposed to explain how reflective simulation experiences may foster emotional intelligence and resilience, ultimately supporting workforce readiness and professional persistence.

Figure 1

Proposed Conceptual Framework for Developing Workforce-Ready Respiratory Therapists Through Reflective Simulation in Open-Access Institutions



Note. The framework proposes that reflective simulation experiences integrated with structured reflection, debriefing, and TeamSTEPPS principles promote emotional intelligence and resilience among students attending open-access institutions. Development of these competencies may enhance workforce readiness, professional persistence, and respiratory therapy workforce development.

As illustrated in Figure 1, the proposed framework begins with the open-access university model and positions reflective simulation experiences as the primary mechanism through which emotional intelligence and resilience are developed among respiratory therapy students. The framework suggests that intentional development of these competencies may enhance workforce readiness, professional persistence, and ultimately contribute to respiratory therapy workforce development.

Missouri Western State University exemplifies this model by providing educational opportunities for students who may not otherwise have access to more selective admission pathways. Although admission to respiratory therapy programs continues to require students to meet established academic and program-specific requirements, the open-access university model broadens access to the educational experiences necessary to become competitive applicants.

Consequently, respiratory therapy programs within open-access institutions may enroll both traditional and nontraditional learners who bring varied experiences, strengths, and perspectives to the educational environment. This diversity enriches healthcare education and contributes to workforce development by expanding pathways into the profession. At the same time, students may enter programs with varying levels of

exposure to adversity, stress-management skills, emotional preparedness, and confidence navigating high-pressure situations. These differences create an opportunity for intentional educational interventions, such as reflective simulation experiences, designed to foster emotional intelligence and resilience among future respiratory therapists.

Reflective simulation experiences provide a common educational platform through which students can safely encounter realistic clinical stressors while developing the emotional and interpersonal competencies necessary for professional practice. By recreating challenging clinical situations in a controlled environment, simulation allows students to apply technical knowledge while simultaneously practicing emotional regulation, communication, teamwork, and adaptive coping strategies.

The developmental value of simulation extends beyond the clinical scenario itself. Meaningful growth in emotional intelligence and resilience occurs when students engage in structured reflection, faculty-guided debriefing, and teamwork-focused learning experiences that encourage examination of emotional responses and coping strategies.

Structured reflection and facilitated debriefing represent critical components of the proposed framework. Following participation in high-stress simulation experiences, students are encouraged to examine emotional responses, analyze decision-making processes, and identify both strengths and areas for improvement. Reflection promotes self-awareness by encouraging students to recognize how emotions influence behaviors and clinical performance. Faculty-guided debriefing further supports emotional regulation by providing opportunities to discuss challenging experiences, receive constructive feedback, and explore adaptive coping strategies. Together, these processes may strengthen key dimensions of emotional intelligence, including self-awareness, self-regulation, empathy, communication, and interpersonal effectiveness.

TeamSTEPPS principles reinforce the development of emotional intelligence by emphasizing communication, leadership, mutual support, and situation monitoring. As students engage in reflective discussion and feedback, they have opportunities to evaluate communication strengths and challenges, consider the perspectives of others, and develop strategies for more effective team interactions during future clinical encounters. These competencies closely reflect the expectations students will encounter in clinical and professional healthcare settings. Consequently, TeamSTEPPS is not intended solely as a component of the proposed simulation experience, but rather as a framework that can be integrated throughout the respiratory therapy curriculum to support the continuous development of emotional intelligence, resilience, teamwork, and workforce readiness.

Collectively, reflection, debriefing, and TeamSTEPPS create opportunities for students to develop greater emotional awareness, interpersonal effectiveness, and adaptive coping skills. Through repeated engagement with these processes, students may

strengthen emotional intelligence and become better prepared to manage the emotional and professional demands of respiratory therapy practice.

As emotional intelligence develops, students may become better equipped to recognize and regulate emotional responses to stress, communicate effectively during challenging situations, and employ adaptive coping strategies. Consequently, emotional intelligence may serve as a foundational mechanism through which resilience is strengthened among respiratory therapy students preparing to enter professional practice. Students who possess greater self-awareness and emotional regulation may be more likely to recognize early signs of stress, seek appropriate support, and implement adaptive coping strategies when confronted with adverse events or second-victim experiences. Through repeated exposure to reflective simulation, debriefing, and teamwork-focused learning experiences, students may develop both the emotional competencies and resilience necessary to successfully transition into professional respiratory therapy practice.

Importantly, the benefits of resilience may extend beyond preparation for professional practice. As emotional intelligence and resilience develop throughout the curriculum, students may become better equipped to manage the academic, personal, and clinical demands associated with a rigorous respiratory therapy program. This enhanced capacity to cope with stress and adversity may support student persistence, academic success, and program retention while simultaneously preparing graduates for the challenges of professional practice. In this way, resilience may contribute not only to successful progression through respiratory therapy education but also to workforce readiness. Graduates who possess higher levels of resilience may be better prepared to adapt to rapidly changing clinical situations, manage workplace stressors, maintain professional performance under pressure, and navigate the emotional demands of respiratory therapy practice.

Although workforce readiness is essential for successful entry into practice, long-term workforce development also depends upon professional persistence. Respiratory therapists who can effectively manage stress, recover from adversity, and maintain professional well-being may be more likely to remain engaged in the profession despite the emotional and technical demands of practice. By fostering emotional intelligence and resilience throughout respiratory therapy education, programs may help graduates not only enter the workforce successfully but also sustain long-term professional engagement and career satisfaction. Increased adaptability, effective coping strategies, and emotional preparedness may reduce the likelihood of burnout, compassion fatigue, and premature workforce departure. In turn, improved retention of qualified respiratory therapists may help strengthen workforce stability and contribute to efforts aimed at addressing ongoing healthcare workforce shortages.

Collectively, the proposed framework suggests that open-access institutions provide a unique opportunity to expand the healthcare workforce by creating pathways for diverse student populations to enter respiratory therapy education. Through the intentional integration of reflective simulation experiences, structured reflection, debriefing, and

TeamSTEPPS principles, students may develop emotional intelligence and resilience that support both academic success and professional readiness. These competencies may enhance adaptability, persistence, and long-term engagement within the profession, ultimately contributing to workforce retention and addressing ongoing respiratory therapy workforce shortages.

Implications for Respiratory Therapy Education

If the proposed framework is supported, respiratory therapy education may benefit from expanding its approach to simulation-based learning beyond the development of technical and clinical competencies alone. While traditional simulation experiences are often designed to evaluate clinical decision-making and procedural skills, educators should also consider intentionally incorporating scenarios designed to elicit emotional responses commonly encountered in healthcare practice. Exposure to emotionally challenging situations within a psychologically safe learning environment may provide opportunities for students to develop self-awareness, emotional regulation, resilience, and adaptive coping strategies before encountering similar experiences in clinical practice.

The framework further suggests that meaningful learning occurs not only during the simulation itself but also through structured reflection and debriefing. Educational activities designed to encourage students to examine emotional responses, identify personal strengths and challenges, and evaluate coping strategies may foster greater emotional intelligence and resilience. By engaging in repeated cycles of experience, reflection, and feedback, students may develop a deeper understanding of how emotions influence communication, decision-making, teamwork, and patient care.

Integration of TeamSTEPPS principles throughout the respiratory therapy curriculum may further strengthen these outcomes. Communication, leadership, mutual support, and situation monitoring are not competencies that should be addressed only during isolated simulation experiences. Rather, these principles may be incorporated throughout classroom instruction, laboratory activities, simulation experiences, and clinical education. Consistent exposure to these concepts may reinforce behaviors that students are expected to demonstrate in clinical and professional practice while simultaneously supporting the development of emotional intelligence and resilience.

An additional implication of the proposed framework is the importance of ongoing self-assessment and reflective practice. Encouraging students to regularly evaluate their emotional responses, coping abilities, communication effectiveness, and areas for growth may promote lifelong habits of self-awareness and professional development. Such practices may help students recognize stressors early, seek support when needed, and develop adaptive strategies that contribute to both academic and professional success.

Finally, the framework suggests that respiratory therapy programs should consider resilience and emotional intelligence not merely as desirable personal attributes but as educational outcomes worthy of intentional cultivation. By creating opportunities for

repeated exposure to challenging clinical scenarios within supportive learning environments, educators may better prepare students to navigate the academic, clinical, and emotional demands of respiratory therapy practice. Such preparation has the potential to improve student persistence, enhance workforce readiness, support long-term professional engagement, and ultimately contribute to efforts aimed at addressing ongoing respiratory therapy workforce shortages.

Directions for Future Research

While emotional intelligence, resilience, and simulation-based learning have each been studied independently within healthcare education, limited scholarship has explored the intentional integration of these constructs within respiratory therapy curricula. Furthermore, little research has examined whether reflective simulation experiences can serve as a mechanism for developing emotional intelligence and resilience among respiratory therapy students. Consequently, the proposed framework offers a foundation for future empirical investigation.

Future research should evaluate whether participation in reflective simulation experiences produces measurable changes in emotional intelligence and resilience among respiratory therapy students. Studies may examine the impact of structured reflection, faculty-guided debriefing, and TeamSTEPPS integration on students' self-awareness, emotional regulation, communication skills, and perceived ability to manage stress in both clinical environments and the rigorous academic demands of respiratory therapy education. Such investigations may help determine whether intentional development of emotional intelligence and resilience contributes not only to professional readiness but also to student persistence, academic success, and program retention.

Longitudinal research may be particularly valuable for examining whether gains achieved during educational experiences persist beyond the simulation environment. Researchers may explore whether students who participate in emotionally focused simulation experiences demonstrate greater resilience, confidence, and emotional preparedness during clinical education. Such investigations could provide insight into how emotional intelligence and resilience evolve throughout professional training.

Additional research should examine whether development of emotional intelligence and resilience during respiratory therapy education influences professional outcomes following graduation. Variables such as workforce readiness, job satisfaction, professional persistence, burnout, compassion fatigue, and retention within the profession may provide important indicators of the framework's long-term effectiveness. Understanding these relationships could help determine whether educational interventions aimed at developing emotional intelligence and resilience contribute to sustainable workforce development and long-term workforce retention.

Testing the proposed framework across multiple respiratory therapy programs and educational settings would strengthen understanding of its generalizability and practical application. Ultimately, empirical evaluation of the framework may provide evidence to support the intentional integration of emotional intelligence, resilience, reflective

simulation, and TeamSTEPPS principles within respiratory therapy education, thereby strengthening student success, workforce readiness, and long-term professional persistence.

Conclusion

The growing demand for respiratory therapists and other healthcare professionals continues to challenge healthcare systems across the United States. Addressing these workforce shortages requires more than simply expanding enrollment capacity; it requires preparing graduates who possess both the technical competencies and emotional capabilities necessary to thrive in demanding healthcare environments. Open-access institutions are uniquely positioned to contribute to this effort by broadening educational opportunity and creating pathways for diverse populations of students to enter healthcare professions.

This conceptual paper proposes that emotional intelligence and resilience are critical competencies for contemporary respiratory therapy practice and should be intentionally cultivated throughout professional education. Reflective simulation experiences, combined with structured reflection, faculty-guided debriefing, and TeamSTEPPS principles, may provide a meaningful mechanism for fostering these competencies within respiratory therapy curricula. Through repeated exposure to emotionally challenging yet psychologically safe learning experiences, students may develop greater self-awareness, emotional regulation, communication skills, adaptive coping abilities, and resilience.

The proposed framework further suggests that development of emotional intelligence and resilience may contribute not only to workforce readiness, but also to student persistence, academic success, professional engagement, and long-term career sustainability. By preparing students to effectively navigate academic challenges, clinical stressors, second-victim experiences, burnout, and compassion fatigue, respiratory therapy programs may better position graduates for success throughout their professional careers.

Ultimately, open-access institutions do not lower professional standards; rather, they expand educational opportunity by creating pathways through which capable students can demonstrate academic readiness and enter healthcare professions. When paired with intentional educational strategies designed to develop emotional intelligence and resilience, these institutions may play a significant role in strengthening workforce readiness, improving professional retention, and helping address ongoing respiratory therapy workforce shortages. The conceptual framework presented in this manuscript provides a foundation for future research and educational innovation aimed at preparing a resilient and sustainable respiratory therapy workforce.

References

American Association of Colleges of Nursing. (n.d.). Resilience concept. Developing Nurse Well-Being and Leadership Tool Kit. https://www.aacnnursing.org/developing-nurse-well-being-and-leadership-tool-kit/tool-kit/resilience-concept

American Association for Respiratory Care. (2026). Staffing-shortage strategies for respiratory care teams 2026. AARC Career Center. https://jobs.aarc.org/career-resources/employer-4/staffing-shortage-strategies-for-respiratory-care-teams-2026-64

American Hospital Association. (2024). *TeamSTEPPS® pocket guide: Team strategies and tools to enhance performance and patient safety.* https://www.aha.org/system/files/media/file/2024/04/TeamTraining_PocketGuide_Feb2024_022824.pdf

Cherniss, C., Goleman, D., Emmerling, R., Cowan, K., & Adler, M. (1998). *Bringing emotional intelligence to the workplace.* Consortium for Research on Emotional Intelligence in Organizations. https://www.eiconsortium.org/pdf/technical_report.pdf

Christodoulakis, A., Samonis, G., & Tsiligianni, I. (2024). A practical guide for improving and evaluating the components of emotional intelligence in healthcare students. *Medical Science Educator, 35*(1), 523–530. https://doi.org/10.1007/s40670-024-02209-3

Eitel, D., Lassen, S., Rose, K., & Vasas, S. (2024). Evaluating secondary traumatic stress of respiratory care students across cohorts. Respiratory Care, 69(10 Suppl), 4136970. https://doi.org/10.4187/respcare.20244136970

Goleman, D. (1996). Emotional intelligence: Why it can matter more than IQ. *Learning, 24*(6), 49–50.

Iqbal, F., Noreen, F., Iqbal, S., Farooq, U., Batool, Q., & Shahbaz, S. (2025). The impact of role overload on healthcare workers' psychological distress and well-being: The mediating role of task distraction and moderating roles of resilience and emotional intelligence. *PLOS Mental Health, 2*(12), e0000461. https://doi.org/10.1371/journal.pmen.0000461

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition and Personality, 9*(3), 185–211. https://doi.org/10.2190/DUGG-P24E-52WK-6CDG

Scott, S. D., Hirschinger, L. E., Cox, K. R., McCoig, M., Brandt, J., & Hall, L. W. (2009). The natural history of recovery for the healthcare provider "second victim" after adverse patient events. *Quality & Safety in Health Care*, *18*(5), 325–330. https://doi.org/10.1136/qshc.2009.032870

U.S. Bureau of Labor Statistics. (2025). *Employment projections: 2024–2034 summary.* Respiratory Therapists : Occupational Outlook Handbook: : U.S. Bureau of Labor Statistics

Educating Humans, Training Machines: From Doing to Becoming in the Age of Artificial Intelligence

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Abstract

Artificial intelligence (AI) is rapidly reshaping higher education. Generative AI systems can summarize texts, generate written work, provide feedback, assist in problem solving, and support increasingly complex cognitive activities across disciplines. While these technologies create significant opportunities for teaching and learning, they also challenge long-standing assumptions about the relationship between academic task performance and evidence of learning. This paper argues that the central challenge for higher education is not simply integrating artificial intelligence into the classroom but reconsidering the purpose of education through a shift from task-oriented learning focused on “doing” toward developmental learning centered on “becoming.” Drawing upon Bloom’s Taxonomy, experiential learning, transformative learning, situated learning and research on human–AI collaboration, this paper develops a conceptual framework for examining the changing relationship between cognitive task performance and learner development in AI-augmented educational environments. Rather than assigning lower-order cognition to artificial intelligence and higher-order cognition exclusively to humans, the framework recognizes that AI can support activity across cognitive levels while distinguishing successful task performance from the intellectual development of the learner. The paper argues that the educational value of AI ultimately depends on whether its use contributes to the development of judgment, agency, reflection, ethical responsibility, creativity, and intellectual identity. Implications for curriculum design, assessment, faculty development, and institutional policy are discussed.

Preface

The paper develops a research-informed argument that higher education must shift its emphasis from task performance to human development. This shift can be understood as moving from “doing” to “becoming.” In this framework, artificial intelligence functions as a cognitive partner capable of supporting learners across a range of cognitive activities, while education remains centered on ensuring that AI-supported work contributes to the development of judgment, agency, reflection, ethical responsibility, creativity, and intellectual identity. The paper concludes by examining implications for curriculum design, assessment, faculty development, and institutional policy. The future of education depends not on competing with intelligent machines, but on creating learning environments in which increasingly capable technologies expand what students can accomplish while contributing to the continuing development of the human learner.

Introduction

Artificial intelligence has become an increasingly influential force in contemporary society, reshaping industries, economies, and educational systems (Holmes et al., 2019). Advances in machine learning, large-scale data analytics, and algorithmic decision-making have transformed how information is produced, processed, and applied across numerous fields. Artificial intelligence is reshaping not only technological systems but also the nature of human work and knowledge production, altering the kinds of skills and competencies that individuals must develop to thrive in modern societies (Brynjolfsson & McAfee, 2014; Holmes et al., 2019). As intelligent systems become more capable of supporting an increasingly broad range of cognitive activities, educators must reconsider which forms of human development-educational systems should prioritize and how those capacities should be cultivated (Miao & Holmes, 2023).

These developments raise important questions about the future of teaching and learning. For decades, educational institutions have relied heavily on written assignments, problem sets, and examinations to measure student learning. However, many of these tasks can now be completed with the assistance of AI systems (Holmes et al., 2019; Chen & Cheung, 2025). Recent research further demonstrates that generative AI can influence a range of university learning outcomes, including academic achievement and higher-order thinking, although the magnitude of these effects varies according to learner, instructional, technological, and contextual factors (Chen & Cheung, 2025). As a result, educators are increasingly asking fundamental questions: What does it mean to learn in a world where intelligent systems can contribute to increasingly sophisticated academic work? What does successful task performance reveal about the development of the learner? And how should education evolve in response to these technologies?

Historically, education has focused heavily on the acquisition and demonstration of knowledge. Students were expected to memorize information, apply procedures, and demonstrate mastery through assessment (Bloom et al., 1956; Anderson & Krathwohl, 2001). These practices remain essential components of education, but they do not define the full scope of human learning. As AI systems increasingly support activities

across a range of cognitive levels, the educational significance of knowledge and skills lies not only in successful task performance but also in how engagement with those tasks contributes to learner development. This emphasis is consistent with human-centered approaches to generative AI that argue technological integration should preserve human agency and support the development of human capabilities rather than simply automate existing educational practices (Miao & Holmes, 2023).

Artificial intelligence therefore does more than challenge existing educational practices. It exposes the limitations of educational models that rely primarily on task performance as evidence of learning. Recent research highlights this challenge, suggesting that generative AI increasingly complicates the distinction between authentic intellectual effort and AI-assisted performance (Nasr et al., 2026). Research also suggests that the cognitive effects of generative AI depend substantially on how it is incorporated into learning, with structured and scaffolded uses supporting higher-order thinking while unstructured reliance may contribute to cognitive offloading and reduced intellectual engagement (Li et al., 2026). The central educational question is consequently shifting from whether students can successfully complete particular cognitive tasks toward whether their engagement in those tasks—including engagement supported by AI—contributes to the development of judgment, agency, creativity, ethical reasoning, and reflective understanding.

This paper examines how artificial intelligence reshapes the relationship between cognitive task performance and learner development in higher education. Using Bloom's Taxonomy as a conceptual starting point, the paper explores how AI interacts with various levels of cognitive activity. Recent empirical research suggests that generative AI can support both lower- and higher-order learning outcomes, including critical and creative thinking when appropriately integrated into instruction, complicating any simple division in which lower-order cognition is assigned to machines and higher-order cognition exclusively to humans (Chen & Cheung, 2025; Li et al., 2026). The paper then examines established theories of human learning and emerging research on human–AI collaboration to consider the implications for curriculum design, assessment, pedagogy, faculty development, and institutional policy. Finally, it proposes a shift in educational philosophy from task-based learning focused primarily on "doing" toward developmental learning centered on "becoming."

Contribution to Literature

This study contributes to emerging scholarship on artificial intelligence and higher education by integrating established learning theories with a new conceptual model of human development in AI-augmented learning environments. While previous research has explored the potential of artificial intelligence to support instructional tasks and influence learning outcomes (Luckin et al., 2016; Holmes et al., 2019; Liu et al., 2026), this paper extends that literature by examining how these technologies reshape the relationship between cognitive task performance and the broader developmental purposes of education.

The framework developed in this paper synthesizes insights from Bloom's Taxonomy, experiential learning, transformative learning, and situated learning to examine the evolving relationship between human cognition and intelligent systems (Bloom et al., 1956; Anderson & Krathwohl, 2001; Kolb, 1984; Mezirow, 1991; Lave & Wenger, 1991). Building on this theoretical foundation, the paper proposes the "Doing → Becoming" model, which conceptualizes education not simply as the acquisition of skills or completion of tasks but as a developmental process through which learners cultivate judgment, creativity, ethical reasoning, and intellectual identity.

By framing artificial intelligence as a cognitive partner capable of supporting activity across a range of cognitive processes, this model aligns with emerging research on human–AI collaboration and hybrid intelligence (Dellermann et al., 2019; Oyelere, 2026). The framework does not assume a fixed division in which particular cognitive tasks belong exclusively to either humans or machines. Instead, it distinguishes between the successful performance of cognitive tasks and the development of the learner engaged in those tasks. In doing so, the paper contributes to ongoing discussions about the future of teaching, learning, and human development in technologically mediated environments. Rather than focusing primarily on artificial intelligence as an instructional tool, this paper reframes the discussion by asking how AI-supported educational activity can contribute to the continuing intellectual development of the learner.

Theoretical Framework

Understanding the role of artificial intelligence in education requires situating technological change within established theories of learning and human development. This study draws upon four complementary theoretical traditions: Bloom's Taxonomy of cognitive learning, experiential learning theory, transformative learning theory, and situated learning. Together, these perspectives provide a framework for examining how artificial intelligence intersects with human cognition and educational development. Recent scholarship on learner agency and cognitive offloading further suggests that the educational consequences of generative AI depend not simply on what the technology can accomplish, but on how its use shapes learners' engagement, judgment, and cognitive autonomy (Suazo Galdames et al., 2026).

Bloom's Taxonomy and Cognitive Learning

Bloom's Taxonomy remains one of the most widely used frameworks for organizing cognitive learning objectives in education. Originally developed by Bloom et al. (1956) and later revised by Anderson and Krathwohl (2001), the taxonomy describes a hierarchy of cognitive processes ranging from remembering and understanding to evaluating and creating. In traditional instructional design, these levels represent progressively more complex forms of thinking. Advances in artificial intelligence highlight the continued relevance of this framework. AI systems perform particularly well in tasks associated with the lower levels of the taxonomy, including remembering, understanding, and procedural application. AI-powered tools can summarize information, generate practice questions, and provide automated feedback efficiently, making them well suited for supporting foundational knowledge acquisition. However,

recent meta-analytic evidence indicates that generative AI can also support learning outcomes associated with higher-order cognitive processes, suggesting that Bloom's taxonomy should not be interpreted as establishing a simple division between lower-order tasks performed by AI and higher-order thinking performed exclusively by humans (Xia et al., 2025).

At the same time, the upper levels of Bloom's taxonomy, analysis, evaluation, and creation require forms of reasoning that extend beyond pattern recognition. These processes involve contextual interpretation, ethical judgment, and creative synthesis. Although generative AI systems can produce outputs associated with higher-order thinking, the production of such outputs does not itself demonstrate that the learner has independently engaged in or developed the corresponding cognitive processes, an increasingly important distinction as generative AI blurs the boundary between authentic intellectual effort and AI-assisted performance (Nasr et al., 2026). Bloom's framework therefore provides a useful lens not simply for distinguishing cognitive tasks that artificial intelligence can support, but for examining whether AI-supported task performance contributes to the cognitive development of the learner.

Experiential Learning

Experiential learning theory further emphasizes that knowledge is constructed through cycles of experience, reflection, conceptualization, and experimentation (Kolb, 1984). Learning is not simply transmitted from instructor to student but developed through active engagement with problems and real-world contexts. In AI-enhanced environments, this perspective highlights the importance of maintaining human cognitive engagement. If students rely excessively on automated tools to generate answers or solutions, they may bypass the reflective processes that lead to deeper understanding, a concern reinforced by recent research linking overreliance on generative AI with cognitive offloading, dependence, uncritical uptake, and weakened learner judgment (Wang et al., 2026). Artificial intelligence can support learning through resources, feedback, and simulations, but meaningful learning still depends on human participation in the experiential learning cycle.

Transformative Learning

Transformative learning theory extends this argument by emphasizing that education involves changes in perspective as individuals critically examine their assumptions and reinterpret experiences (Mezirow, 1991). From this viewpoint, learning is not merely about acquiring information but about developing the capacity for reflection and intellectual transformation. Artificial intelligence may assist with processing information and may even scaffold critical reflection, but transformative learning requires the learner to actively question beliefs, reconsider assumptions, and develop new perspectives (Chick, 2026). The distinction between information generation and intellectual development therefore becomes central: AI systems may generate information and alternative perspectives, but learners must interpret, evaluate, and integrate that information into their own developing understanding and worldview.

Situated Learning and Communities of Practice

Situated learning theory reinforces the social dimensions of this process. Human cognitive development is shaped through social interaction and collaborative problem solving, rather than solely through isolated information processing (Vygotsky, 1978). According to Lave and Wenger (1991), knowledge develops through participation in communities of practice rather than through isolated individual learning. Even as artificial intelligence tools become more capable, education continues to occur within social environments where students interact with instructors, peers, and professional communities. AI systems may assist with or mediate certain aspects of learning, but their increasing presence does not eliminate the importance of the social processes through which learners develop professional identity, ethical awareness, and disciplinary understanding (Lavercombe, 2026).

Human–AI Collaboration and Hybrid Intelligence

Research across economics, organizational science, and human–computer interaction increasingly suggests that the most productive future lies not in competition between humans and machines but in collaboration between them. Research on hybrid intelligence proposes that human and artificial intelligence can be deliberately combined so that their complementary capabilities contribute to complex problem solving (Dellermann et al., 2019). Within educational contexts, recent scholarship extends this concept toward human-centered hybrid intelligence systems in which humans and AI collaborate and adapt while human agency, contextual judgment, and ethical responsibility remain central to the educational process (Oyelere, 2026). Within this framework, artificial intelligence functions as a cognitive partner rather than a substitute for human learning, supporting learners across a range of cognitive activities while learners and educators remain responsible for interpreting, evaluating, contextualizing, and making decisions about AI-supported work.

Taken together, these theoretical perspectives clarify how artificial intelligence reshapes education without eliminating the need for human learning. Bloom’s Taxonomy provides a framework for examining whether AI-supported task performance reflects and contributes to the cognitive development of the learner. Experiential learning emphasizes active engagement and reflection, transformative learning underscores the importance of perspective change, and situated learning reminds us that education is fundamentally social and developmental. Within this integrated framework, artificial intelligence can function as a cognitive partner that supports learning across a range of cognitive activities, while the educational process remains centered on cultivating human judgment, agency, reflection, ethical reasoning, creativity, and intellectual identity.

These theoretical perspectives collectively suggest that advances in artificial intelligence do not diminish the importance of human learning but instead clarify why successful task performance alone is increasingly insufficient as evidence of learner development. As AI systems become capable of supporting a wider range of cognitive tasks, education must place greater emphasis on the development of learner agency,

interpretive reasoning, ethical judgment, creativity, and reflective thinking (Wang et al., 2026). This shift reframes the purpose of education from demonstrating what students can do toward developing who students become, an intellectual transition that is conceptualized in this paper as the movement from “doing” to “becoming.”

Conceptual Model: Human Learning in the Age of Artificial Intelligence

The conceptual model presented in Figure 1 synthesizes the theoretical perspectives discussed above to illustrate how artificial intelligence reshapes the relationship between cognitive task performance and learner development in education. Building on Bloom’s Taxonomy and theories of experiential, transformative, and situated learning, the model distinguishes between the successful performance of cognitive tasks and the developmental processes through which learners cultivate judgment, agency, reflection, creativity, ethical reasoning, and intellectual identity. Within this framework, AI functions as a cognitive partner that can support learners across a range of cognitive activities, while education remains centered on ensuring that AI-supported performance contributes to, rather than substitutes for, the development of the learner (Wang et al., 2026).

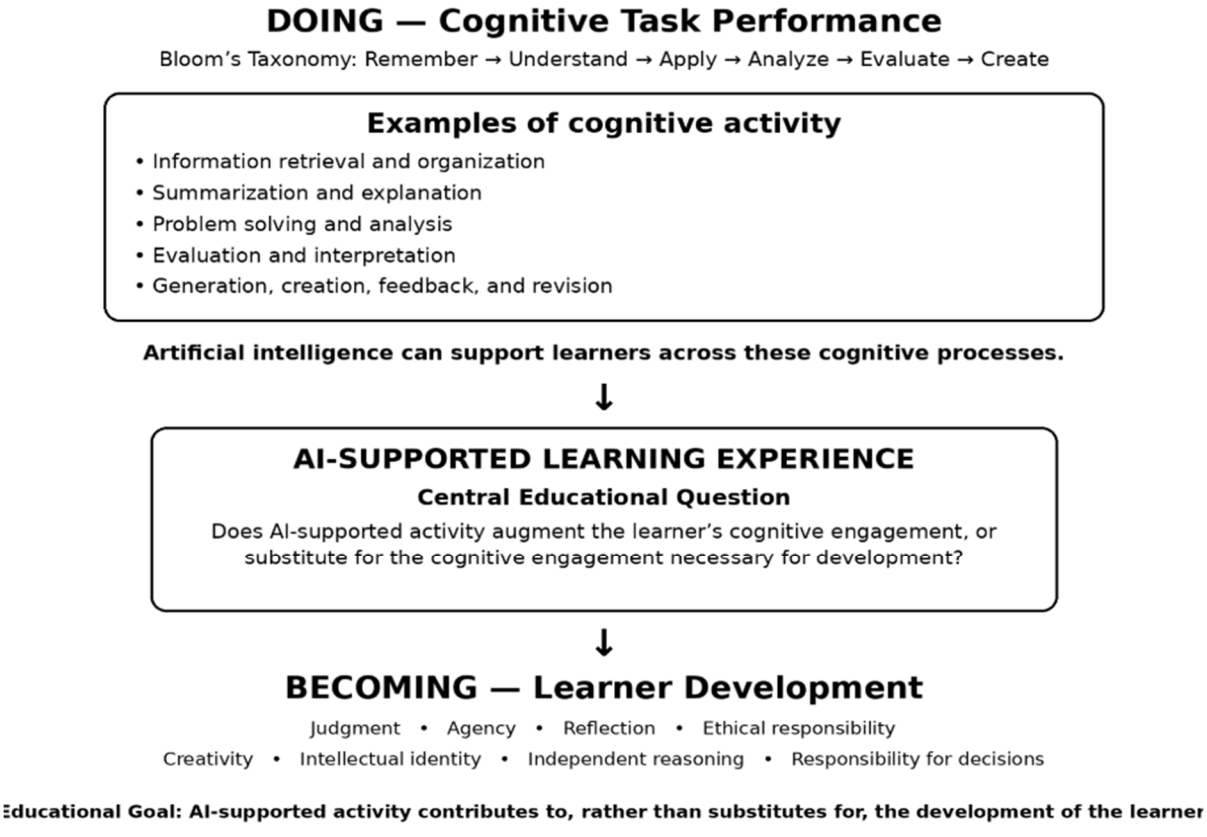


Figure 1: Human–AI Distribution of Cognitive Work and the Shift from “Doing” to “Becoming”

Figure 1 illustrates how the integration of artificial intelligence reshapes the relationship between cognitive task performance and learner development in educational environments. Rather than assigning particular levels of cognition exclusively to either humans or artificial intelligence, the model recognizes that AI can support learners across a range of cognitive activities. The educational significance of AI-supported performance therefore depends not simply on the sophistication of the task or product, but on whether the learner remains cognitively engaged in interpreting, evaluating, reflecting, deciding, and creating. Within this framework, the movement from “doing” to “becoming” represents a shift in educational emphasis from successful task performance alone toward the development of judgment, agency, reflection, ethical responsibility, creativity, and intellectual identity.

In the 2025 Student Generative AI Survey, 92% of surveyed undergraduates reported using AI in some form, while 88% reported using generative AI in relation to assessment (Freeman, 2025). These patterns reinforce the argument developed in this paper: as AI becomes increasingly integrated into academic work, educators must reconsider not only how learning is structured and assessed, but how AI-supported activity can preserve the cognitive engagement, reflection, and agency necessary for learner development.

Human–AI Collaboration

Research across economics, organizational science, and human–computer interaction increasingly suggests that the relationship between humans and artificial intelligence is moving beyond simple competition or substitution toward various forms of collaboration and augmentation (Dellermann et al., 2019). The effectiveness of this collaboration, however, cannot be assumed. A systematic review and meta-analysis of 106 experiments found that human–AI combinations generally improved performance relative to humans working alone but did not, on average, outperform the better-performing member of the human–AI system (Vaccaro et al., 2024). The effectiveness of collaboration varied according to factors such as task type and the relative capabilities of humans and AI. These findings suggest that the value of human–AI collaboration depends not simply on combining human and machine capabilities, but on how that collaboration is structured.

Human–AI collaboration can be understood in terms of complementary capabilities rather than a fixed division of cognitive strengths. Artificial intelligence can contribute speed, scalability, information processing, pattern recognition, and generative capabilities, while humans contribute contextual knowledge, judgment, goals, values, and responsibility for how AI-generated information is interpreted and used. The relative contribution of each may vary according to the task, context, and capabilities of the participants. Effective collaboration therefore depends on identifying when and how human and artificial intelligence can complement one another rather than assuming that either possesses a predetermined set of cognitive tasks (Vaccaro et al., 2024; Oyelere, 2026).

Within educational environments, this collaborative relationship suggests a new model of learning. Students must develop not only disciplinary knowledge but also the capacity to work critically and deliberately with intelligent systems. This includes determining when AI assistance is appropriate, evaluating the accuracy and relevance of AI-generated information, recognizing limitations or biases, and taking responsibility for the conclusions and products that emerge from AI-supported work. In this sense, AI literacy extends beyond technical proficiency to include judgment, intellectual skepticism, ethical responsibility, and the capacity for independent reasoning (Miao & Holmes, 2023).

Effective collaboration with artificial intelligence also requires metacognitive awareness and learner agency. Students must learn to reflect on when, why, and how they use AI and how that use influences their own thinking and decision-making processes. Recent research suggests that generative AI can support reflection, feedback, problem solving, and self-regulated learning when it is deliberately integrated into learning, but uncritical reliance can also encourage cognitive offloading, dependence, and diminished learner judgment (Wang et al., 2026). The educational objective should therefore not be to prevent cognitive offloading altogether, but to ensure that AI does not substitute for the cognitive engagement necessary for learner development.

Human–AI collaboration consequently presents both an opportunity and a pedagogical responsibility. AI can function as a cognitive partner that extends what learners are able to explore, analyze, and create, but the educational value of that partnership depends on whether learners remain intellectually engaged in the process. Effective educational design must therefore preserve opportunities for interpretation, evaluation, reflection, and independent judgment while teaching students to use artificial intelligence responsibly and productively. The goal is not simply to improve what learners can do with artificial intelligence, but to ensure that AI-supported activity contributes to who they are becoming as learners.

Ethical and Pedagogical Challenges

The integration of artificial intelligence into education introduces a range of ethical and pedagogical challenges that extend beyond the adoption of new instructional technologies. As AI tools become increasingly capable of generating written responses, solving problems, analyzing information, and producing sophisticated academic work, educators must reconsider both how learning occurs and how it is evaluated. These challenges involve not only academic integrity but also the authenticity of student work, cognitive dependency, algorithmic bias, data privacy, equitable access, and the development of responsible AI literacy (Miao & Holmes, 2023).

One of the most immediate challenges concerns assessments. Traditional assessments have often treated the quality of a completed product—an essay, a solution to a problem, a laboratory report, or project—as evidence of the cognitive processes involved in producing it. Generative AI complicates this assumption because students may now produce sophisticated academic work with substantial machine assistance. As a result, educators must increasingly distinguish between the quality of the submitted product and the learning demonstrated through the process of producing it (Nasr et al.,

2026). This distinction suggests a need for assessment practices that make student reasoning, reflection, decision making, and intellectual development more visible rather than relying exclusively on the evaluation of final products.

Academic integrity presents a related but more complex challenge. The widespread availability of generative AI has blurred traditional boundaries surrounding authorship, originality, collaboration, and acceptable assistance. Recent research suggests that students themselves frequently encounter uncertainty when determining what constitutes appropriate AI use, creating an ethical environment in which institutional expectations and individual practices may not always align (Ying, 2026). Rather than treating every use of AI as academic misconduct, institutions must develop clear expectations regarding when AI assistance is appropriate, how its use should be acknowledged, and what intellectual responsibilities remain with the learner.

A second concern involves cognitive dependency. Artificial intelligence can reduce unnecessary cognitive burden and provide valuable support for learning, but excessive or uncritical reliance may also encourage cognitive offloading, dependence, and reduced intellectual engagement (Wang et al., 2026; Suazo Galdames et al., 2026). The educational challenge is therefore not to eliminate cognitive offloading, which is a normal feature of human interaction with tools, but to distinguish productive cognitive support from substitution for the thinking necessary for learning. Students must learn when AI assistance enhances their reasoning and when reliance on AI may bypass opportunities for analysis, reflection, problem solving, and independent judgment. Ethical AI use also requires attention to the limitations of the technology itself. AI-generated information may contain inaccuracies, reproduce biases embedded in training data, or present uncertain information with apparent confidence. Questions of privacy, data security, transparency, and equitable access further complicate the adoption of these systems in educational environments (Miao & Holmes, 2023). AI literacy must therefore extend beyond learning how to operate particular tools. Students and educators need the capacity to evaluate AI-generated information critically, recognize technological limitations, understand the ethical implications of AI use, and assume responsibility for decisions made with AI assistance.

Taken together, these challenges suggest that the integration of artificial intelligence into education is not simply a technological issue but a pedagogical and developmental transformation. Addressing these concerns will require innovative approaches to assessment, clear expectations for responsible AI use, increased attention to AI literacy, and educational practices that preserve learner agency and intellectual responsibility. The central challenge is not merely to regulate the use of artificial intelligence, but to design learning environments in which AI supports rather than substitutes for cognitive engagement through which learners develop judgment, reflection, ethical awareness, and intellectual independence

Beyond Task Performance

The increasing capabilities of artificial intelligence invite educators to reconsider the broader goals of education. Historically, educational systems have emphasized the

demonstration of competence through task performance, solving problems, producing written work, or recalling information. These activities remain important components of learning. However, as generative AI becomes capable of supporting an increasingly broad range of cognitive activities, successful task completion alone becomes a less complete indicator of what a learner understands, can do independently, or is developing intellectually. The emergence of generative AI therefore raises a more fundamental educational question: if the performance of an academic task can increasingly be supported by an intelligent system, what should the educational experience ultimately develop within the learner?

This question provides the foundation for the distinction between “doing” and “becoming” proposed in this paper. “Doing” refers to the performance and completion of academic tasks through which competence has traditionally been demonstrated. “Becoming” refers to the developmental processes through which learners cultivate judgment, agency, reflection, ethical responsibility, creativity, and intellectual identity. These dimensions are not mutually exclusive. Doing remains an important part of learning, but its educational value increasingly depends on whether engagement in academic work contributes to the development of the learner. The purpose of education, therefore, extends beyond producing successful academic outputs toward creating experiences through which learners develop the capacities necessary to interpret, evaluate, create, decide, and act responsibly.

Dimension	***Doing: Task Performance***	***AI-Augmented Learning***	***Becoming: Learner Development***
Primary Educational Focus	Demonstrate competence through academic tasks	Use AI to support and extend learner cognitive activity	Cultivate intellectual and personal development
Evidence of Learning	Quality and accuracy of completed work	AI-supported products and learning processes	Demonstrated understanding, judgment, reflection, and growth
Cognitive Activity	Remember, understand, apply, analyze, evaluate, and create	AI may support activity across cognitive levels	Learners remain actively engaged in interpreting, evaluating, reflecting, and creating
Role of AI	Limited or peripheral	Cognitive partner, scaffold, feedback source, and generative tool	Augment rather than substitute for learner development
Role of the Instructor	Content expert, evaluator, and task designer	Designer and facilitator of AI-supported learning	Mentor and architect of experiences that foster judgment, agency, reflection, and intellectual growth
Role of the Student	Complete assigned tasks and demonstrate competence	Engage critically and deliberately with AI-supported work	Exercise agency, judgment, responsibility, and reflective thought

Assessment Emphasis	Evaluate the final product	Examine both product and process	Make reasoning, judgment, reflection, and development visible
Central Question	What can the student do?	What can the student accomplish with AI?	Who is the learner becoming through the educational experience?
Educational Outcome	Task competence and knowledge acquisition	Expanded capability through human–AI collaboration	Intellectual growth, agency, ethical responsibility, and identity formation

Table 1: *From "Doing" to "Becoming" in AI-Augmented Education*

Table 1 summarizes the conceptual shift proposed in this study. The model does not suggest that "doing" should be abandoned or that artificial intelligence assumes responsibility for one category of cognitive activity while humans retain another. Rather, it recognizes that AI can participate in activities across a range of cognitive levels and that the educational significance of those activities depends on how they contribute to learner development. The distinction is therefore not between tasks performed by machines and higher-order cognition performed by humans, but between the successful performance of cognitive tasks and the development of the human learner.

Understanding education as a process of becoming places intellectual development at the center of the educational experience. In a predominantly doing-oriented model, learning is often demonstrated through the successful completion of academic tasks. A becoming-oriented model asks an additional question: what capacities are developing within the learner through the performance of those tasks? From this perspective, the purpose of education is not simply to produce correct answers or sophisticated products but to cultivate individuals capable of interpreting complex problems, exercising sound judgment, reflecting on their assumptions, acting responsibly, and developing increasingly sophisticated intellectual identities. This perspective aligns with theories of learning as identity formation, which emphasize that education involves becoming a participant in communities of knowledge and practice rather than merely acquiring discrete skills (Wenger, 1998).

The theoretical perspectives discussed earlier—experiential learning, transformative learning, and situated learning—reinforce this developmental orientation. Learning emerges through cycles of experience and reflection (Kolb, 1984), through critical examination of underlying assumptions (Mezirow, 1991), and through participation in communities of practice (Lave & Wenger, 1991). In AI-augmented environments, these processes remain important because the educational value of artificial intelligence depends not simply on what technology enables learners to produce, but on how its use shapes learner engagement, reflection, judgment, agency, and responsibility. Artificial intelligence may support these developmental processes through feedback, dialogue, information access, simulation, and cognitive scaffolding, but educational design must ensure that such support augments rather than substitutes for the learner's participation in the learning process (Wang et al., 2026).

Understanding education as a process of becoming therefore reframes the role of artificial intelligence in the classroom. Rather than assigning routine cognition to machines and higher-order cognition to humans, educators can ask how AI should be incorporated into learning experiences so that technological assistance contributes to human development. The educational objective is not to minimize the use of artificial intelligence or to preserve forms of academic work simply because they predate AI. It is to design learning environments in which students learn to use increasingly capable technologies while continuing to develop the judgment, agency, reflection, ethical responsibility, creativity, and intellectual identity necessary to direct those technologies purposefully and responsibly.

In this sense, artificial intelligence does not diminish the importance of human learning; it makes the developmental purpose of education more visible. As the ability to produce sophisticated academic outputs becomes increasingly shared between humans and intelligent systems, education must look beyond the output itself and ask what has developed within the learner through the process of producing it. The movement from "doing" to "becoming" therefore represents not an abandonment of knowledge, skills, or task performance, but a reorientation of their purpose: what students do remains important because of what those experiences enable them to become.

Implications for Higher Education

The emergence of artificial intelligence carries significant implications for how higher education institutions design curricula, assess learning, and support faculty development. If AI systems increasingly perform structured cognitive tasks, educational environments must place greater emphasis on the development of higher-order intellectual capacities.

Curricula may need to prioritize critical thinking, ethical reasoning, and interdisciplinary problem-solving capacities that allow students to interpret complex situations and make informed decisions in technologically mediated environments. This shift does not eliminate the value of foundational knowledge or procedural learning but repositions them within a broader developmental framework. Similarly, assessment practices may need to evolve (Nasr et al., 2026). Alternative approaches such as oral examinations, project-based learning, and reflective portfolios may better capture students' reasoning processes and intellectual development.

Faculty development will also play a critical role in this transition. Many instructors recognize the potential of artificial intelligence but remain uncertain about how to incorporate these tools effectively into their teaching. Professional development initiatives focused on AI literacy, ethical considerations, and instructional design will therefore be essential.

Finally, institutions must develop clear policies governing the responsible use of artificial intelligence in academic settings. Such policies can help ensure that AI technologies

support learning rather than undermine it, while also providing guidance for both students and faculty navigating rapidly evolving technological landscapes.

Conclusion

Artificial intelligence is reshaping the educational landscape by transforming how information is generated, accessed, analyzed, and applied. As increasingly capable AI systems support learners across a broad range of cognitive activities, they challenge long-standing assumptions about the relationship between academic task performance and evidence of learning. The significance of this transformation lies not simply in what artificial intelligence can do, but in what its growing capabilities require educators to reconsider about the purpose of education.

This paper has argued that the critical distinction in AI-augmented education is not between lower-order cognition performed by machines and higher-order cognition performed by humans. Rather, it is between the performance of cognitive tasks and the development of the human learner. Artificial intelligence can contribute to increasingly sophisticated academic work, but the quality of an AI-supported product does not, by itself, reveal the extent to which the learner has developed understanding, judgment, agency, reflection, ethical responsibility, creativity, or intellectual identity. The educational challenge is therefore not simply to determine what students can accomplish with artificial intelligence, but to ensure that their engagement with these technologies contributes to their continuing intellectual development.

Viewed through this lens, the integration of artificial intelligence does not diminish the role of education; rather, it sharpens its purpose. This paper conceptualizes that purpose as a movement from “doing” to “becoming.” “Doing” represents the knowledge, skills, tasks, and intellectual activities through which learners engage with disciplinary and professional problems. “Becoming” represents the developmental process through which those experiences contribute to the formation of judgment, agency, ethical awareness, reflective thought, creativity, and intellectual identity. The movement from doing to becoming does not diminish the importance of knowledge, skills, or task performance. Instead, it repositions them as essential components of a larger developmental process.

The future of higher education therefore lies neither in competing with artificial intelligence nor in simply incorporating increasingly capable technologies into existing educational practices. It lies in designing learning environments in which human–AI collaboration expands what students can accomplish while preserving and strengthening the intellectual engagement and responsibility through which they develop. This requires educators to consider not only the quality of what students produce, but also the reasoning, reflection, judgment, agency, and growth that occur through the process of producing it. The central question for education is therefore not simply what students can do with artificial intelligence, but who they are becoming through their engagement with it.

Artificial intelligence will continue to change what students can do. The enduring responsibility of education is to ensure that, through what they do, students continue to become thoughtful, capable, ethical, reflective, and intellectually independent human beings.

References

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

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals*. Longmans, Green.

Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W. W. Norton & Company.

Chen, S., & Cheung, A. C. K. (2025). Effect of generative artificial intelligence on university students learning outcomes: A systematic review and meta-analysis. *Educational Research Review, 49*, 100737. https://doi.org/10.1016/j.edurev.2025.100737

Chick, J. C. (2026). Navigating the AI revolution: Generative AI as a potential disorienting dilemma in adult and continuing education. *Journal of Transformative Education*. Advance online publication. https://doi.org/10.1177/15413446261442461

Dellermann, D., Ebel, P., Söllner, M., & Leimeister, J. M. (2019). Hybrid intelligence. *Business & Information Systems Engineering, 61*(5), 637–643. https://doi.org/10.1007/s12599-019-00587-2

Freeman, J. (2025). *Student generative AI survey 2025* (HEPI Policy Note 61). Higher Education Policy Institute.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Lavercombe, M. (2026). From doing to being: Generative AI, workplace affordances, and professional identity. *Medical Teacher*. Advance online publication. https://doi.org/10.1080/0142159X.2026.2710213

Li, C., Cui, H., & Hagedorn, L. S. (2026). The cognitive impact of ChatGPT in higher education: A systematic review of critical and creative thinking outcomes. *Computers and Education: Artificial Intelligence, 10*, 100571.

Liu, C., Xie, L., & Xu, G. (2026). Generative AI in higher education: A meta-analysis of intellectual and social–emotional outcomes. *Frontiers in Psychology, 17*, 1848745.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.

Mezirow, J. (1991). *Transformative dimensions of adult learning*. Jossey-Bass.

Miao, F., & Holmes, W. (2023). *Guidance for generative AI in education and research*. UNESCO.

Nasr, N. R., Tu, C.-H., Sujo-Montes, L., Haniya, & S., Yen, C.-J. (2026). Generative artificial intelligence impact on critical thinking in higher education: A comprehensive bibliometric analysis and systematic review. *Journal of Computers in Education*. Advance online publication. https://doi.org/10.1007/s40692-026-00396-z

Oyelere, S. S. (2026). A scoping review of hybrid intelligence systems for human-centred AI in education. *Computers in Human Behavior: Artificial Humans, 7*, 100273. https://doi.org/10.1016/j.chbah.2026.100273

Suazo Galdames, I. C., Santiesteban Velázquez, M., Saracostti, M., & Chaple Gil, A. M. (2026). Between cognitive offloading and critical autonomy: A systematic review of the epistemic implications of generative AI in higher education. *Frontiers in Education, 11*, 1878665. https://doi.org/10.3389/feduc.2026.1878665

Vaccaro, M., Almaatouq, A., & Malone, T. (2024). When combinations of humans and AI are useful: A systematic review and meta-analysis. *Nature Human Behaviour, 8*, 2293–2303. https://doi.org/10.1038/s41562-024-02024-1

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

Wang, G., Wang, W., Yang, D., & Ren, J. (2026). Generative AI, cognitive offloading, and learner agency in higher education: A scoping review. *Behavioral Sciences, 16*(7), 1150. https://doi.org/10.3390/bs16071150

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

Xia, Q., Zhang, P., Huang, W., & Chiu, T. K. F. (2025). The impact of generative AI on university students' learning outcomes via Bloom's taxonomy: A meta-analysis and pattern mining approach. *Asia Pacific Journal of Education*. Advance online publication. https://doi.org/10.1080/02188791.2025.2530503

Ying, J. (2026). Academic integrity in the age of generative AI: A scoping review of research on higher education student voices. *Journal of Academic Ethics, 24*, Article 78. https://doi.org/10.1007/s10805-026-09752-1

Examining the relationship between career focused high-impact practices (HIPs) and undergraduate students' career and communication confidence

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Abstract

Higher education institutions implement high-impact practices (HIPs) to improve student learning outcomes and provide workforce preparation. HIPs are evidenced-based teaching and learning practices that promote high levels of engagement, retention, and academic success. While HIPs have been shown to improve student performance and graduation rates, the relationship between HIPs and student confidence in career preparation and communication has not been analyzed. Our work explored the relationship between career focused HIPs in major or minor programs and self-reported career preparation and communication confidence. Data were collected using a survey completed by 365 undergraduate students at a midsized regional doctoral/professional university. Our findings reveal that students who engaged in at least 1 career focused HIP as part of their major or minor coursework self-reported increased confidence in career preparation and communication skills. Although effect sizes found were small, these results support previous work that show HIPs embedded in higher education courses facilitate career readiness. Additionally, these results warrant further examination of career focused HIPs and their dynamic effect on career planning and preparation.

Examining the effect of career focused high-impact practices (HIPs) on student career and communication confidence

Over the past decade, college completion rates have attracted significant public attention due to rising tuition costs, concerns about institutional accountability, and the value of a degree (The Chronicle of Higher Education, 2023; Kelchen, 2024; St Amour, 2019). In response to budget limitations and taxpayer expectations, state and federal lawmakers have pushed colleges to improve their graduation rates. Additionally, many educators argue that the value of a college education extends beyond simply finishing courses to include the types of experiences students engage in. The American Association of Colleges and Universities (AAC&U) first identified high-impact practices (HIPs) in 2008 as those that are “especially effective in promoting student learning and preparing students for their future careers” (Kuh, 2008, p. 44).

The American Association of Colleges and Universities reported a list of 10 “effective educational practices” that require students to engage actively inside and outside the classroom (Kuh, 2008). Though definitions have changed with time, lists of HIPs typically include capstone courses and projects, collaborative assignments and projects, diversity/global learning, internships, service- and community-based learning, first-year seminars and experiences, learning communities, writing-intensive courses, undergraduate research, and common intellectual experiences (Kuh et al., 2013; Kuh et al., 2017). Numerous studies report a strong positive correlation between student course grades, transferable skills, retention, and graduation rates when participating in HIPs (Binder, et. al., 2015; Bonet & Walters, 2016; Brownell & Swaner, 2010; Buch & Spaulding, 2008; Kilgo et al., 2015; Miller et al., 2022). Other studies report increased early job placement and career planning for students participating in HIPs (Dorman & Brown, 2018; Miller et al., 2022). Thus, high impact practices gained significant attention and have been implemented across various segments of higher education.

Literature Review

Participation in HIPs is also linked to increased self-efficacy among college students. For example, Kuh (2008) notes that undergraduates participating in HIPs - such as study abroad, service learning, research with faculty, or an internship - provides students a better understanding of themselves in relation to others and the larger world, and the acquisition of “intellectual tools and ethical grounding to act with confidence for the betterment of the human condition” (p. 17). Self-efficacy is essential to student success because it refers to an individual’s beliefs about their ability to complete necessary behaviors to produce a specific performance outcome (Bandura, 1977, 1997). Additionally, research has shown that experiential learning curriculum, which includes internships, can influence career efficacy. Career efficacy is related but differs from self-efficacy in that it encompasses the beliefs in career choice goals, the actions taken to pursue and persist in the career path, and the quality of performance in the career path (Brown, & Lent, 2023). Caza and colleagues (2015) found a holistic, experiential curriculum led to greater career efficacy and student satisfaction than traditional curricula. Internship experiences, specifically, offer opportunities to apply classroom knowledge in professional settings, enhancing self-assurance and career readiness (Hart Research Associates, 2009).

HIPs can also enhance student learning and engagement, which can indirectly impact students’ career confidence and communication skills. Dorman and colleagues (2018) found that curricular enhancements resulted in students reporting that they felt more confident “in their abilities to identify appropriate employers and positions, present their experiences and skills effectively, network, and plan their own careers”. Similarly, Miller and colleagues (2022) reported that art alumni who participated in HIPs reported higher levels of career development. Moreover, HIP activities were associated with more successful post-graduation job searches, with those completing portfolios and internships during college more likely to have shorter initial job searches.

Kuh (2008) explains that HIPs help students develop strong written and oral communication skills—abilities that are essential for meeting the demands of today’s workforce. National survey results from employers show that only 30% believe students were very well-prepared in oral communication and only 26% for written communication. Recently, 95% of employers responding to the National Association of Colleges and Employers Job Outlook report (2024) cited communication as the most important competency for graduates to meet. However, in the same report, only 55.2% of employers rate students as very/extremely proficient in communication. HIPs such as service learning and undergraduate research strengthen both professional identity and communication skills. In a virtual service-learning project, students reported improved communication when mentoring school-aged children (Torres et al., 2022). Undergraduate research similarly builds professional identity while enhancing scientific communication through oral, poster, and written formats (Hunter et al., 2007). These experiences also foster empathetic and collaborative communication with diverse communities (Eyler & Giles, 1999). Building on this research, the current study examines a range of career-focused HIPs embedded in undergraduate majors and minors to further explore their impact on professional identity and communication skills.

Overall, HIPs have gained recognition for their potential to significantly enhance student learning outcomes, including communication skills and confidence levels. Institutions have prioritized HIPs because they meet the needs of employers who seek graduates with analytical skills, creativity, and adaptability (An & Loes, 2023; Finley, 2021; Flateby & Rose, 2021). Thus, colleges and universities have attempted to respond to lawmakers and taxpayers demands by incorporating HIPs across the curricula to improve student engagement, graduation rates, and post-graduation employment.

One concern that has been voiced regarding traditional HIPs in higher education is that not all HIPS are created and delivered equally in terms of student awareness and engagement. Passive HIPs have been described as those that are simply built into the curriculum (i.e. general education requirements global awareness courses, and writing-intensive courses) where students are engaging naturally but likely unknowingly (Tice, 2025). Whereas active HIPs are described as those requiring intentional participation (i.e. internships, research, service-learning projects, etc.), are accessible, participatory, and student-driven experiences. Career focused HIPs embedded in the curriculum meet the guidelines for the active HIP description and support research that has shown students develop critical career, leadership, and interpersonal skills through mentorship in professional communities, campus leadership positions, and meaningful employment experiences (Pascarella & Terenzini, 2005). However, if the impacts of career focused HIPs on student career outcomes and professional development are not clear and easily communicated to students, faculty, and administrators, efforts to increase career HIPs and work integrated learning (WIL) in the curriculum may be minimized.

Previous research has found positive effects of HIPs on some career outcomes and communication skills, but there have been no direct studies of the effects of career-focused HIPs on career and communication confidence among students engaged in these practices. Preliminary research focusing on perceptions of increased confidence after engaging in career focused HIPs could address this concern. Thus, our work aims to understand if incorporating career focused HIPs in university major or minor program curricula impacts students' self-reported career and communication confidence.

Summary and Significance of Proposed Research

As higher education faces increasing pressure to demonstrate the value of a college degree, institutions are being challenged to show not only that the students graduate, but that they leave college prepared to enter and succeed in the workforce. HIPs, including internships, undergraduate research, service-learning, collaborative projects, and other experiential learning opportunities, represent one strategy for connecting academic learning with professional preparation. Research consistently associates participation in HIPs with positive outcomes such as student engagement, retention, academic achievement, transferable skill development, career planning, and employment outcomes (Kuh, 2008; Kuh et. al, 2013; Miller et. al., 2022). These experiences may be particularly valuable because they allow students to apply

disciplinary knowledge in authentic contexts while developing confidence in their ability to communicate, collaborate, solve problems, and navigate professional environments.

However, an important gap remains in the HIP literature. Although previous work has linked HIP participation to academic success, career development, employment outcomes, and communication skills, considerably less is known about whether career-focused HIPs embedded within undergraduate majors and minors are associated specifically with student's confidence in their career and communication abilities. Moreover, HIPs differ in the extent to which they require intentional student engagement. Career-focused experiences such as internships, undergraduate research, service-learning, and other forms of work-integrated learning represent active applications of academic knowledge rather than passive exposure to professional development. Understanding the outcomes associated with these intentional experiences is necessary for determining how institutions should design, support, and communicate the value of applied learning.

The proposed research addresses this problem by examining student's self-reported career and communication confidence as a function of participation in career-focused HIPs embedded within undergraduate academic programs. Specifically, the study addresses the following research questions:

1. To what extent does self-reported career confidence differ between undergraduate students who have participated in career-focused HIPs in their major and those who have not?

2. To what extent does self-reported career confidence differ between undergraduate students who have participated in career-focused HIPs in their minor and those who have not?

3. To what extent does self-reported communication confidence differ between undergraduate students who have participated in career-focused HIPs in their major and those who have not?

4. To what extent does self-reported communication confidence differ between undergraduate students who have participated in career-focused HIPs in their minor and those who have not?

A potential solution to the disconnect between academic learning and workforce preparation is the more intentional integration of career-focused HIPs and work-integrated learning into undergraduate curricula. Rather than treating career readiness and preparation as an activity that occurs primarily outside the curriculum or near graduation, programs can provide structured experiences for students to apply disciplinary knowledge, interact with professional communities, communicate with diverse audiences, and reflect on how their academic experiences translate into workplace competencies. Importantly, simply increasing the number of HIPs embedded

in the major and minor may not be as impactful as the quality of professional development, communication, and applied disciplinary learning that the HIPs include.

Further research is warranted because the expansion of applied learning requires evidence about which experiences contribute to career readiness and employability, and how students perceive their professional development through those experiences. Establishing relationships between career-focused HIP participation and career and communication confidence can provide preliminary evidence for designing more intentional curricula, allocating institutional resources, and helping faculty communicate the career relevance of experiential learning. Such evidence would also help institutions move beyond using HIPs as a general student success outcome and toward evaluating whether these experiences produce the professional competencies and confidence that is expected.

Ultimately, the proposed study shifts the conversation from whether HIPs are generally beneficial to the more applied question of how intentional, career-focused experiences contribute to student's perceptions of their readiness to communicate and function effectively in professional environments. The aim of this study is for the findings to offer preliminary evidence that will inform curricular design, career-readiness initiatives, and institutional decisions about work-integrated learning while providing a foundation for subsequent research examining the mechanisms through which career-focused HIPs influence professional development and post-graduation outcomes.

Method

Participants

We emailed our survey to all university students via the University's student affairs campus email list. We received complete survey responses from 365 respondents (out of 770 total responses received). This resulted in a 4.4 percent response rate when considering the undergraduate enrollment. The sample was majority white, 21 years of age, with a breakdown of 260 women and 90 men. The demographics of the respondents were in line with the university's enrollment population. Please see table 1 for participant demographics, major breakdowns, and self-reported post-graduation plans.

Materials

Career Planning Confidence Scale (CPCS) (McAuliffe et al., 2006)

The Career Planning Confidence Scale is composed of 39 items evaluated on a 5-point scale ranging from "No confidence" (1) to "Complete confidence" (5) divided across six domains. The original authors assessed the reliability and validity of the CPCS using data from 1,574 first-year students at a public university. They later gave the CPCS to 400 incoming college students to assess test-retest reliability (McAuliffe et al.,2006). Content validity was established through specific behavior-related items developed and evaluated by content experts based on seven career planning domains: (a) readiness to engage in career planning, (b) self-assessment, (c) generating options, (d) information

seeking, (e) deciding, (f) making plans, and (g) taking action (McAuliffe et al., 2006). Construct validity was established through factor analysis, resulting in a six-factor structure aligning with the developer's proposed theoretical model. Criterion-related validity was established through positive correlations with other career planning and development measures. The six domains were moderately to strongly stable across a 2-week period (r = .58 to r = .75). The domains showed strong internal consistency with Cronbach's alpha values ranging from .81 to .92. We used questions from two domains from the CPSC in the current study to assess students' confidence in searching for career information and implementing their career decisions.

The original Information-Seeking domain consisted of seven items answered on a 5-point scale ranging from "No confidence" (1) to "Complete confidence" (5) developed to assess how confident students were in seeking career information and communicating career interests and values. Example items included "find general career information about the occupations in which you are interested" and "list the benefits and risks of choosing each one of these occupations". The current study added one additional item that read "identify an appropriate salary range for the position you are interested in based on the industry, location, and job requirements". This item was created by the authors for this study to address concerns found in previous work (Chin, et. al., 2019; Foster et. al., 2024; Milosheva et. al., 2022) that emphasize career information literacy is lacking in coursework as it relates to career exploration.

Reliability analysis for these items revealed a Cronbach's alpha value of .94, which suggest the items showed strong internal consistency. The domain's positive correlation (r = .67) with the Communication Confidence scale used in this study to assess student's confidence in communicating to different audiences and using different modalities suggest the two scales are measuring related but different areas of confidence.

The Confidence in Implementing your Decision domain included ten items evaluated with the same rating scale as the information seeking confidence domain to access a student's confidence in performing steps to pursue a selected career. All ten items in this domain were implemented as written in the original scale, except for minor word adjustments to reflect current language usage. Example items included "preparing a good resume" and "move to another area to seek employment in your chosen occupation". Reliability analysis for this domain revealed a Cronbach's alpha value of .92, which suggest the items showed strong internal consistency even with minor word adjustments. The subscale's positive correlation (r = .66) with the Communication Confidence domain suggests the two domains are measuring related but different areas of confidence.

Communication Confidence Scale (CCS)

The Communication Confidence scale measured participants' confidence in communicating in various professional contexts. The scale was created specifically for this study and consists of eight items presented in Table 2. Example items include "I am confident in my public speaking skills" and "I am confident in my ability to communicate

in small groups". Participants answered each item on a 5-point scale that ranged from "strongly disagree" to "strongly agree." The mean and standard deviation for each item on the CCS is also presented in Table 2. As the Communication Confidence Scale (CCS) was created specifically for this study, we evaluated the scale's reliability. Internal consistency reliability of eight items used to capture communication confidence was assessed using Cronbach's alpha: 0.91 (95% CI [0.90, 0.92]), indicating excellent internal consistency reliability for the scale. Pairwise complete cases were utilized for analysis.

HIPs in the Major and Minor

To determine the perception of career focused HIPs in the major and minor, participants were asked if their major and minor program included career preparation opportunities. Participants selected yes or no, then were asked about specific career preparation opportunities in their major. The career preparation opportunities included: internships, practicums, service-learning courses, research opportunities, professional networking opportunities, and career selection/exploration course. Answer options for each career HIP category included not available, required, or recommended. The same categories were presented to respondents who indicated their program of study included a minor. Additionally, respondents were asked if they had directly experienced career focused HIPs in their program of study to ensure students completed one of the required or recommended HIPs. Further, respondents were asked to identify the level (lower division or upper division courses) at which the career focused HIPs occurred in their major and/or minor. The authors confirmed all program career HIP requirements for majors and minors included in the study responses by reviewing major and minor check sheets used by the university advising office and by confirming with program directors. The quasi-independent variable was created by comparing students who had experienced at least 1 career focused hip in their major (and minor) to those who had not.

Although HIP definitions typically include other practices such as writing intensive courses, living-learning communities, common intellectual experiences, and first-year seminar courses, the current study focused on the above-mentioned HIPs because they fit the description of active HIPs (Tice, 2025) that focused on or included career planning or preparation.

Procedures

After receiving exempt approval to conduct the campus-wide study from the University of Central Arkansas' Institutional Review Board, participants received the study invitation to their student email, either through a general email sent through the Student Affairs student distribution list or an email from a course instructor. Because this was a web-based survey, participants completed it at locations and times of their choosing. Participants completed the survey by clicking the selected response option or typing responses in a textbox. Those who chose to participate clicked a link in the email to begin. The first portion of the survey presented participants with an informed consent letter that included the purpose of the study, which was described as "to understand perceptions of career preparation as it relates to confidence in skills, abilities, decisions,

goals, and plans". The consent form also described the procedure, potential risks and benefits, anonymity of responders' identity, and primary investigator contact information for the research. Only participants who indicated agreement with the content letter received survey items. After informed consent, participants reported their demographics and completed several survey items, including questions about career-focused high impact practices in their major and minor as well as questions about their career preparation confidence and communication confidence. After completing all survey items, participants were presented with a debriefing letter and an option to submit their name, email, and course information for potential course points (at the instructor's discretion). All instructors offering course credit for completing the survey offered their students alternative assignments if they chose not to complete the survey. The data was only viewable by the authors of the study and was stored secured according to IRB data requirements.

Design & Data Analysis

The present study employed a between-subjects, comparative design to examine whether students who completed at least one career preparation course (that were required or recommended) in their major and minor courses scored higher on self-report questionnaires of career preparation and communication confidence compared to students who had not taken such courses in their major and minor courses. The quasi-independent variable was course experience, with two levels: (a) students who had enrolled in and completed at least one career preparation course in the major and/or minor, and (b) students who had not enrolled in any career preparation courses. The dependent variable was self-reported career preparation confidence, measured using standardized self-report questionnaires that assess participants' perceived confidence in their career planning for entering the workforce and confidence in communicating professionally in various professional contexts.

The primary focus of this design was to test whether mean differences in self-reported career planning and communication confidence existed between the two groups. Participants were assigned to groups naturally, based on their prior course experience, rather than through experimental manipulation. Group comparisons were conducted using independent-samples t tests, which allowed for evaluation of whether the mean scores differed significantly. This design was chosen to determine if the experience of structured career planning and communication coursework corresponds with higher self-perceived confidence relative to peers without such coursework experience.

Due to the exploratory nature of our work on career focused HIPs, we utilized an online survey method to gather data to address these research questions. Asking students directly if their confidence in career preparation and professional communication has been influenced by teaching methods and approaches embedded in their major and minor programs is the first step in determining if career focused HIPs are effective in increasing career preparation and communication among college students. Further, survey methods are known to be cost-effective and efficient methods to collect large amounts of data (that can be generalizable) from broad populations such as student populations (Goodfellow, 2023). All data collected was primary data taken directly from survey responses.

To address the four study questions, separate independent sample t-tests were planned to compare career planning confidence and communication confidence scores for students who reported not having career focused HIPs available in their major and minor to those who reported HIPs were required or recommended in their major and/or minor. Normality, homogeneity of variance, and independence assumptions were all tested following analysis guidelines (Turner & Thayer, 2001). There was slight deviation from normality and a violation of homogeneity of variance ($p < .001$) in the data, so the Mann Whitney statistic was used in place of the studentized t statistic to address these violations. The Mann-Whitney U test is a non-parametric test that can identify differences in independent groups in the presence of violations of the assumptions of normality and/or equal variances (Fay & Proschan, 2010). For each comparison, a power analysis using G* Power version 3.1.9.7 (Faul et. al., 2007) was conducted to identify the sample size needed to determine a small effect size ($r = .4$) with a Type 1 error rate of .05 and Type 2 error rate of .10. The sample size needed for each analysis to achieve these parameters was 226. The results of each comparison across the confidence scores are discussed below and can be found in Table 3.

Results

Comparison of career focused HIPs in the major on career confidence- Information seeking (CPCS-ISC)

The Mann-Whitney U test was conducted to compare the information-seeking scores of the two groups ($n1 = 177$, $n2 = 270$) and revealed a significant difference across the groups, $U = 18863$, $p < .01$. The median information seeking score for the students without career focused HIPs in the major was 30, while the median for the students with career focused HIPs in the major was 32. The effect size (r) was calculated to be -0.22, indicating a weak effect.

Comparison of including career focused HIPs in the major on career confidence- Implementing a decision (CPCS-CID)

The Mann-Whitney U test conducted to compare the implementing scores of the two groups ($n1 = 176$, $n2 = 261$) and revealed a significant difference across the groups, $U = 16388$, $p < .01$. The median information seeking score for the students without career focused HIPs in the major was 37, while the median for the students with career focused HIPs in the major was 41. The effect size (r) was calculated to be -0.29, indicating a weak effect.

Comparison of including career focused HIPs in the major on communication confidence (CCS)

The Mann-Whitney U test conducted to compare the communication confidence scores of the two groups ($n1 = 197$, $n2 = 292$) and revealed a significant difference across the groups, $U = 16388$, $p < .01$. The median information seeking score for the students without career focused HIPs in the major was 29, while the median for the students with

career focused HIPs in the major was 31. The effect size (*r*) was calculated to be -0.22, indicating a weak effect.

Comparison of career focused HIPs in the minor on career confidence- Information seeking (CPCS-ISC)

The Mann-Whitney U test conducted to compare the information seeking scores of the two groups ($n1 = 134$, $n2 = 113$) and revealed a significant difference across the groups, $U = 5468$, $p < .01$. The median information seeking score for the students without career focused HIPs in the major was 30, while the median for the students with career focused HIPs in the major was 33. The effect size (*r*) was calculated to be -0.28, indicating a weak effect.

Comparison of including career focused HIPs in the minor on career confidence- Implementing a decision (CPCS-CID)

The Mann-Whitney U test was conducted to compare the implementing scores of the two groups ($n1 =132$, $n2=107$) and revealed a significant difference across the groups, $U = 5202$, $p < .01$. The median information seeking score for the students without career focused HIPs in the major was 38, while the median for the students with career focused HIPs in the major was 41. The effect size (*r*) was calculated to be -0.26, indicating a weak effect.

Comparison of including career focused HIPs in the minor on communication confidence (CCS)

The Mann-Whitney U test conducted to compare the information seeking scores of the two groups ($n1 = 145$, $n2 = 120$) and revealed a significant difference across the groups, $U = 7091$, $p < .01$. The median information seeking score for the students without career focused HIPs in the major was 30, while the median for the students with career focused HIPs in the major was 32. The effect size (*r*) was calculated to be -0.19, indicating a weak effect.

Discussion

This study examined the perception of career focused HIPs in the curriculum (major and minor) and their impact on student's self-reported career and communication confidence. Results revealed significant differences in self-reported career and communication confidence when students had career focused HIPs incorporated into their major and minor curriculum that were required or recommended. However, all effect sizes were small in nature so our interpretations must be tempered. Our results do provide partial support of previous literature highlighting positive influences of career training and work integrated learning (WIL) on students' preparedness and confidence in navigating career paths (Jackson, 2023). WIL refers to experiences imbedded in the curriculum that immerse students in a professional setting typically related to the field of study such as internships, practicums, and service-learning projects.

Specifically, our results support previous literature that has found HIPs have a notable influence on students' preparedness and confidence in seeking career-related information (Dorman & Brown, 2018; Miller et al., 2018). Higher confidence in career information seeking can contribute to students' long-term career success in that confident individuals are more likely to actively seek opportunities, network effectively, and make informed decisions about their career paths (Dorman et al., 2018). Our results regarding students' confidence in implementing career decisions also support previous findings by Caza and colleagues (2015) that have shown presence of HIPs within students' major influences career decisions. We know HIPs provide students with opportunities to bridge the gap between theory and practice by allowing them to see real-world relevance of academic studies (Caza et al.,2015). Additional studies should be conducted to further examine how tailoring educational experiences to specific fields of study maximize effectiveness in preparing students for future careers. Specifically, future research should examine what differences, if any, exist in specific dimensions of career confidence based on students' participation in career-focused HIPs.

The results of the current study also provide partial support for work that has shown immersive learning experiences impacting students' communication ability. Exposure to HIPs in both the major and minor fields of study exposes students to diverse perspectives and requires them to communicate professionally and effectively across disciplinary boundaries (Eyler & Giles, 1999; Kuh, 2013; Torres et al., 2022). This interdisciplinary approach enriches students' learning experiences and enhances ability to communicate complex ideas to audiences with varied backgrounds. Although our results produced small effects, exposure to career focused HIPs in the major and minor courses did influence students' confidence in communicating professionally. This is important because any growth in professional skill development is positive for students' long-term success.

Our findings suggest that integrating experiential, career-oriented activities—such as internships, service learning, and research projects—can meaningfully enhance students' readiness for the workforce. By actively engaging in real-world scenarios and data, students not only develop clearer career goals but also build essential communication skills that are critical for professional success. This underscores the value of designing curricula that go beyond traditional lectures to include hands-on, career-relevant experiences that foster both personal and professional growth. Educators should embed career HIPs systematically across courses to support students' career development. Encouraging students to articulate their career plans and practice communication in authentic contexts helps build their self-efficacy, communication confidence, and career efficacy simultaneously. Additionally, these practices can promote deeper student engagement and motivation by connecting academic content with future career opportunities. Ultimately, the classroom environment that emphasizes career preparation and communication skills equip students with the tools they need to navigate the job market effectively and adapt to evolving professional demands.

Limitations & Future Directions

We recognize that these results are not robust and include several limitations that must be addressed. First, our response rate can be perceived as small in terms of the number of students attending the institution who received an invitation to complete the survey. We received well over 700 responses, but not all responses were usable and complete. This is a common disadvantage to using survey methods for data collection, but for the current study the survey methods were the most appropriate to reach varying types of students attending the university (Goodfellow, 2023).

Additionally, although we shared the survey broadly at the institution of interest, we primarily received responses from psychology, biology, and nursing majors. We suspect this is a result of these majors comprising a large quantity of enrolled students at the institution and the positionality of the authors. Two authors teach in the Psychology Department. We also recognize that other demographics could have influenced participants' career planning confidence and communication confidence. For example, it is possible that the students that completed at least 1 career focused HIP in their major or minor were majority junior and senior students completing required capstone experiences, which are reserved for the latter portion of the program. Thus, higher classification may yield higher career confidence and communication confidence regardless of the completion of a career HIP experience. Future research should compare lower classification students to upper classification students to determine the differences, if any, in career confidence and communication confidence across these groups. We did not assess or control demographic variables in our analyses because that was not the focus of our research questions. We encourage future research to examine how these variables may independently and dynamically work to impact career planning and communication confidence.

Our study also does not look at longitudinal effects of HIPs on communication and career confidence because we only examined scores at one time point. Our method was suited to reveal a snapshot of career preparation and communication confidence. We did not examine if effects go beyond this period or are longer lasting. It is possible that multiple exposures across the major and minor curriculum lead to stronger and longer-lasting effects. Additionally, we did not triangulate our data by gathering information from instructors regarding career readiness and communication skills. Future research should gather feedback from instructors of career focused HIP courses to determine their perspective of their students’ career and communication skills and the strengths and challenges of work-integrated learning in the curriculum.

Lastly, the lack of a factor analysis of the CCS we developed to address the specific research question regarding communication confidence limits the generalizability of the results. Our study aimed to create unique items on the scale that addressed different aspects of professional communication confidence, but our research aim was not focused on scale development. Future researchers that wish to replicate our findings should further develop the scale through factor analysis to confirm the structure of the eight items that were found in the current sample.

Going forward, additional research would be needed to distinguish between different types of career focused HIPs and their relationship to professional communication confidence in students. We believe it would be very beneficial to replicate this study with recent graduates across multiple higher education institutions (public, private, 4-year, 2-yr, etc.) to provide evidence of professional application of skills gained from career focused HIPs. Additionally, our findings would be more comprehensive and complemented by future longitudinal studies with repeated measures that cut across multiple disciplines to fully understand the dynamic processes and long-term effects of career and communication skill development through career focused HIPs.

Implications for Education

Our work supports the current belief that career focused HIPs have a broad utility to improve students' confidence in professional communication, regardless of their future planning or field of study. This study is significant because it highlights how career-focused high-impact practices in higher education not only support academic success but also strengthen students' confidence in career preparation and communication skills. By demonstrating these benefits, the research underscores the value of embedding career-oriented HIPs into curricula to enhance student readiness for the workforce.

In conclusion, results of our study indicate that incorporating HIPs into both majors and minors significantly enhances students' self-perceived career preparation and communication confidence. Our research helps bridge the gap between the potential of HIPs and their perceived value, thus maximizing their impact on student development and success. HIPs exposure and experience foster a deeper understanding and application of communication techniques, ultimately leading to increased self-assurance in their ability to convey ideas effectively across various contexts. In the age of increased use of technology in higher education, this work is not only timely but also important. HIPs provide crucial opportunities to practice and refine career skills, better preparing students for personal and professional success. Future educational strategies should consider integrating these practices more widely to maximize their positive impact on student outcomes.

References

An, B. P., & Loes, C. N. (2023). Participation in high-impact practices: Considering the role of institutional context and a person-centered approach. *Research in Higher Education*, *64*(4), 520–546. https://doi.org/10.1007/s11162-022-09715-6

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215.

Bandura, A. (1997). *Self-Efficacy: The exercise of control*. W. H. Freeman.

Binder, J. F., Baguley, T., Crook, C., & Miller, F. (2015). The academic value of internships: Benefits across disciplines and student backgrounds. *Contemporary Educational Psychology*, *41*, 73–82. https://doi.org/10.1016/j.cedpsych.2014.12.001

Bonet, G., & Walters, B. R. (2016). High impact practices: Student engagement and retention. *The College Student*, *15*(2), 224–235.

Brown, S. D., & Lent, R. W. (2023). Social cognitive career theory. In W. B. Walsh, L. Y. Flores, P. J. Hartung, & F. T. L. Leong (Eds.), *Career psychology: Models, concepts, and counseling for meaningful employment* (pp. 37–57). American Psychological Association. https://doi.org/10.1037/0000339-003

Brownell, J., & Swaner, L. E. (2010). *Five high-impact practices: research on learning outcomes, completion and quality*. Association of American Colleges and Universities.

Buch, K., & Spaulding, S. (2008). A longitudinal assessment of an initial cohort in a psychology learning community. *Teaching of Psychology, 35*(3), 189–193. https://doi.org/10.1177/009862830803500306

Caza, A., Brower, H. H., & Wayne, J. H. (2015). Effects of a holistic, experiential curriculum on business students' satisfaction and career confidence. *The International Journal of Management Education, 13*(1), 75–83. https://doi.org/10.1016/j.ijme.2015.01.006

Chin, M. Y., Cohen, C. B. A., & Hora, M. (2019). Examining US business undergraduates' use of career information sources during career exploration. *Journal of Education and Training, 62*, 15-30. https://doi.org/10.1108/et-05-2019-0103

Chittum, J. R., Enke, K. A. E., & Finley, A. P. (2022). *The effects of community-based and civic engagement in higher education*. American Association of Colleges and Universities. https://dgmg81phhvh63.cloudfront.net/content/user-photos/Research/PDFs/Effects-of-Community-based-and-Civic-Engagement.pdf

Dorman, S., & Brown, K. (2018). The liberal arts: Preparing the workforce of the future. *Liberal Education, 104*(4).

Eyler, J., & Giles Jr, D. E. (1999). *Where's the learning in service-learning?* Jossey-Bass Higher and Adult Education Series. Jossey-Bass, Inc.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical Sciences. *Behavior Research Methods, 39*(2), 175–191. https://doi.org/10.3758/bf03193146

Fay, M., & Proschan, M. (2010). Wilcoxon–Mann–Whitney or t-test? On assumptions for hypothesis tests and multiple interpretations of decision rules. *Statistics Surveys, 4*: 1–39. https://doi:10.1214/09-SS051.

Finley, A. (2021). *How college contributes to workforce success: Employer views on what matters most*. Association of American Colleges & Universities.

Flateby, T. & Rose, T. (2021, July 16). *From college to career success. How educators and employers talk about skills*. AACU. https://www.aacu.org/liberaleducation/articles/from-college-to-career-success-how-educators-and-employers-talk-about-skills

Foster, K., Lambert, L., Solomon, R., Perkins, H., & Masani, S. (2024). In real life: a curriculum for developing students' self-efficacy and outcome expectations through purpose-driven career exploration and planning within a core STEM course. *Journal of Microbiology & Biology Education, 26*. https://doi.org/10.1128/jmbe.00137-24

Goodfellow L. T. (2023). An overview of survey research. *Respiratory Care, 68*(9), 1309–1313. https://doi.org/10.4187/respcare.11041

Hart Research Associates. (2009). *Trends in learning outcomes, general education, and assessment: A survey among members of the association of American Colleges and Universities.* https://www.aacu.org/membership/documents/2009MemberSurvey_Part1.pdf

Hora, M. T., Parrott, E., & Her, P. (2020). How do students conceptualize the college internship experience? towards a student-centered approach to designing and implementing internships. *Journal of Education and Work, 33*(1), 48–66. https://doi.org/10.1080/13639080.2019.1708869

Hunter, A., Laursen, S. L., & Seymour, E. (2006). Becoming a scientist: The role of undergraduate research in students' cognitive, personal, and professional development. *Science Education, 91*(1), 36–74. https://doi.org/10.1002/sce.20173

Jackson, D. (2023). The relationship between student employment, employability-building activities and graduate outcomes. *Journal of Further and Higher Education, 48*(1), 14–30. https://doi.org/10.1080/0309877X.2023.2253426

Jepsen, D. A., & Dilley, J. S. (1974). Vocational decision-making models: A review and comparative analysis. *Review of Educational Research, 44*(3), 331. https://doi.org/10.2307/1169979

Johnson, S. R., & Stage, F. K. (2018). Academic engagement and student success: Do high-impact practices mean higher graduation rates? *The Journal of Higher Education, 89*(5), 753–781. https://doi.org/10.1080/00221546.2018.1441107

Kelchen, R. (2024). The role of state higher education policy in student success and equity. *Journal of Postsecondary Student Success*, 3(3), 4–24. https://doi.org/10.33009/fsop_jpss135047

Kilgo, C. A., Sheets, J. K. E., & Pascarella, E. T. (2015). The link between high-impact practices and student learning: some longitudinal evidence. *Higher Education, 69*(4), 509–525. https://doi.org/10.1007/s10734-014-9788-z

Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter* (p. 44). Association of American Colleges and Universities.

Kuh, G.D., O'Donnell, K., & Reed, S. (2013). *Ensuring Quality and Taking High Impact Practices to Scale*. Association of American Colleges & Universities.

https://www.aacu.org/publication/ensuring-quality-and-taking-high-impact-practices-to-scale

Kuh, G., O'Donnell, K., & Schneider, C. G. (2017, September/October). HIPs at ten. *Change: The Magazine of Higher Learning, 49*(5), 8-16. https://doi.org/10.1080%2f00091383.2017.1366805

Maxwell, K., Pittman, S. (2022). Experiential learning: An innovative way to bring success in the future endeavors of transfer students. *New Directions for Teaching & Learning, 171*, 29-35. https://doi.org/10.1002/tl.20514

McAuliffe, G., Jurgens, J. C., Pickering, W., Calliotte, J., Macera, A., & Zerwas, S. (2006). Targeting low career confidence using the career planning confidence scale. *Journal of Employment Counseling, 43*(3), 117–129. https://doi.org/10.1002/j.2161-1920.2006.tb00011.x

Miller, A. L., Martin, N. D., & Frenette, A. (2022). Unpacking high-impact practices in the arts: Predictors of college, career, and community engagement outcomes. *The Journal of Arts Management, Law, and Society, 52*(3), 190–210. https://doi.org/10.1080/10632921.2022.2029786

Miller, A. L., Rocconi, L. M., & Dumford, A. D. (2018). Focus on the finish line: Does high-impact practice participation influence career plans and early job attainment? *Higher Education, 75*(3), 489–506. https://doi.org/10.1007/s10734-017-0151-z

Milosheva, M., Hall, H., Robertson, P., & Cruickshank, P. (2022). *New Information Literacy Horizons: Making the Case for Career Information Literacy*. 239-252. https://doi.org/10.1007/978-3-030-99885-1_21

National Association of Colleges and Employers. (2024). Job outlook 2024 (November 2023). https://www.naceweb.org/career-readiness/trends-and-predictions

Parent, M. C. (2013). Handling item-level missing data: Simpler is just as good. *The Counseling Psychologist, 41*(4), 568-600. https://doi.org/10.1177/0011000012445176

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research*. Jossey-Bass.

St Amour, M. (2019, December 9). *Completion rates still rising, new data show, but at slower pace*. Inside Higher Ed | Higher Education News, Events and Jobs. https://www.insidehighered.com/news/2019/12/10/completion-rates-still-rising-new-data-show-slower-pace

The Chronicle of Higher Education. (2023, December). *Daily Briefing: College-completion rates have stalled. Why?* https://www.chronicle.com/newsletter/daily-briefing/2023-12-01

Thomas, D. T., Walsh, E. T., Torr, B. M., Alvarez, A. S., & Malagon, M. C. (2021). Incorporating high-impact practices for retention: A learning community model for transfer students. *Journal of College Student Retention: Research, Theory & Practice, 23*(2), 243-263. https://doi.org/10.1177/1521025118813618

Tice, J. R. (2025, March 16). *Rethinking high-impact practices: Expanding the pathways to student success.* LinkedIn. https://www.linkedin.com/pulse/rethinking-high-impact-practices-expanding-pathways-student-tice-tghne

Torres, Y., Walsh, N., & Tahvildary, N. (2022). Impact of mediator mentors service-learning on college student social-emotional expertise and cultural competence.

Journal of Practical Studies in Education, 3(1), 3–13. https://doi.org/10.46809/jpse.v3i1.38

Turner, J. R., & Thayer, J. F. (2001). *Introduction to analysis of variance: Design, analysis, & interpretation*. Sage Publications.

Wolniak, G. C., & Engberg, M. E. (2019). Do “high-impact” college experiences affect early career outcomes? *The Review of Higher Education, 42*(3), 825–858. https://doi.org/10.1353/rhe.2019.0021

Flashcard creation and use in a histology lecture course: A survey-based case study.

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Abstract

Histology, like many basic science subjects requires mastery of terminology, visual structures, and integration of these things to describe functional relationships, making effective study strategies essential for student success. Flashcards are widely used to support retrieval practice and spaced repetition, but students can struggle to develop deeper understanding beyond surface memorization. The relatively recent integration of artificial intelligence (AI) into mainstream higher education exposes new opportunities to enhance active learning strategies. This case study assesses the extent to which flashcards are being used by students in a histology lecture class, and explores the role that AI plays. Data were collected through two voluntary online surveys that included questions asking for multiple-choice responses and short written responses. The subjective and quantitative comparisons together with students' self-reflection statements prompted classroom discussions about intentional flashcard design and use, and the broader applicability of course-specific study strategies.

Introduction

Histology is the study of microscopic anatomy, that is, the parts that are too small for the naked eye to see clearly. A university level course on histology typically includes a large number of images, each potentially with a large number of features of interest that each are associated with related terminology and definitions. Introductory anatomy incorporates details of gross (macroscopic) anatomy alongside histology and is also an inherently visual subject. Many of the students that first take the introductory anatomy lecture course (Biology 218) later take the histology lecture course (Biology 328) and vice versa, depending on their degree program requirements. The majority of students in the histology lecture class are biology or chemistry majors in their sophomore, junior, or senior year. This work was informed by feedback from undergraduate students regarding their study practices, gathered through office-hour discussions and end of semester course evaluations of histology lecture and introductory human anatomy lecture and lab classes. Students frequently reported using flashcards as a primary strategy to prepare for exams, and for many this was an approach that they would recommend. In contrast, some students expressed disappointment in how they felt their exam performance didn't reflect the time and effort they had put into studying. These student perspectives underscored the need to better understand how flashcards are constructed and utilized as a learning tool and to consider how students might be guided toward more effective study practices. This survey-based study was conducted as part of normal course activities for course improvement purposes, and all student response data were fully de-identified. Because this study did not meet the federal definition of research, Institutional Review Board (IRB) review was not sought.

Three main questions of interest were addressed in this study: 1) How prevalent is flashcard use among students enrolled in the histology lecture course? 2) How do students obtain and use flashcards when studying histology? 3) How do students who use flashcards perceive their effectiveness as a study tool?

Literature Review

Beyond Memorization

There is sometimes a tendency for students to dismiss anatomy-related subjects as memorization-heavy disciplines due to the large volume of novel terminology relating to specific anatomical structures (Miller et al. 2002). Students, especially those new to anatomy, often make the mistake of putting emphasis on learning lists of facts and reducing concepts to items of trivia. Despite attempts by an instructor to draw attention to functional relationships, clinical relevance, and spatial patterns, students may feel resigned to attempt learning through rote memorization and cramming (McIntyre et al. 2008). There is often an attempt to reduce complex conceptual relationships described in lecture notes to a series of binary facts in an effort to make the information feel more digestible. Making decks of flashcards is a popular approach that students perceive as an effective way to memorize information. It is safe to say that not all flashcards are equal and that their level of utility depends on how they are constructed and incorporated into a plan of study. Far from being limited to rote memorization and short-

term memory recall, when used strategically flashcards can become the foundation of more effective active learning techniques. Flashcards may be combined with spaced repetition strategies and gamification to become much more interesting and tailored towards longer term retention. Drawing together related information on the same flashcard and incorporation of clinical applications can bridge the gap between active learning and applied learning to solidify concepts (Kolb, 2015).

Learning has been demonstrated to improve through recalling information from memory (Roediger & Karpicke, 2006) and this so-called Testing Effect is at the core of the success of flashcard use, encouraging active recall rather than passive rote memorization.

This is especially true when used in combination with spaced repetition, which is a technique in which information is reviewed at increasing intervals over time rather than in one intensive study session (Rawson & Dunlosky, 2011).

Digital Solutions

In recent years digital flashcards have increasingly become a widely used study strategy associated with improved learning outcomes (Hartwig & Dunlosky, 2012). This is particularly evident among medical students (Haughey *et al.,* 2025) and those with an interest in gamification-oriented study approaches (Mishall *et al.,* 2023). Digital resources such as Anki and Quizlet use algorithms to repeat questions over time based on the level of mastery. Metacognition is the term for the process of being aware and conscious of your own thinking, in this context regarding which concepts are already mastered and which remain to be mastered. Questions in a slide deck that were guessed incorrectly previously are preferentially repeated more frequently in contrast to questions based on concepts that are simpler, more intuitive, or already mastered, which are repeated less frequently; this is known as the spacing effect (Cepeda et al. 2006).

As alluded to previously, one of the biggest issues associated with the concept of the spacing effect is that many students procrastinate, not because they do not want to study but rather because they struggle to keep up with the demands of their academic schedule and fail to balance the competing demands of multiple classes. Cramming information over a short duration, typically before a test or exam typically results in higher stress levels for the student and failure to achieve long term retention of information. This truncated time frame can in part be helped if a study guide is provided, although a study guide is never intended to replace lecture attendance.

The concept of the forgetting curve (Murre & Dros, 2015) is relevant and relates to how long it has been since a student saw a piece of information. Terms that are frequently mentioned in a lecture series have more opportunities to be memorized, not only because they appear more often but because they may be associated with more related terms and concepts.

The act of manually writing physical cards and having to consciously assess the relative importance of information is something that many students find incredibly helpful, especially those with a preference for kinesthetic engagement (Fleming, 2012). However potential disadvantages of using physical flashcards relate to the additional planning burden and need for discipline that is required of students (Kang, 2016).

The range of available software options on top of an already extensive amount of information can feel overwhelming for many students and for an increasing number of students it is tempting to leverage some of the new artificial intelligence resources, particularly the Large Language Model (LLM) artificial intelligence programs such as ChatGPT or Claude to automate the production of flashcard decks directly from uploaded lecture notes.

Common Flashcard Formats

The main flashcard types are basic, cloze deletion, and image occlusion (Elmes, n.d.). Basic flashcards are the most traditional type and have a front side and a back side, often with a term or question on one side and the associated definition or answer on the other. Variations on this format might incorporate a picture on the front side or be reversed. Cloze deletion flashcards are based on the structure of a sentence or paragraph in which one or more of the words is occluded. Image occlusion flashcards are variations on cloze deletion flashcards that focus on images, especially those that have labeled features. One modification of this type can include ‘hide all, obscuring all text labels leaving no labels uncovered, and have you identify one label at a time. Another modification is the hide one, guess one type in which only the label that is to be identified is obscured.

Methodology

Students in a histology lecture class (Biology 328) were invited to complete surveys on the topic of flashcards as study tools. Participation was voluntary and incentivized by two extra credit points per survey. Some students completed both surveys and others completed only one. Alternate options for earning extra credit were available throughout the semester. Surveys were created in Microsoft Forms and were completed online through password-protected accounts associated with official university email addresses. A repeated cross-sectional survey design (Brady & Johnston, 2015) was used, with surveys administered at two time points to students enrolled in the histology lecture course. The surveys each contained twelve related but non-identical questions addressing the three main areas of interest described in the Introduction, and were not designed as traditional pre- and post-assessments. Questions were presented in multiple-choice or free-response formats and are provided in Appendix A. Variation between the two survey question sets allowed for more specificity in certain aspects of interest. Each survey remained open to submissions for one week. The first survey period occurred after the first end-of-unit examination and the second survey period occurred after the second end-of-unit examination and before the third end-of-unit examination. Because responses were associated with university accounts it was possible to determine which students responded to one or both of the surveys, however,

individual responses were de-identified and not linked between the two surveys except for identifying whether respondents reported using flashcards.

RESULTS

Global Survey Response Statistics

Out of a total enrollment of 111 students in the histology lecture class, a total of 90 students (81.1%) completed at least one survey with 57 respondents (51.4%) completing both surveys. Twenty five students of the students that completed both surveys (43.9%) reported that they used flashcards in preparation for both units, while 17/57 (29.8%) said that they did not use flashcards for either unit. All summary data are shown in Table 1.

Survey respondent comparisons across the two surveys.
Total students enrolled = 111
Students that completed both surveys = 57/111 (51.4%)
Students that completed only survey 1 = 12/111 (10.8%)
Students that completed only survey 2 = 21/111 (18.9%)
Students that didn't complete either survey = 21/111 (18.9%)
Flashcard use among respondents that completed both surveys.
Reported using flashcards in both surveys = 25/57 (43.9%)
Reported using flashcards in survey 1 only = 11/57 (19.3%)
Reported using flashcards in survey 2 only = 4/57 (7.0%)
Reported that they did not use flashcards = 17/57 (29.8%)

Table 1. Summary Statistics of the Surveys.

Survey Results

The full results of the questions from the first and second surveys are presented in Appendix A and Appendix B respectively.

Responses to question 1 of survey 1 indicate that just over 62% (43/69) of participating students used flashcards as part of their preparation for the end-of-unit 1 examination. Almost 74% (51/69) of the students that had used flashcards during unit 1 said that they had also used flashcards in a previous semester (survey 1, question 2).

Just over half of the students using flashcards in preparing for the unit 1 examination 1 created their own flashcard decks (24/43, 55.8%) while the rest either used a flashcard set that someone else in class had created or that they had found by searching online,

for instance (survey 1, question 3). Of the students that used flashcards in unit 1, 93% said that their cards incorporated at least some pictures (40/43) and within that group 6/43 (14%) said that all of their flashcards were based on pictures (survey 1, question 4).

A majority of students reported that they did not use AI for flashcard production (49/69, 71%). The remainder either chose to fully let an AI tool such as ChatGPT generate flashcards for them from uploaded course notes, or elected to customize how the AI tool produced the cards (survey 1, question 5). This generation customization was achieved by entering specific prompts that had been sourced online. After cards had been acquired it was very common for students to import them into a program, such as Anki or Quizlet, that could help manage and interact with the flashcards (survey 1, question 6). The results of question 7 of survey 1 indicate a preference for having several smaller flashcard decks (27/43, 62.8%) instead of fewer, larger decks. Most frequently students reported finding it convenient to organize around blocks of course material, such as individual lecture sessions or even major topics within a lecture (survey 1, question 8). There was no clear consensus for the number of flashcards in a deck with some decks being as small as 20 slides and others being as large as 100 slides. The students that used a single large deck containing all of their flashcards reported a wide range of sizes from as small as 100 and others far exceeding 1000 flashcards. Question 9 indicated that the frequency at which students reported interacting with their slide decks was very inconsistent with some students claiming they reviewed at least one slide deck on a daily basis, some said they were only able to review their decks on a weekly basis, and others revisited their flashcards just once before the unit exam. Although some students reported that they reviewed their decks many times in a consistent fashion, surprisingly few students that used the online apps specifically made any reference to spaced repetition. This also applied to students that used physical flashcards as part of their study plan.

Performance Expectations

Students were invited to predict what grade they thought they had earned on examination 1, before grades were posted, and these predictions were compared to the actual grades earned (survey 1, question 10. Table 2).

Comparison of estimated grades with actual grades for end-of-unit 1 examination

Students that used flashcards

Estimated unit 1 grades:			Actual unit 1 grades:		
A or A-	=	13/43 (30.2%)	A or A-	=	10/43 (23.3%)
B+, B, or B-	=	18/43 (41.9%)	B+, B, or B-	=	13/43 (30.2%)
C+, C, C-	=	8/43 (18.6%)	C+, C, C-	=	10/43 (23.3%)
D+, D, D-, F	=	4/43 (9.3%)	D+, D, D-	=	10/43 (23.3%)

Students that did not use flashcards

Estimated unit 1 grades:			Actual unit 1 grades:		
A or A-	=	6/26 (23.1%)	A or A-	=	7/26 (26.9%)
B+, B, or B-	=	7/26 (26.9%)	B+, B, or B-	=	6/26 (23.1%)
C+, C, C-	=	9/26 (34.6%)	C+, C, C-	=	3/26 (11.5%)
D+, D, D-, F	=	4/26 (15.4%)	D+, D, D-	=	10/26 (38.5%)

Quality of grade prediction for end-of-unit 1 examination

Used flashcards:	Scored better than predicted	1/43 (2.3%)
	Scored as well as predicted	28/43 (65.1%)
	Scored worse than predicted	14/43 (32.6%)
Didn't use flashcards:	Scored better than predicted	2/26 (7.7%)
	Scored as well as predicted	13/26 (50.0%)
	Scored worse than predicted	11/26 (42.3%)

Table 2. Comparisons of Estimated and Actual Examination Scores for Unit 1.

Respondents that used flashcards predicted higher grades compared to respondents that had not used flashcards, although both groups scored worse than they had predicted. Furthermore, there was an almost equal divide in satisfaction levels among students that had used flashcards in terms how adequately they viewed their prepared with flashcards (survey 1, question 11). Despite this, a clear majority (62/69, 89.9%) reported (survey 1, question 12) that they were at least considering using flashcards as part of their study efforts for unit 2. A much lower actual usage statistic was reported in survey 2, question 1, with only 35/78. 44.9% responding that they had used flashcards

in their study plan for unit 2. Many students in fact said that their flashcard use decreased in unit 2 compared to unit 1 (survey 2, question 2; 20/78, 25.6%). The majority 32/35, 91.4%) of those that did continue to use flashcards in unit 2 reported at least a moderate level of satisfaction with the effectiveness (survey 2, question 3). Most flashcard users (18/35, 51.4%) said that they chose to make flashcards manually, although others still reported using AI to make flashcards and a minority chose to either download a pre-made deck from the internet or borrow one from a friend (8/35, 22.9%; survey 2, question 4). When asked again about the role AI played in the production of their flashcards, a higher number (22/35, 62.9%) reported that AI may have played at least a minor role in producing their cards, potentially indicating some uncertainty about the process (survey 2, question 6). Some students expressed some concern about how effective the AI is at producing effective study materials (survey 2, question 7), with 89.7% (70/78) having moderate to low confidence levels in the technology to adequately cover all of the material in appropriate detail. Confidence in flashcards as a whole remained high with 57/78 (73.1%) stating that they intended to use flashcards as part of their study plan for unit 3 (survey 2, question 8).

Types of Flashcards

Among the common flashcard formats the basic back/front type flashcards were shown to be the most common in use receiving 36 of the 106 responses (34%) for question 9 of survey 2. The image occlusion format flashcards with a single occluded item were the second most popular option (25/106, 23.6%). Anecdotally, the single occluded item format appears to be most common among students using manually-produced or physical flashcards (on paper or produced using software like Microsoft PowerPoint) while the multiple item occlusion format is most popular amongst students using apps that are specifically aimed at flashcard use (such as Anki).

The reversed version of the basic back/front format received the fewest responses (12/106, 11.3%), with the text-based cloze deletion format received only marginally more with 14/106 (13.2%), Additionally, 20/78 students (25.6%) reported that they used more images in their flashcards for unit 2 than they had for unit 1 (survey 2, question 10).

Discussion

Flashcards were just one of the study strategies employed by students in the histology lecture class. During office hour conversations students described some of the other study strategies they used during the course. Some of the most common involved watching recordings of in-class lecture sessions, review and editing of lecture notes, drawing diagrams on a whiteboard, and using the provided study guide as a checklist to guide study. Some students said that they found watching YouTube videos to be a useful way to augment class notes whereas others preferred to revisit the weekly quizzes and complete practice tests (not for any additional credit). It would be difficult to fully separate the effects of any one study strategy from the rest and it is possible that taking an active approach in instructor-assigned or self-directed study activities may really be a central contributing factor to building success in the course.

Without additional longitudinal data collected over a longer period about flashcard creation and usage patterns it is difficult to tell if some students that used flashcards did so because they are an established study strategy of theirs or if they are simply taking advantage of the recent increased ease of access to artificial intelligence resources, and thereby the ease of acquiring flashcards, or if something else is happening. Similarly, we may be seeing a reduction in the number of students that are actively producing flashcards themselves, or we could be seeing an increase in the number of students becoming willing to try using flashcards because of the relative ease in obtaining and organizing flashcard decks. Due to the limited scope and breadth of this study it is not possible to fully distinguish among these potential explanations or determine how they may interact.

Among the 57 students enrolled in the histology lecture class that participated in both surveys, 40/57 (70.2%) reported using flashcards in one of the units or in both units. Compared to physical flashcards, digital flashcards have the benefit of being easily incorporated into algorithms that can guide study patterns of inexperienced students and assist even experienced users in more effectively assessing their continuing progress. Digital flashcards may be created manually by a user or acquired through use of an AI-assisted tool. A majority of flashcard users in unit 1 (49/69, 71%) claimed that an AI tool played no role in the creation of their flashcards. Furthermore, data from the second survey suggest that confidence levels relating to the accuracy and completeness of AI-created flashcards are in general moderate to low, but this may be referring specifically to the initial output of flashcards from an AI tool and could be more of a potential issue for users that rely on AI-generated flashcards with little or no critical review. One of the strengths of AI-assisted flashcard generation is that a large number of potential flashcards can be created in a short span of time, however based on a cursory inspection of some AI-created flashcards, image-based flashcards and in particular those involving unlabeled images, appear difficult for AI to interpret. Students should be encouraged to take the time to actively inspect created flashcards for quality control, and to manually delete poor quality cards from the deck before studying begins. Likewise, slides on related content may be added to ensure that there are no gaps in content coverage. Another approach could be to label images prior to uploading to the AI tool to give the AI a better chance of success.

Occasionally students express embarrassment and frustration that they do not have a good sense of how to study effectively, particularly when faced with content heavy subjects. Several students have even suggested that it may be desirable if an official set of course flashcard decks were provided by the instructor for the class to use. However, a more productive and beneficial approach might be to instead use this as the basis for an official class activity, peer-to-peer sharing opportunity, or even an extra credit opportunity for students wanting to improve or add to their suite of study strategies. One such activity might involve demonstrating how to use an AI tool with a subset of lecture material, and asking students, individually or in groups, to critique and/or improve upon the resultant flashcards. This might be especially beneficial for students that are prone to procrastination and those that have a history of last-minute cramming, as it may be

an important first step towards developing better study habits related to critical thinking, self-reliance, and time management.

Conclusion

The three areas of focus for this study were as follows:

1) How prevalent is flashcard use among students enrolled in the histology lecture course?
2) How do students obtain and use flashcards when studying histology?
3) How do students who use flashcards perceive their effectiveness as a study tool?

Responses to the two surveys suggest that the use of flashcards is a common study strategy among students in the histology lecture class. Within the class cohort there was considerable variation in students' perceptions concerning both the use of artificial intelligence and computer-based tools to acquire flashcards and their perceived effectiveness compared to more traditional manually produced flashcards. Using AI to generate flashcards has the advantage of reducing the time needed to build a study deck, but student feedback highlighted the importance of critically evaluating and revising the flashcards before regular use. This need for review may discourage some students from using AI-generated flashcards, but encouraging students to see AI-assisted tools as potentially useful resources and promoting more intentional design of study materials is something that may benefit students in both the short and long term. Future studies could build on this work by examining flashcard use habits over a longer period and adopting a more traditional pre- and post-assessment survey model to facilitate direct comparisons of changes in student perceptions and study practices over time.

References

Brady, H. E. and Johnston, R. (2015). Repeated cross-sections in survey data. In Emerging Trends in the Social and Behavioral Sciences (eds R. A. Scott and S. M. Kosslyn). https://doi.org/10.1002/9781118900772.etrds0284

Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin, 132*(3), 354–380. https://doi.org/10.1037/0033-2909.132.3.354

Chen, H. and Yang, J. (2020). Multiple exposures enhance both item memory and contextual memory over time. *Frontiers in Psychology 11*, 1-14. https://doi.org/10.3389/fpsyg.2020.565169

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4–58. https://doi.org/10.1177/1529100612453266

Elmes, D. (n.d.). *Anki manual*. Anki. Retrieved June 25, 2026 from, https://docs.ankiweb.net/

Fleming, N. D. (2012). *VARK: A guide to learning styles*. Author.

Hartwig, M. K., & Dunlosky, J. (2012). Study strategies of college students: Are self-testing and scheduling related to achievement? *Psychonomic Bulletin & Review, 19*(1), 126–134. https://doi.org/10.3758/s13423-011-0181-y

Haughey, C., Kajitani, S., Buckley, M., Mohamed, M., Rae, M., & Brint, E. (2025). An assessment of Anki flashcards use in comparison to alternative study methodologies among medical students. *Medical Science Educator 35(6):2973–2983.*
https://doi.org/10.1007/s40670-025-02504-7

Kang, S. H. K. (2016). Spaced repetition promotes efficient and effective learning: Policy implications for instruction. *Policy Insights from the Behavioral and Brain Sciences, 3*(1), 12–19. https://doi.org/10.1177/2372732215624708

Kolb, D. A. (2015). Experiential learning: Experience as the source of learning and development (2nd ed.). Pearson Education.

McIntyre, S. H. & Munson, J. M. (2008). Exploring Cramming: Student Behaviors, Beliefs, and Learning Retention in the Principles of Marketing Course. Journal of Marketing Education, 30(3), 226-243. https://doi.org/10.1177/0273475308321819

Miller, S. A., Perrotti, W., Silverthorn, D. U., Dalley, A. F., & Rarey, K. E. (2002). From college to clinic: reasoning over memorization is key for understanding anatomy. *Anatomical. Record. 269(2), 69-80.* https://doi.org/10.1002/ar.10071.

Mishall, P. L., Burton, W., & Risley, M. (2023). Flashcards: The preferred online game-based study tool self-selected by students to review medical histology image content*. Advances in Experimental Medicine and Biology, 1406, 209–224.* https://doi.org/10.1007/978-3-031-26462-7_10

Murre, J. M. J., & Dros, J. (2015). Replication and analysis of Ebbinghaus' forgetting curve. *PLOS ONE, 10*(7), e0120644. https://doi.org/10.1371/journal.pone.0120644

Rawson, K. A., & Dunlosky, J. (2011). Optimizing schedules of retrieval practice for durable and efficient learning: How much is enough? *Journal of Experimental Psychology: General*, *140*, 283–302. https://doi.org/10.1037/a0023956

Roediger, H. L., III, & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications for educational practice. *Perspectives on Psychological Science, 1*(3), 181–210. https://doi.org/10.1111/j.1745-6916.2006.00012.x

Appendix A

Survey One Questions and Data.
Each question related to one of the three focus areas of this study as follows:
1) How prevalent is flashcard use among students enrolled in the histology lecture course?
= Questions 1 and 2
2) How do students obtain and use flashcards when studying histology?
= Questions 3, 4, 5, 6, 7, and 8
3) How do students who use flashcards perceive their effectiveness as a study tool?
= Questions 9, 10, 11, 12

Question 1) Did you use flashcards during unit 1 in preparation for the end-of-unit examination?
Yes, I used flashcards = 43/69 (62.3%)
No, I did not use flashcards = 26/69 (37.7%)

Question 2) Have you used flashcards in a previous semester?
Yes = 51/69 (73.9%)
No = 18/69 (26.1%)

Question 3. If you used flashcards in unit 1, how did you get the flashcards?
I made my own flashcards = 24/43 (55.8%)
I used flashcards from multiple sources = 11/43 (25.6%)
I used a set of flashcards made by another person = 8/43 (18.6%)
I bought a set of flashcards = 0/43

Question 4. Did your flashcards include pictures or just text?
Some had pictures = 34/43 (79.0%)
They all had pictures = 6/43 (14.0%)
None had pictures = 3/43 (7.0%)

Question 5. To what extent did an artificial intelligence tool play a role in the production of flashcards?
AI tools played no role = 49/69 (71%)
I was able to customize how an AI tool made the flashcards = 14/69 (20.3%)
AI fully took care of it for me = 6/69 (8.7%)

Question 6. If you used an app or website to help manage flashcards, which did you use?
Multiple including other = 18/43 (41.9%)
Anki = 15/43 (34.9%)
Quizlet = 10/43 (23.3%)

Question 7. Describe your approach to flashcard organization (do you have one slide deck for each lecture or one large slide deck for everything?)
Several smaller decks of slides = 27/43 (62.8%)

One larger deck = 14/43 (32.6%)
No response = 2/43 (4.7%)

Question 8. If you used several smaller flashcard decks how did you subdivide them?
Free responses discussed in body text

Question 9. How many times did you review each flashcard deck in preparation for the unit 1 examination?
Free responses discussed in body text

Question 10. What letter grade do you estimate that you earned on the unit 1 exam?

A or A-	19/69 (27.5%)
B+, B, or B-	25/69 (36.2%)
C+, C, C-	17/69 (24.6%)
D+, D, D-, F	8/69 (11.6%)

These data are explained in more detail in the body text alongside actual scores

Question 11. Do you feel satisfied that use of your flashcards prepared you adequately for the unit 1 exam?

Yes	20/69 (29.0%)
Somewhat	27/69 (39.1%)
No	22/69 (31.9%)

Question 12. Do you plan on using flashcards in preparing for the unit 2 exam?

Yes	49/69 (71.1%)
Maybe	13/69 (18.8%)
No	7/69 (10.1%)

Appendix B

Survey Two Questions and Data.

Each question related to one of the three focus areas of this study as follows:
1) How prevalent is flashcard use among students enrolled in the histology lecture course?
= Questions 1
2) How do students obtain and use flashcards when studying histology?
= Questions 2, 3, 4, 5, 6, 7, and 8
3) How do students who use flashcards perceive their effectiveness as a study tool?
= Questions 9, 10, 11, 12

1. Did you use flashcards during unit 2 in preparation for the end of unit exam?
Yes, I used flashcards = 35/78 (44.9%)
No, I did not use flashcards = 43/78 (55.1%)

2. How has then your level of flashcard use changed in unit 2 compared to during unit 1?
Flashcard usage increased in unit 2 = 14/78 (17.9%)
Usage was similar in both units = 13/78 (16.7%)
Flashcard usage decreased in unit 2 = 20/78 (25.6%)
Not applicable = 31/78 (39.7%)

3. If you used flashcards, how effective do you feel that they have been in your preparation for the end-of-unit 2 examination?
Very effective = 5/35 (14.3%)
Moderately effective = 27/35 (77.1%)
Not effective = 3/35 (8.6%)

4. If you used flashcards in unit 2, how did you primarily obtain the flashcards?
I made flashcards manually without using AI = 18/35 (51.4%)
I made flashcards with the use of AI = 9/35 (25.7%)
A friend shared their flashcards with me = 6/35 (17.1%)
I downloaded a pre-made flashcard deck from the internet = 2/35 (5.7%)
I bought a set of flashcards = 0/35 (0.0%)

5. To what level would you estimate the role played by AI in creation of your flashcards?
No role = 13/35 (37.1%)
Minimal role = 9/35 (25.7%)
Moderate role = 9/35 (25.7%)
Significant role = 4/35 (11.4%)

6. If you have used AI to create flashcards, do you think it did a good job in covering the material adequately?
Yes, it covered all of the required information adequately = 2/31 (6.5%)

It did okay but missed some details = 21/31 (67.7%)
No, it covered the range of information poorly = 8/31 (25.8%)

7. How would you rate your confidence level of AI as an aid in the preparation of effective study materials?
High = 8/78 (10.3%)
Moderate = 48/78 (61.5%)
Low = 22/78 (28.2%)

8. Do you plan on using flashcards to prepare for the unit 3 exam?
Yes = 57/78 (73.1%)
No = 21/78 (26.9%)

9. Which type of flashcards have you used? (select all that apply)
Basic back and front flashcards = 36/106 (34.0%)
Basic flashcard reversed = 12/106 (11.3%)
Cloze flashcard with one or more missing words = 14/106 (13.2%)
Image occlusion with one identified structure = 25/106 (23.6%)
Image occlusion with more than one identified structure = 19/106 (17.9%)

10. How many image flashcards did you use for unit 2 compared to unit 1?
More images in unit than for unit 1 = 20/78 (25.6%)
About the same in both units = 13/78 (16.7%)
Fewer images in unit than for unit 1 = 5/78 (6.4%)
Not applicable = 40/78 (51.3%)

11. How did you organize your flashcards? For example, did you make several single-lecture decks or one deck for the entire unit?
Free responses discussed in body text

12. Approximately how many flashcards did you create for unit 2? Indicate whether this number refers to a slide deck or multiple
Free responses discussed in body text

From Theory to Practice: Measuring Learning Transfer in a Full-Scale Sheltering Exercise

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Abstract

This pilot study evaluated applied learning transfer during a full-scale sheltering exercise involving students, community volunteers, and emergency preparedness partners. Data included 26 pre-exercise survey responses, 24 post-exercise survey responses, and 7 post-exercise reflection responses. The exercise was designed to help participants apply emergency management concepts, including the Incident Command System, shelter operations, interagency coordination, role clarity, and personal preparedness. An unmatched pre-test/post-test design was used with supplemental post-exercise perception items and qualitative reflection responses. Because individual pre-test and post-test responses could not be linked, Welch's independent-samples t-tests compared group-level differences. The quantitative pre/post comparison did not show statistically significant improvement on the five-item core composite. However, post-exercise impact ratings were high, indicating perceived gains in ICS application, coordination and communication, and preparedness action. Qualitative reflections supported these findings by emphasizing experiential learning, shelter complexity, confidence, and personal preparedness. Findings suggest that full-scale sheltering exercises can provide meaningful applied learning experiences, even when measurable pre/post score changes are limited.

Keywords: applied learning, emergency management education, experiential learning, full-scale exercises, Incident Command System, learning transfer, shelter operations

Introduction

Emergency services education must prepare students to move beyond conceptual knowledge and apply emergency management principles in realistic, high-consequence environments. Emergency management involves the organization and application of measures used to prepare for, respond to, and recover from disasters and other emergencies (United Nations Office for Disaster Risk Reduction [UNDRR], 2017b). For purposes of this study, a disaster is understood as a serious disruption in the functioning of a community or society resulting from the interaction of hazardous events with conditions of exposure, vulnerability, and capacity and producing human, material, economic, or environmental losses or impacts (UNDRR, 2017a). Such events may include natural hazards, technological incidents, public health emergencies, or other occurrences that disrupt normal community functioning and require coordinated response capabilities.

Disasters and complex emergencies frequently require coordinated action among public safety agencies, emergency managers, health professionals, voluntary organizations, governmental entities, and community partners. The National Incident Management System (NIMS) provides a common framework for coordinating these organizations, while the Incident Command System (ICS) provides a standardized organizational structure for managing incidents across agencies and jurisdictions (Federal Emergency Management Agency [FEMA], 2017). ICS incorporates principles such as common terminology, modular organization, management by objectives, manageable span of control, integrated communications, chain and unity of command, and accountability. Consequently, emergency services learners must understand not only the terminology associated with incident management but also how concepts such as ICS, shelter operations, interagency communication, role clarity, resource coordination, and preparedness function in practice.

Applied and experiential learning can help students develop this ability to transfer academic knowledge into operational settings. Experiential learning activities allow learners to engage directly with realistic problems, reflect on their experiences, connect those experiences with disciplinary concepts, and consider how the knowledge may be applied in future situations (Kolb, 1984). Within emergency management education, partnerships and exercise-based activities have been used to connect classroom theory with community-based emergency management practice. Research has shown that experiential exercises can contribute to preparedness competencies and that simulation-based emergency management curricula can provide authentic learning experiences that strengthen workforce readiness (Sanchez Cristal et al., 2019). Emergency management higher education research has likewise emphasized the value of experiential partnerships that allow students to integrate academic concepts with community emergency management practice.

Full-scale exercises represent a particularly intensive form of experiential learning because they reproduce operational activities, roles, communication requirements, and interorganizational interactions more closely than classroom discussions or lower-fidelity exercises. FEMA’s Homeland Security Exercise and Evaluation Program (HSEEP)

identifies exercises as a means of testing and validating plans and capabilities, familiarizing participants with roles and responsibilities, identifying areas for improvement, and strengthening communication across organizations (FEMA, 2020). Research comparing emergency preparedness exercises has also found that participants perceive full-scale exercises as valuable for learning, usefulness, and collaboration, although exercise outcomes vary according to design, participants, and organizational context (Roud et al., 2021). Recent research involving full-scale disaster exercises similarly supports the educational value of active participation and observation as mechanisms for experiential learning (Turan, 2026).

Full-scale exercises are nevertheless resource intensive. They may require substantial planning, facilities, equipment, volunteer recruitment, safety coordination, evaluation procedures, and participation from multiple organizations. These requirements create a need for educational programs to examine whether the resources devoted to exercises produce meaningful outcomes in areas such as knowledge application, confidence, preparedness, coordination, and professional readiness. This is especially important because perceived value and measurable learning gains are not necessarily equivalent. Exercise-based education therefore benefits from systematic assessment using multiple forms of evidence, including quantitative measures of knowledge and confidence and qualitative evidence describing how participants interpret and apply their experiences.

The present pilot study was conducted within the context of undergraduate emergency services education at Utah Valley University (UVU). Participation in the full-scale sheltering exercise was an extracurricular applied-learning opportunity offered to students enrolled in the Emergency Services Bachelor of Science program rather than an assignment required within a specific academic course. Students from other academic majors also volunteered to participate. Additional participants included members of American Red Cross student clubs at UVU and neighboring Brigham Young University (BYU), American Red Cross personnel, and community volunteers. As a result, the exercise population was intentionally heterogeneous and represented participants with varying levels of prior emergency management experience. Some participants entered the exercise with a relatively strong understanding of ICS, emergency preparedness, or shelter operations, whereas others had little prior familiarity with these concepts.

This variation in participant backgrounds reflects the multidisciplinary and whole-community environment in which emergency management occurs but also creates challenges for measuring learning transfer. Participants with considerable prior training may begin an exercise with high baseline knowledge or confidence, leaving relatively little room for measurable improvement, while participants with limited prior exposure may experience more substantial learning. The pilot-study design therefore provides an initial examination of whether a full-scale sheltering exercise can generate measurable or perceived learning across a diverse group of students, volunteers, and community participants while also identifying methodological considerations for larger replication studies.

Accordingly, this pilot study evaluates learning transfer associated with participation in a full-scale sheltering exercise. Using unmatched pre-exercise and post-exercise survey data, supplemental post-exercise perception items, and qualitative reflection responses, the study examines whether participation was associated with differences in emergency management knowledge and confidence, perceived educational value, application of ICS concepts, interagency coordination and communication, and personal preparedness. The findings are intended to provide preliminary evidence regarding the educational value of full-scale sheltering exercises and to inform the design of future studies using larger samples, matched pre/post measures, and more homogeneous participant groups.

Literature Review

Emergency services education faces a fundamental instructional challenge: professionals must be prepared to perform effectively in events that are complex, uncertain, multidisciplinary, and often difficult to reproduce during routine education. Disasters may require personnel from emergency management, fire and emergency medical services, public health, healthcare, voluntary organizations, government agencies, and community organizations to make decisions and coordinate activities under time pressure and with incomplete information. Research across disaster-related disciplines suggests that preparedness cannot be assumed simply because learners have completed traditional coursework. For example, Labrague and Hammad's (2024) systematic review found continuing deficiencies in disaster knowledge and skills among nurses in disaster-prone countries, illustrating the broader problem of translating professional preparation into readiness for disaster response. Similarly, Loke et al. (2021) found that disaster education programs have expanded substantially but remain uneven in content and frequently emphasize preparedness and response rather than the full spectrum of disaster-management competencies.

This distinction matters because emergency-services education must develop more than declarative knowledge. Learners may be able to define concepts such as Incident Command System (ICS), unity of command, span of control, resource management, shelter operations, or interagency coordination without necessarily being able to use those concepts when conditions become ambiguous or rapidly changing. Disaster operations require participants to integrate knowledge with communication, situational awareness, teamwork, resource allocation, and decision-making. A systematic review of disaster simulation exercises found that exercises are used to strengthen preparedness and response precisely because they provide opportunities to test plans, procedures, systems, and participant actions under simulated emergency conditions (Mahdi et al., 2023). Research on mass-casualty simulations similarly identified recurring learning related to communication, command, coordination, equipment, resources, and organizational response, while also noting that exercise literature has sometimes focused more heavily on conducting simulations than on systematically capturing what participants learn from them (Ledbury et al., 2023).

Traditional instructional approaches remain important for establishing foundational concepts, terminology, policy, and procedural knowledge, but the literature suggests

that knowledge acquisition alone is insufficient preparation for complex professional performance. Professional education increasingly incorporates active, competency-based, interdisciplinary, and simulation-based approaches intended to move learners from knowing about a problem to acting within it. In disaster education specifically, Loke et al. (2021) identified a broad movement toward competency-based education, interprofessional approaches, simulation, tabletop exercises, and virtual reality. More recent evidence reinforces this direction. Alharbi et al. (2024), in a systematic review of simulation-based learning in nursing education, found that simulation generally improved students' knowledge and skills, while also identifying a continuing need for stronger evidence concerning long-term retention. These findings suggest that applied instruction is most valuable not as a replacement for classroom learning but as a mechanism for requiring learners to integrate and operationalize what they have learned.

This need is particularly important in emergency services because response is inherently interdisciplinary. Professional education reform has long emphasized that competence requires more than content transmission. The Institute of Medicine (2003) called for health-professions education that develops collaborative, evidence-based, and professionally relevant competencies, while Cooke et al. (2010) emphasized movement toward integration and professional formation in medical education. Within emergency management, Farris and McCreight (2014) similarly argued that professionalization depends on stronger higher-education structures and closer alignment between academic preparation and professional practice. Considered together, these perspectives suggest that emergency-services curricula should connect disciplinary knowledge with opportunities to practice coordination, communication, decision-making, and role performance in conditions that approximate the environments graduates may encounter professionally.

The challenge is therefore not simply one of expanding curriculum content. Adding more information to already crowded curricula does not ensure that students will be able to recognize when or how that information should be applied. Concept-based education offers one strategy for addressing this problem by organizing information around transferable principles rather than isolated facts (Erickson, 2007; Giddens et al., 2015). In emergency services education, this means that ICS principles, preparedness concepts, and shelter procedures should function as frameworks for decision-making rather than terminology to be recalled only on an examination. The importance of this distinction becomes especially apparent when learners encounter unfamiliar circumstances in which procedures cannot simply be reproduced mechanically.

Applied and simulation-based learning provide a mechanism for testing whether this conceptual knowledge can be used under more realistic conditions. Dayberry and Fisher (2023) found that applied emergency-preparedness learning in an international context supported engagement, career readiness, and connections between academic concepts and community preparedness. Broader reviews provide similar evidence. Mahdi et al. (2023) concluded that tabletop, functional, and full-scale simulation exercises can strengthen disaster planning and response, although the authors also

emphasized the need for more rigorous evaluation and greater standardization of exercise programs. Alharbi et al. (2024) likewise found evidence that simulation-based learning improves knowledge and skill development, while Ledbury et al. (2023) demonstrated that disaster simulations can generate learning about operational problems that closely resemble weaknesses identified during actual incidents.

Taken together, the literature suggests that the central educational issue is not whether students can acquire emergency-management knowledge, but whether that knowledge can be transferred into coordinated action. This distinction is consequential for emergency services programs because graduates may eventually be expected to perform in environments where ineffective communication, unclear responsibilities, poor coordination, or failure to recognize operational priorities can affect organizational response and community safety. Full-scale exercises provide one of the most realistic educational settings available for examining this transition from conceptual understanding to applied performance. They require learners to interact with other participants, function within organizational structures, respond to evolving circumstances, and confront logistical and coordination challenges that are difficult to reproduce through lecture or written assessment alone. At the same time, current reviews indicate that exercise effectiveness and learning outcomes require more rigorous and systematic evaluation (Mahdi et al., 2023). This creates an important rationale for examining not simply whether participants value a full-scale exercise, but whether the experience produces evidence of learning transfer, increased preparedness, and greater ability to connect emergency-management concepts with operational practice.

Theoretical Framework

This pilot study is guided by an integrated framework incorporating experiential learning, applied learning, and learning transfer. Although experiential learning and applied learning are closely related, they are not identical concepts. Experiential learning explains how individuals construct knowledge through experience and reflection, whereas applied learning emphasizes the deliberate use of academic knowledge, theories, and skills in authentic, practical, or simulated settings. Learning transfer provides the connecting mechanism by examining whether knowledge and skills developed through education and experience can be generalized to new situations and maintained in practice (Baldwin & Ford, 1988; Jach & Trolian, 2019; Kolb, 1984).

Experiential Learning

Kolb’s Experiential Learning Theory provides the primary theoretical foundation for understanding how participation in a full-scale sheltering exercise may produce learning. Kolb (1984) described learning as a process through which knowledge is created by transforming experience. Learning therefore involves more than participation alone. Experience becomes educationally meaningful when learners reflect on what occurred, connect the experience to existing concepts, and use the resulting understanding to inform subsequent action.

Kolb's model consists of four interconnected processes: concrete experience, reflective observation, abstract conceptualization, and active experimentation. These processes do not necessarily occur as discrete or strictly sequential stages but together describe how learners can transform experience into knowledge.

Within the present study, the concrete experience was participation in the full-scale sheltering exercise. Participants encountered realistic shelter functions, organizational roles, communications, interagency interactions, and operational demands. Unlike classroom instruction in which students might read about shelter operations or Incident Command System (ICS) principles, the exercise required participants to encounter these concepts within an operational environment.

Reflective observation occurred as participants considered what they observed, what was difficult, how different organizations interacted, and how their understanding changed as a result of the exercise. The study's post-exercise reflection questions were particularly relevant to this component because they encouraged participants to interpret the meaning of their experience rather than simply report whether they enjoyed the activity.

Abstract conceptualization occurred when participants connected what they experienced to broader emergency management concepts, including ICS, shelter operations, communication, coordination, role clarity, preparedness, and resource management. At this stage, participants could reconsider previously learned concepts in light of what they had observed during the exercise.

Finally, active experimentation involves using newly developed understanding to guide future behavior. Within this study, active experimentation was reflected when participants identified actions they might take to improve personal preparedness, perform differently during a future emergency, communicate more effectively, or better understand their role within an emergency response organization.

Experiential learning is particularly relevant to emergency services education because disasters are typically low-frequency but potentially high-consequence events. Students may complete substantial academic preparation without experiencing an actual emergency shelter, disaster response operation, or large multiagency incident. Structured exercises provide opportunities to encounter some of the uncertainty and complexity of these events while still operating within a controlled educational environment.

Applied Learning

Applied learning provides a complementary perspective. Whereas experiential learning explains how learning occurs through experience, applied learning emphasizes where and for what purpose academic knowledge is used. Jach and Trolian (2019) describe applied learning as an educational approach in which students connect academic knowledge with practical situations, while applied-learning models commonly

emphasize direct application of theories, skills, and disciplinary concepts to authentic or real-world problems.

Applied learning therefore focuses on moving from knowing to doing. A student may understand the definition of span of control, unity of command, resource management, or shelter registration in a classroom but demonstrate applied learning only when that knowledge is used to interpret a situation, make a decision, solve a problem, perform a task, or coordinate with others. Applied learning may occur in internships, field experiences, simulations, service-learning activities, research, clinical experiences, or other curricular and co-curricular settings that require students to use disciplinary knowledge in practice (Jach & Trolian, 2019).

The distinction is important for the present study. The sheltering exercise was an applied-learning environment because participants were placed in a realistic setting in which emergency management concepts could be used or observed in practice. At the same time, participation in that environment created an experiential-learning process as participants experienced the event, reflected on it, reconsidered existing knowledge, and identified possible future applications.

Thus, applied learning and experiential learning perform different but complementary roles in the framework. Applied learning provides the practical context in which academic concepts are put into action, while experiential learning explains the cognitive and reflective processes through which those experiences can become new or revised knowledge.

Learning Transfer

Learning transfer connects experiential and applied learning to the central purpose of this study. Baldwin and Ford (1988) describe transfer as the generalization of knowledge and skills acquired during training to subsequent settings and the maintenance of that learning over time. Transfer is therefore more demanding than knowledge acquisition. A learner may remember information presented in a course without being able to recognize when, where, or how to apply it during an unfamiliar operational problem.

In emergency services education, transfer occurs when learners use concepts acquired through academic instruction in practical emergency-management contexts. For example, knowing the definition of unity of command represents conceptual knowledge; recognizing conflicting reporting relationships during an exercise and understanding why they create operational problems reflects transfer. Similarly, memorizing shelter functions represents classroom knowledge, while recognizing how client registration, feeding, accessibility, communications, staffing, and resource coordination interact during shelter operations reflects applied transfer.

Baldwin and Ford (1988) proposed that transfer is influenced by characteristics of the learner, the design of the learning experience, and the environment in which knowledge is subsequently applied. This perspective is particularly relevant to the present pilot

study because participants entered the exercise with differing levels of emergency management knowledge and prior experience. The full-scale exercise provided a common applied environment in which participants could encounter emergency management principles under more realistic conditions than conventional classroom instruction.

Within the integrated framework, applied learning creates the opportunity for transfer, while experiential learning provides processes that can strengthen transfer. Practical participation requires learners to retrieve and apply prior knowledge. Reflection encourages them to examine the relationship between that knowledge and what occurred in practice. Conceptualization helps learners reorganize or refine their understanding, and active experimentation prepares them to use that understanding in future situations. Transfer therefore represents the movement of learning across contexts—from classroom knowledge to simulated operational practice and, potentially, from the exercise environment to future professional or preparedness situations.

Application to the Pilot Study

The theoretical framework can be represented as a progression:

Academic knowledge → Applied learning opportunity → Concrete experience → Reflection and conceptual integration → Transfer to practical understanding and future action

The full-scale sheltering exercise served as the applied-learning environment and provided the concrete experience. Participants entered the exercise with varying levels of prior knowledge regarding ICS, shelter operations, coordination, communication, and preparedness. Participation allowed them to encounter these concepts within a realistic operational setting. Post-exercise perception and reflection measures then examined whether participants believed that the experience helped them apply concepts, better understand coordination and communication, increase preparedness, or identify future actions.

This framework also helps explain why measurable pre/post score change is only one indicator of learning. Experiential and applied learning may produce changes in contextual understanding, awareness of complexity, confidence, operational judgment, or recognition of one's own knowledge limitations that are not fully captured by a short knowledge or confidence scale. The quantitative pre/post measures in this pilot study examine group-level differences in knowledge and confidence, while the post-exercise perception items and qualitative reflections provide complementary evidence regarding applied learning and perceived transfer.

Accordingly, the study does not assume that participation in an exercise automatically produces learning transfer. Rather, the theoretical framework proposes that a realistic applied-learning environment, combined with experience and reflection, creates conditions through which classroom knowledge may be reorganized and translated into practical understanding. The pilot study evaluates preliminary evidence of that process

and provides a foundation for future research using matched participants, larger samples, objective performance measures, and longitudinal assessment of transfer.

FEMA Training, ICS, and Exercise-Based Preparedness

Emergency services education in the United States is influenced by national doctrine, training standards, and exercise guidance developed by the Federal Emergency Management Agency (FEMA). FEMA is the federal agency responsible for supporting national preparedness, response, recovery, mitigation, and emergency management capabilities. Its National Disaster & Emergency Management University (NDEMU), which incorporates the Emergency Management Institute (EMI), provides emergency management training and professional development for practitioners and partner organizations (FEMA, n.d.-a).

A central component of this training is the National Incident Management System (NIMS). NIMS is a nationwide framework that provides common terminology, organizational structures, processes, and principles so that government agencies, nongovernmental organizations, and private-sector partners can work together during incidents (FEMA, n.d.-d). NIMS is broader than the Incident Command System (ICS). ICS is one component of the NIMS command-and-coordination framework and provides a standardized, scalable organizational structure for managing personnel, resources, communications, and responsibilities at an incident scene. Because ICS can be adapted to incidents of different sizes and types, it provides a common organizational approach that enables personnel from different agencies and disciplines to work within the same incident-management structure.

FEMA's NIMS training curriculum (FEMA, n.d.-d) includes a progressive sequence of foundational courses. These include ICS-100: Introduction to the Incident Command System; ICS-200: Basic Incident Command System for Initial Response; ICS-300: Intermediate Incident Command System for Expanding Incidents; ICS-400: Advanced Incident Command System for Complex Incidents; IS-700: An Introduction to the National Incident Management System; and IS-800: National Response Framework, An Introduction. ICS-100 introduces the basic features, principles, and organizational structure of ICS, while ICS-200 prepares personnel to function effectively during initial response and in supervisory roles. ICS-300 extends these concepts to expanding incidents requiring more complex incident management, and ICS-400 addresses advanced ICS application for complex incidents and senior command and general staff functions. IS-700 introduces the broader NIMS framework, whereas IS-800 introduces the National Response Framework and the principles used to organize a coordinated national response. FEMA's NIMS training program therefore progresses from basic incident-command concepts to increasingly complex applications of coordination and incident management.

Exercise-based preparedness is guided by FEMA's Homeland Security Exercise and Evaluation Program (HSEEP). HSEEP is not a specific exercise or course; rather, it is a standardized methodology for planning, designing, conducting, evaluating, and improving emergency preparedness exercises. FEMA describes HSEEP as providing a

common approach to exercise program management, design and development, conduct, evaluation, and improvement planning (FEMA, 2020). Exercises conducted within this framework allow organizations to practice plans and procedures, assess capabilities, clarify responsibilities, identify weaknesses, and develop corrective actions before an actual emergency occurs.

HSEEP is especially relevant to full-scale exercises because these exercises involve the operational deployment of personnel and resources in conditions designed to approximate actual emergency response. Rather than functioning only as demonstrations or training events, exercises can also serve as structured evaluation opportunities. In an educational setting, a full-scale sheltering exercise can therefore allow students to observe and apply ICS principles, practice communication and coordination, understand shelter functions and organizational roles, and reflect on areas requiring additional preparedness.

For the present pilot study, FEMA's NIMS, ICS, and HSEEP frameworks provide the professional context connecting emergency management education with applied practice. NIMS establishes the broader national system for coordinating incidents, ICS provides the organizational structure used to manage operations, and HSEEP provides the methodology for designing and evaluating exercises. Together, these frameworks help explain why a full-scale sheltering exercise can function as both an emergency preparedness activity and an applied educational experience.

From Tabletop Exercises to Full-Scale Exercises

The growing professionalization of emergency management has increased expectations that practitioners possess a defined body of knowledge, standardized competencies, formal education, practical experience, and continuing professional development (Farris & McCreight, 2014; Federal Emergency Management Agency [FEMA], n.d.-a). FEMA’s National Disaster & Emergency Management University describes professional development as a career-long process through which emergency managers develop the knowledge, skills, and abilities needed to work effectively in increasingly complex environments (Federal Emergency Management Agency [FEMA], n.d.-a). Similarly, the U.S. Fire Administration’s Fire and Emergency Services Higher Education initiative integrates academic education, training, relevant experience, and continuing education as complementary components of professional development (U.S. Fire Administration, 2026). In this context, professionalization refers to the continuing development of emergency management from an activity based primarily on experience and technical training toward a recognized profession supported by formal education, standardized competencies, specialized knowledge, research, and structured career development.

Exercise-based learning is one component of this professional development process. Emergency preparedness exercises exist along a continuum of complexity and operational realism. FEMA’s Homeland Security Exercise and Evaluation Program (HSEEP) distinguishes generally between discussion-based exercises, which emphasize facilitated examination of plans and procedures, and operations-based exercises, which require participants to perform or simulate operational activities

(FEMA, 2020). The appropriate exercise type depends on the objectives being tested, participants' prior training, available resources, and the level of operational performance that planners intend to evaluate.

A tabletop exercise is a discussion-based exercise in which participants are presented with a simulated emergency scenario and discuss how they would respond. Rather than physically deploying personnel or equipment, participants work through the scenario by examining plans, organizational responsibilities, decision points, communications, resource requirements, and potential problems. FEMA describes tabletop exercises as relatively low-stress activities that encourage discussion, problem solving, and decision-making while allowing participants to assess plans and response procedures (FEMA, n.d.-e). Tabletop exercises are therefore particularly useful for orienting participants to emergency plans, clarifying responsibilities, identifying policy or procedural gaps, and exploring potential actions before organizations progress to more complex operational exercises. Because they generally require fewer personnel, facilities, and physical resources than operations-based exercises, tabletop exercises can also be conducted more readily and repeatedly as part of preparedness programs.

Simulation-based learning can occur at multiple levels within this continuum. It can include role-based scenarios, clinical simulations, virtual environments, computer-assisted simulations, high-fidelity mannequins, tabletop exercises, drills, and larger operational exercises. Sanchez Cristal et al. (2019) argued that simulation-based exercises can be integrated into public health emergency management curricula to strengthen preparedness competencies by allowing learners to practice decision-making and other skills in controlled environments. Such activities permit instructors to control scenario complexity, introduce changing conditions or scenario injects, observe participant decisions, and assess specific learning objectives. However, more controlled simulations may not fully reproduce the simultaneous communication demands, movement of personnel and resources, interorganizational coordination, logistical problems, uncertainty, and time pressures that characterize actual disaster operations.

A full-scale exercise (FSE) is an operations-based exercise designed to approximate real incident conditions as closely as practical. FEMA describes full-scale exercises as multiagency, multijurisdictional, and multidisciplinary activities that involve operational response, mobilization of personnel and resources, and physical performance of tasks in a realistic environment (FEMA, n.d.-b). Rather than merely discussing what participants would do, participants perform assigned functions as though an actual incident were occurring. Exercise events and scenario updates drive activity, personnel and equipment may be deployed, and multiple functions may operate simultaneously. The increased realism allows participants and evaluators to examine coordination, communications, resource use, organizational roles, decision-making, and operational performance under conditions that more closely resemble an actual emergency. FEMA also notes that full-scale exercises generally require greater logistical support, safety oversight, facilities, personnel, and resources than less complex exercises (FEMA, n.d.-b).

Under HSEEP, full-scale exercises are not isolated training events but part of an exercise cycle that includes program management, design and development, conduct, evaluation, and improvement planning (FEMA, 2020). Exercise objectives are established in advance, participant and organizational performance is observed during the exercise, strengths and areas for improvement are documented, and corrective actions can be incorporated into subsequent planning and training. FEMA's HSEEP guidance emphasizes that exercise evaluation should assess performance in relation to established objectives and capabilities and use the results to support improvement planning (FEMA, 2020). This process parallels educational assessment because instructors can similarly establish learning objectives, create realistic conditions, observe participant behavior, collect quantitative and qualitative data, and use findings to refine future instruction.

A sheltering exercise applies these exercise principles specifically to mass care and congregate shelter operations. Emergency sheltering involves considerably more than providing a temporary physical location for displaced people. FEMA defines congregate care as the provision of essential mass-care and emergency-assistance services to people in a collective setting following a disaster or emergency. These activities can include sheltering, feeding, distribution of essential supplies, reunification assistance, emotional support, information and referral, and other survivor services (FEMA, 2009). FEMA's Operating a Shelter training further identifies shelter management as involving multiple roles, resources, operational functions, and potential challenges required to safely open, operate, and close a congregate shelter (FEMA, n.d.-c).

A full-scale sheltering exercise, therefore, is an operations-based exercise in which participants practice or simulate the functions required to establish and operate an emergency shelter under realistic conditions. Depending on the exercise objectives, participants may establish the shelter facility, register simulated clients, organize client flow, provide feeding or dormitory functions, coordinate staffing and resources, communicate with partner organizations, address access and functional needs, and respond to changing operational conditions. FEMA guidance emphasizes that general-population shelters must be planned and operated to accommodate children and adults with access and functional needs and that these considerations must be integrated into shelter operations rather than treated as separate functions (FEMA, 2010). Shelter operations also commonly involve coordination among government agencies, nongovernmental organizations, voluntary organizations, healthcare providers, and community partners (FEMA, 2023). The American Red Cross is a principal national partner in disaster mass care and commonly works with state and local governments to establish and operate emergency shelters; however, sheltering is a shared responsibility rather than an exclusive Red Cross mandate (Federal Emergency Management Agency [FEMA], 2016).

For students, a full-scale sheltering exercise provides an opportunity to encounter aspects of emergency response that are difficult to reproduce through lecture or discussion alone. Learners may observe how registration, feeding, sleeping arrangements, accessibility, volunteer management, communications, resource

coordination, and client services interact within a single operational environment. They may also see how Incident Command System principles, organizational roles, and interagency relationships affect decisions in practice. Because shelter operations require coordination across emergency management, public health, social services, logistics, voluntary organizations, and incident command, the exercise requires learners to integrate knowledge across disciplinary and organizational boundaries.

The distinction among tabletop, simulation-based, and full-scale sheltering exercises is therefore important to the present study. A tabletop exercise primarily asks participants to discuss how they would respond, while a full-scale exercise requires participants to perform operational activities under simulated incident conditions. A full-scale sheltering exercise further focuses those operational activities on the specialized functions required to provide mass care to disaster-affected populations. This higher degree of operational realism makes full-scale sheltering exercises particularly useful for examining whether theoretical understanding can be translated into applied decision-making, coordination, preparedness, and professional practice.

Learning Transfer, Confidence, and Professional Readiness

Learning transfer refers to the extent to which knowledge and skills acquired in one context are generalized and maintained in another setting, particularly in the environment where they are expected to be used (Baldwin & Ford, 1988). Research on training transfer has consistently shown that successful transfer depends on multiple factors, including learner characteristics, instructional design, opportunities to practice, and the environment in which the acquired knowledge or skills are later applied (Burke & Hutchins, 2007). In emergency services education, transfer is especially important because students must move from classroom instruction to field application. They must not only define concepts such as span of control, unity of command, resource management, and shelter operations; they must also recognize how these concepts shape decisions during incidents.

Realistic exercises and simulations can provide opportunities for learners to practice applying knowledge in environments that more closely approximate professional practice. Simulation-based education has been associated with the development of knowledge, skills, decision-making, and other competencies, although the extent to which simulation experiences transfer to actual practice remains an important area for continued research (Ropponen et al., 2025; Yuan et al., 2012). This distinction is particularly relevant to emergency services education, where professional readiness depends not simply on knowing emergency management concepts but on applying them appropriately within complex, uncertain, and collaborative operational environments.

Confidence is an important but complex dimension of learning transfer. Realistic simulation experiences may contribute to learners' confidence by allowing them to practice roles and decision-making in controlled settings. However, confidence and competence are related but distinct outcomes. A systematic review of high-fidelity simulation found mixed evidence regarding improvements in both confidence and

competence and emphasized the need for objective measures when evaluating performance outcomes (Yuan et al., 2012). Research on learner self-assessment also indicates that perceptions of one's own performance do not always correspond closely with objectively measured competence (Blanch-Hartigan, 2011). Confidence therefore should not be treated as a substitute for demonstrated competence. In emergency services education, both perceived readiness and observable performance are relevant when evaluating whether students are prepared to apply what they have learned.

Reflection and debriefing are important mechanisms for helping learners transform an exercise experience into more meaningful learning. Debriefing allows participants to examine their actions, decisions, communication, and assumptions after a simulated experience and connect those observations to broader disciplinary principles. Systematic reviews of simulation-based education support the role of debriefing as an important component of learning and have found evidence that structured debriefing can contribute to improvements in knowledge, teamwork, situational awareness, technical skills, and other learning outcomes (Duff et al., 2024; Levett-Jones & Lapkin, 2012). Debriefing is therefore more than a discussion of whether an exercise went well; it provides a structured opportunity to examine why events occurred and how knowledge and behavior might be modified in future situations.

The post-exercise reflection process is also consistent with Kolb’s experiential learning cycle, in which concrete experience is followed by reflective observation, conceptualization, and subsequent application (Kolb, 1984). FEMA’s Homeland Security Exercise and Evaluation Program similarly incorporates evaluation and improvement planning following exercises to identify strengths, areas for improvement, and corrective actions (Federal Emergency Management Agency [FEMA], 2020). In emergency services education, reflection is particularly important because incidents involve ambiguity, stress, competing priorities, incomplete information, and interdependent decision-making. Structured reflection can help learners move beyond remembering the activity to interpreting their experience, connecting it to emergency management concepts, and considering how their decisions and actions might change in future operational settings.

Gaps in Full-Scale Exercise Research and Implementation

Although the theoretical rationale for experiential and simulation-based learning is well established, important gaps remain in the evidence base concerning emergency preparedness exercises and, more specifically, full-scale exercises. Simulation-based emergency management education can provide learners with authentic opportunities to practice critical thinking, dynamic problem solving, decision-making, and other competencies relevant to real-world emergency response (Sanchez Cristal et al., 2019). However, systematic reviews of disaster preparedness exercises have identified continuing limitations in the rigor, consistency, and standardization of exercise evaluation. A systematic review of disaster simulation exercises concluded that more rigorous evaluation and greater standardization of simulation exercise programs are still needed, while a recent rapid review similarly identified a need for more rigorous research on evidence-informed practices in emergency preparedness exercise design

and evaluation (Chambers et al., 2025; Mahdi et al., 2023). These limitations create several distinct gaps that are relevant to emergency services education.

The first is a measurement and evaluation gap. Emergency preparedness exercises are commonly used to test plans, clarify responsibilities, identify capability gaps, and strengthen preparedness. FEMA's Homeland Security Exercise and Evaluation Program (HSEEP) specifically identifies evaluation as a central component of the exercise cycle and emphasizes systematic observation, data collection, analysis, reporting, and improvement planning (Federal Emergency Management Agency [FEMA], 2020). Nevertheless, research examining disaster exercise evaluation has found considerable variation in evaluation approaches and methodological quality. A systematic review of health disaster preparedness exercises found relatively few studies meeting criteria for formal exercise evaluation and identified methodological weaknesses in much of the available research (Sheikhbardsiri et al., 2018). More recently, Chambers et al. (2025) found that the evidence base for public health emergency preparedness exercises remained limited, with much of the available literature focusing on tabletop exercises, and called for additional rigorous research on exercise design and evaluation. The gap is important because systematic evaluation allows educators and emergency management organizations to determine whether an exercise achieved its intended objectives and to identify strengths, deficiencies, and opportunities for improvement rather than relying primarily on participant satisfaction or completion of the exercise (FEMA, 2020).

The second is a learning-transfer gap. Demonstrating that participants viewed an exercise positively is different from demonstrating that knowledge and skills can be applied in realistic operational contexts. Simulation-based emergency management education is intended to give learners opportunities to practice judgment, problem solving, and decision-making in settings that approximate professional practice (Sanchez Cristal et al., 2019). Research on simulated mass-casualty exercises indicates that exercises can improve participant familiarity and confidence, but a systematic review found that published studies often concentrated more heavily on conducting the exercise than on systematically documenting and applying the learning generated from it (Ledbury et al., 2023). Recent research examining participation in a full-scale disaster exercise likewise emphasizes the importance of examining what participants actually learn from active involvement rather than assuming that participation itself produces educational gains (Turan, 2026). In emergency services education, this distinction is particularly important because learners ultimately need to apply concepts such as the Incident Command System (ICS), communication, role clarity, resource coordination, shelter operations, and preparedness in complex operational environments. Multiple forms of assessment—including pre/post measures, performance observations, post-exercise perceptions, debriefing, and qualitative reflection—can therefore provide complementary evidence about whether conceptual knowledge is being translated into applied understanding and practice (FEMA, 2020; Sanchez Cristal et al., 2019).

A third gap concerns implementation and instructional capacity. Full-scale and other operations-based exercises require considerably more than presentation of academic content. FEMA's HSEEP framework describes an extensive exercise cycle involving program management, design and development, exercise conduct, evaluation, and improvement planning, often requiring collaboration among multiple organizations, personnel, evaluators, and other resources (FEMA, 2020). Educational institutions must therefore have sufficient faculty expertise, organizational support, external partnerships, logistical resources, and evaluation capacity to implement complex disaster exercises effectively. Evidence from disaster education also indicates that faculty preparation can be a barrier. Freshwater's (2018) mixed-methods study of 76 nurse educators found a continuing need for faculty education in emergency preparedness and disaster response, and participating nurse directors identified simulation as a preferred teaching approach. Earlier national research similarly found that 75% of surveyed U.S. nursing programs reported that faculty were inadequately prepared to teach disaster-management content (Weiner et al., 2005). These findings are relevant because experiential disaster education requires instructors not only to understand emergency management content but also to design realistic learning experiences, facilitate participation, conduct meaningful debriefing, and connect exercise observations to intended educational outcomes.

These gaps are important to emergency services education because exercises are intended to do more than expose participants to realistic scenarios. They are expected to strengthen preparedness, clarify roles and responsibilities, identify capability limitations, and provide opportunities to develop competencies before an actual emergency occurs (FEMA, 2020). Yet recent reviews continue to call for more rigorous evaluation methods, stronger evidence-informed exercise practices, and additional research on how exercises produce learning and preparedness outcomes (Chambers et al., 2025; Mahdi et al., 2023). The need is particularly relevant for full-scale exercises because much of the existing educational and preparedness literature includes tabletop, functional, simulation, and other exercise formats rather than focusing exclusively on full-scale educational exercises.

The present pilot study addresses a portion of this research need by examining educational outcomes associated with participation in a full-scale sheltering exercise. Specifically, it combines unmatched group-level pre/post measures, post-exercise perception items, and qualitative reflections to examine both measurable outcomes and perceived learning transfer. Although the pilot design does not resolve the broader evidence gaps, it contributes preliminary evidence regarding the use of full-scale sheltering exercises as applied learning experiences and identifies methodological considerations that can inform larger, matched, and replicated studies.

Summary

The literature review establishes that emergency services education must prepare learners to apply knowledge in complex, uncertain, and interagency environments. Research supports experiential and applied learning as complementary approaches for helping students connect academic concepts with practical performance, while learning-

transfer theory explains how knowledge and skills may generalize to new settings. FEMA's NIMS, ICS, and HSEEP frameworks provide the professional and operational context for exercise-based preparedness, and full-scale exercises offer a high-fidelity environment for practicing coordination, communication, shelter operations, and decision-making. However, the literature also identifies continuing gaps in the measurement of educational outcomes, evidence of learning transfer, and the capacity to implement and evaluate complex exercises. These gaps support the need for the present pilot study examining learning transfer in a full-scale sheltering exercise.

Problem Statement

Emergency services education aims to prepare students and community partners to operate in complex, uncertain, and time-sensitive environments. Disasters require coordination across agencies, disciplines, and jurisdictions, yet classroom instruction alone may not provide sufficient opportunity to apply emergency management concepts in realistic settings. This creates a gap between theoretical knowledge and applied performance, especially in areas such as the Incident Command System (ICS), sheltering operations, interagency communication, role clarity, and personal preparedness.

Applied disaster education is supported by both theory and practice. Achora and Kamanyire (2016) emphasized the need to include disaster preparedness in professional education, while Kolb's (1984) Experiential Learning Theory suggests that learners develop competence through experience, reflection, conceptual understanding, and future application. FEMA's ICS, NIMS, and HSEEP frameworks also support structured exercise-based learning and evaluation (FEMA, 2017, 2020).

The problem addressed in this study is that full-scale sheltering exercises are often assumed to promote applied learning, but learning transfer is not always systematically measured. This study examines group-level pre/post survey results, post-exercise perception items, and qualitative reflections to evaluate learning transfer from a full-scale sheltering exercise.

Research Questions

The purpose of this study is to evaluate learning transfer associated with participation in a full-scale sheltering exercise. Specifically, the research questions are:

RQ1: What baseline levels of knowledge and confidence did participants report before the full-scale sheltering exercise?

RQ2: Were post-exercise group-level knowledge and confidence scores higher than pre-exercise baseline scores?

RQ3: Did participants perceive the exercise as educationally valuable for applying ICS concepts, improving coordination and communication, and strengthening preparedness?

RQ4: What themes emerged from qualitative reflection responses regarding applied learning transfer?

Methodology

Research Design

This pilot study used an unmatched pre-test/post-test design with supplemental post-exercise perception and reflection data. It was considered a pilot study because it involved a relatively small and heterogeneous sample, relied on unmatched pre-test and post-test response groups, and was designed to provide preliminary evidence about the feasibility and educational value of measuring learning transfer during a full-scale sheltering exercise. The pilot design also allowed the researchers to identify methodological issues, including participant tracking, survey sensitivity, subgroup classification, and response rates, that can inform larger replication studies. Quasi-experimental designs are appropriate when researchers examine an intervention in a real-world setting but cannot randomly assign participants or fully control participation conditions (Shadish et al., 2002). In this study, the intervention was participation in a full-scale sheltering exercise conducted on April 16 at the UCCU Center.

The design was originally intended to compare baseline and post-exercise responses. However, individual pre-test and post-test responses could not be reliably linked. Consequently, the study compared independent pre-exercise and post-exercise response groups rather than measuring change within the same participants. Findings therefore represent group-level differences and should not be interpreted as individual learning gains.

The study also included post-exercise perception items and open-ended reflection questions. These additional data sources were included because learning transfer may not be fully captured by quantitative scores alone. Experiential learning theory emphasizes the role of reflection in transforming experience into learning (Kolb, 1984). Qualitative responses were therefore used to examine how participants interpreted the exercise, what they learned, and how they expected to apply that learning in future emergency or preparedness contexts.

Setting and Intervention

The intervention was a full-scale sheltering exercise conducted on April 16, 2026, at the UCCU Center on the Utah Valley University campus. The exercise simulated the establishment and operation of an emergency shelter and provided an applied-learning environment in which participants could experience the organizational, logistical, and interpersonal demands of shelter operations.

The shelter environment incorporated major functions associated with congregate sheltering, including setup, registration and client flow, role assignment, communication, resource coordination, volunteer management, and consideration of individual and

family needs. Before and during the exercise, participants received instructions regarding their assigned responsibilities. American Red Cross personnel and exercise organizers provided operational direction and structured the activities.

Participants were assigned roles that required them to take part in or observe shelter functions, follow procedures, interact with other volunteers, and respond to operational instructions. Unlike a tabletop exercise, the activity required participants to physically move through shelter processes and experience how separate functions must operate together within a shared emergency environment.

Inclement weather on the day of the exercise reduced community attendance below anticipated levels. As a result, student and volunteer participants had fewer opportunities than planned to interact directly with members of the public. The exercise nevertheless continued with shelter setup, preparedness education activities, operational role assignments, and other planned shelter functions. Meals were provided to volunteers and community attendees by the university's Culinary Arts Department, adding a practical feeding component to the shelter environment.

Participants entered the exercise with varying levels of prior emergency management experience. Some had previous knowledge of the Incident Command System, emergency preparedness, or American Red Cross sheltering practices, while others had limited prior exposure. This variation reflected the community-based nature of disaster sheltering, in which trained personnel, volunteers, and partner organizations may need to work together during an actual emergency.

Consistent with FEMA's Homeland Security Exercise and Evaluation Program framework, the exercise was designed to provide practice while also creating opportunities to observe performance, identify strengths and challenges, and support subsequent evaluation and reflection (Federal Emergency Management Agency [FEMA], 2020). For this pilot study, the exercise served as the applied-learning intervention through which participants could connect emergency management concepts with practical shelter operations.

Participant Population

The exercise involved approximately 70 adult volunteers, including students from the Emergency Services Department at Utah Valley University (UVU), members of American Red Cross clubs at UVU and Brigham Young University, community volunteers, American Red Cross personnel, and other adult participants. Members of the general public who attended or observed the exercise were not included in the study. All study participants were age 18 or older.

Because participant-type information was incomplete, age was used as a supplemental proxy for exploratory subgroup analysis. Respondents were divided into two groups: ages 18–29 and ages 30 and older. The age-29 cutoff was selected as a pragmatic threshold intended to capture younger adult participants, including both traditional-age and somewhat older university students, while distinguishing them from an older group

expected to include a greater proportion of community volunteers and experienced adult participants. The cutoff was not based on a validated demographic classification and was not intended to establish participant status. Accordingly, age-based comparisons were treated as exploratory and interpreted cautiously.

Participation in both the exercise research and survey data collection was voluntary. Prior to data collection, the study was reviewed and approved by the Utah Valley University Institutional Review Board. As part of the survey process, prospective participants received an informed consent form describing the study and their participation. Participants signed the consent form before completing the study surveys.

Data Collection

Data were collected through three survey instruments. These documents as well as the informed consent are included in the Appendices.

The first instrument was a pre-exercise survey administered before participation in the full-scale sheltering exercise. The survey measured baseline self-reported knowledge and confidence related to ICS structure, multiagency coordination, shelter functions, role confidence, and personal preparedness.

The second instrument was a post-exercise survey administered immediately after the exercise. It included items corresponding to the pre-exercise survey for group-level comparison and additional post-only perception items measuring whether participants believed the exercise improved their ability to apply ICS concepts, communicate and coordinate during shelter operations, and strengthen personal preparedness.

The third instrument was a post-exercise reflection survey administered through a QR code. Open-ended questions asked participants what they learned, how the exercise affected their confidence, what they observed about shelter operations, and how they might apply the experience in future emergency or preparedness contexts. These responses provided qualitative evidence of perceived learning transfer and captured aspects of the experience not represented by the Likert-type items.

Measures

Quantitative survey items used a five-point Likert-type response format, with higher scores indicating stronger agreement, greater confidence, or greater perceived understanding. Five items common to the pre-test and post-test measured ICS structure, multiagency coordination, shelter functions, role confidence, and personal preparedness. These items were combined to create a core composite score representing average self-reported scores across the shared measures.

Post-exercise impact items were analyzed separately because they were administered only after the exercise. These items assessed perceived ability to apply ICS concepts, coordinate and communicate in a sheltering environment, and identify actions to improve personal preparedness.

Qualitative reflection responses were analyzed thematically. Thematic analysis is appropriate for identifying recurring patterns of meaning in open-ended responses (Braun & Clarke, 2006). Themes were developed deductively from the study purpose and initial codebook categories and refined inductively based on participant responses. Coding categories included experiential learning, ICS application, shelter complexity, interagency coordination, confidence and readiness, personal preparedness, time management, operational judgment, and community resilience.

Data Analysis

Quantitative analysis began with data cleaning. Survey files were reviewed for missing values, unusable responses, inconsistent demographic entries, and nonnumeric age data. Likert-type responses were coded numerically, and descriptive statistics were calculated for each item and composite score, including sample size, mean, standard deviation, and response distribution.

Because individual pre-test and post-test responses could not be matched, Welch's independent-samples t-tests were used to compare group means. Welch's t-test is appropriate when groups are independent and equal variances cannot be assumed (Welch, 1947). The primary quantitative analysis compared pre-exercise and post-exercise scores on the five common items and the core composite.

Exploratory analyses also compared the age-based groups defined previously. These comparisons were interpreted cautiously because participant status could not be verified from age alone and subgroup sizes were uneven.

Post-exercise impact items were analyzed descriptively using means and percentages of respondents who agreed or strongly agreed with each statement. These post-only measures were not included in pre/post statistical comparisons.

For the qualitative analysis, each reflection response was reviewed and assigned one or more thematic codes. Responses could receive multiple codes when they addressed more than one learning outcome. Theme frequencies were then calculated to identify the most common patterns. Qualitative findings were compared with the quantitative results to determine whether participants' reflections supported, expanded, or clarified the survey findings.

Findings

Overview of the Data

Three sources of data were analyzed: 26 pre-exercise survey responses, 24 post-exercise survey responses, and 7 post-exercise reflection responses. The findings are organized according to the four research questions. RQ1 addresses baseline knowledge and confidence, RQ2 examines group-level pre/post differences, RQ3 evaluates perceived educational value and learning transfer, and RQ4 examines themes emerging from qualitative reflections. Exploratory age-based comparisons are presented separately because they were not part of the primary research questions.

Demographic Findings

Respondents represented a mix of students, community volunteers, American Red Cross personnel, and other adult participants.

Using the exploratory age-based classification described in the Methodology, the pre-test included 8 respondents ages 18–29 and 17 respondents ages 30 and older, with 1 missing age response. The post-test included 3 respondents ages 18–29 and 20 respondents ages 30 and older, with 1 missing age response. All 7 reflection respondents were ages 30 and older.

RQ1: Baseline Knowledge and Confidence

The first research question asked: What baseline levels of knowledge and confidence did participants report before the full-scale sheltering exercise?

Pre-exercise scores indicated generally high baseline levels of self-reported knowledge and confidence. Mean scores ranged from 3.72 for multiagency coordination to 4.40 for shelter functions on the five-point scale. Participants reported a mean of 4.04 for understanding of ICS structure, 3.72 for multiagency coordination, 4.40 for shelter functions, 4.38 for confidence in performing an assigned role, and 4.00 for personal preparedness. The five-item core composite mean was 4.10.

These findings indicate that participants entered the exercise with relatively strong self-reported knowledge and confidence overall, although understanding of multiagency coordination was somewhat lower than the other baseline measures. The high baseline scores also suggest limited room for measurable improvement on several items.

RQ2: Pre/Post Group-Level Differences

The second research question asked: Were post-exercise group-level knowledge and confidence scores higher than pre-exercise baseline scores?

The five-item core composite showed almost no difference between the pre-test and post-test groups. The pre-test composite mean was 4.10, compared with a post-test mean of 4.13, for a mean difference of 0.03. This difference was not statistically significant, $p = .937$.

Item-level results were mixed. Multiagency coordination increased from a pre-test mean of 3.72 to a post-test mean of 4.09, a difference of 0.37. Personal preparedness increased from 4.00 to 4.32, a difference of 0.32. Neither increase was statistically significant. ICS structure, shelter functions, and role confidence decreased slightly from pre-test to post-test, and none of these differences reached statistical significance.

Outcome	Pretest Mean	Posttest Mean	Difference	Welch's p	Interpretation
ICS structure	4.04	3.82	-0.22	.605	No significant increase
Multiagency coordination	3.72	4.09	+0.37	.359	Positive but not significant
Shelter functions	4.40	4.14	-0.26	.390	No significant increase
Role confidence	4.38	4.27	-0.11	.696	No significant increase
Personal preparedness	4.00	4.32	+0.32	.320	Positive but not significant
Core composite	4.10	4.13	+0.03	.937	No significant difference

Table 1: Comparison of Pretest and Posttest Results

Overall, the unmatched pre/post comparison did not provide statistical evidence of significant group-level improvement. However, positive descriptive changes in multiagency coordination and personal preparedness were consistent with important objectives of the sheltering exercise.

RQ3: Perceived Educational Value and Learning Transfer

The third research question asked: Did participants perceive the exercise as educationally valuable for applying ICS concepts, improving coordination and communication, and strengthening preparedness?

Post-exercise impact ratings were high. The item assessing whether the exercise improved participants' ability to apply ICS concepts had a mean of 4.60; 86.7% agreed or strongly agreed, and 73.3% strongly agreed. The item assessing improved coordination and communication had a mean of 4.47; 80.0% agreed or strongly agreed, and 73.3% strongly agreed. The strongest rating concerned personal preparedness. The item assessing whether the exercise led participants to identify actions to improve preparedness had a mean of 4.80; 100.0% agreed or strongly agreed, and 80.0% strongly agreed.

Post-exercise impact item (N-24)	Mean	Agree/Strongly Agree	Strongly Agree
Exercise improved ability to apply ICS concepts	4.60	86.7%	73.3%
Exercise improved coordination/communication ability	4.47	80.0%	73.3%
Exercise led to intent to improve preparedness	4.80	100.0%	80.0%
Post-impact composite	4.62	86.7% at 4.0 or higher	—

Table 2: Post-exercise Impact Results

These findings indicate strong perceived educational value and perceived learning transfer. Participants generally believed that the exercise strengthened their ability to

apply emergency management concepts, understand coordination and communication, and identify preparedness actions.

RQ4: Qualitative Evidence of Applied Learning Transfer

The fourth research question asked: What themes emerged from qualitative reflection responses regarding applied learning transfer?

Seven post-exercise reflection responses were analyzed. The most common theme was experiential learning-by-doing, which appeared in all 7 responses. Participants described learning through direct participation, observation, interaction with experienced personnel, and involvement in shelter activities. One participant explained that learning occurred by “walk[ing] through the entire shelter experience” and speaking with more experienced volunteers and American Red Cross staff. Another participant stated that they learned how to operate a Red Cross shelter “by helping set it up.” These responses illustrate how participation allowed individuals to encounter shelter operations in a practical rather than exclusively conceptual setting.

Personal preparedness and action planning appeared in 5 responses. Participants identified specific actions they intended to take after the exercise, including continuing Red Cross training, updating emergency supplies, and improving household preparedness. One participant stated, “I will continue to prepare and take Red Cross training,” while another planned to “update [my] go-bag.” A third participant described a more detailed intention to “audit my own personal emergency ‘go-bag’ and household plan” based on logistical considerations encountered during the exercise.

Confidence and readiness appeared in 4 responses. Participants described the experience as helping them feel better prepared for future emergencies or response activities. One participant explained, “I will be better prepared if ever I’m called to help,” while another indicated that collaboration during the exercise would leave the participant “better prepared for [an] actual event.” These comments suggest that participation contributed to perceived readiness, although perceived confidence should not be interpreted as an objective measure of operational competence.

Shelter complexity and logistics appeared in 3 responses. Participants recognized that shelter operations involved substantially more coordination and logistical planning than they had previously understood. One participant observed that “sheltering is complex and requires many agencies and volunteers,” explaining that assigned tasks demonstrated “how many teams were needed to make the shelter work.” Another participant reflected that they had previously thought Red Cross shelters were similar to hospitals or MASH units but came to understand “all of the other logistical stuff” required to meet the immediate needs of displaced people.

Interagency coordination and collaboration also appeared in 3 responses. Participants identified the importance of teamwork, organizational relationships, and coordination among those involved in disaster response. One participant summarized the primary lesson simply as “collaboration,” learned through “interacting with [the] team.” Another

described how the “processes and organizations involved with the exercise” demonstrated the transitions required across disaster relief, preparedness, and recovery activities.

Disaster risk awareness appeared in 3 responses. Participants connected the sheltering exercise to broader awareness of hazards and community preparedness. One participant emphasized that “you never know when a disaster or crisis will occur in your community,” while another identified learning about “earthquake safety and...the needs of people who come to a shelter.” These reflections indicate that the exercise prompted participants to consider both disaster risk and the needs of affected populations.

Less frequent themes included ICS or application to a realistic setting, time management and prioritization, and community resilience. For example, one participant identified “time management” as a key lesson and explained that “time is of the essence during real emergencies.” Another described the exercise as reinforcing the importance of “community adaptation” and developing reliable networks that can support preparedness and response.

Theme	Count	Percent
Experiential learning-by-doing	7	100.0%
Personal preparedness/action planning	5	71.4%
Confidence/readiness for future role	4	57.1%
Shelter complexity/logistics	3	42.9%
Interagency coordination/collaboration	3	42.9%
Disaster risk awareness	3	42.9%
ICS/application to realistic setting	1	14.3%
Time management/prioritization	1	14.3%
Community resilience/adaptation	1	14.3%

Table 3: Qualitative Survey Results

Taken together, the qualitative findings provide participant-level evidence supporting the identified themes. Although the small number of reflection responses limits the breadth of interpretation, the quotations demonstrate that participants associated the exercise with learning through direct experience, increased awareness of shelter complexity, collaboration, personal preparedness, and future application.

Exploratory Age-Based Group Comparisons

Exploratory age-based comparisons were conducted to examine whether baseline and post-exercise patterns differed between respondents ages 18–29 and those ages 30 and older. These analyses were supplemental and were not associated with a primary research question.

On the pre-test, respondents ages 18–29 had a core composite mean of 3.40, compared with 4.40 among respondents ages 30 and older. The 1.00-point difference was statistically significant, $p = .031$. Shelter functions also showed a significant

baseline difference, with means of 3.63 for the younger group and 4.75 for the older group, p = .020.

Post-test age-group differences were not statistically significant. Respondents ages 30 and older continued to report higher scores on most items, but only 3 post-test respondents were in the younger group, limiting the usefulness of inferential comparisons.

Within-group unmatched pre/post comparisons also showed no statistically significant change. The ages 18–29 group had a core composite mean of 3.40 on both the pre-test and post-test. The ages 30-and-older group decreased slightly from 4.40 to 4.24, but the difference was not statistically significant.

These exploratory findings suggest that older respondents entered the exercise with higher baseline knowledge or confidence, which may have reduced the potential for detectable improvement. Because age was used only as a proxy for participant type and subgroup sizes were uneven, these findings should be interpreted cautiously.

Discussion

Interpretation of the Overall Findings

This pilot study examined learning transfer associated with participation in a full-scale sheltering exercise using four research questions addressing baseline knowledge and confidence, pre/post group-level differences, perceived educational value, and qualitative evidence of applied learning transfer. Taken together, the findings provide a mixed but informative picture. Participants entered the exercise with relatively high baseline scores, the unmatched pre/post comparison did not demonstrate statistically significant improvement, post-exercise impact ratings were consistently high, and qualitative reflections described learning through direct participation, increased awareness of shelter complexity, collaboration, preparedness actions, and perceived readiness.

This pattern is consistent with the broader exercise and simulation literature, which generally supports the educational value of realistic exercises while also showing that measurable learning outcomes vary substantially across studies and assessment approaches. Mahdi et al. (2023), in a systematic review of disaster-preparedness simulation exercises, concluded that tabletop, functional, and full-scale exercises can contribute to disaster planning and response but also identified a need for more rigorous and standardized evaluation. Similarly, Pek et al. (2023) found that full-scale disaster and mass-casualty simulations generally demonstrated learning and positive participant reactions, but evidence at the higher levels of behavioral transfer and real-world outcomes was limited. These findings are relevant to the present study because they indicate that positive exercise experiences do not necessarily produce easily detectable changes on short pre/post measures.

The results are also consistent with Roud et al. (2021), who found high perceived learning, usefulness, and collaboration outcomes from emergency exercises, with particularly strong perceived learning and usefulness associated with full-scale exercises. Turan (2026) likewise identified cognitive and affective learning outcomes among participants in a full-scale disaster exercise, including gains related to field knowledge, decision-making, understanding of roles, and self-confidence. The present findings therefore correspond with prior research suggesting that full-scale exercises can provide meaningful opportunities to understand roles, coordination, and operational processes that are difficult to reproduce through conventional instruction.

RQ1: Baseline Knowledge and Confidence

RQ1 asked what baseline levels of knowledge and confidence participants reported before the full-scale sheltering exercise. Pre-exercise scores were generally high. The five-item core composite mean was 4.10 on a five-point scale, with particularly high baseline scores for shelter functions and role confidence.

These findings suggest that many participants entered the exercise with existing knowledge, confidence, or previous exposure to emergency preparedness, sheltering, or emergency-management activities. This is important when interpreting subsequent outcomes because learning transfer is influenced by learner characteristics and prior experience. Baldwin and Ford (1988) emphasized that trainee characteristics, training design, and the transfer environment all affect whether learning is generalized to practice.

The relatively high baseline scores may also have contributed to a ceiling effect. Participants who began near the upper end of the response scale had comparatively little room to report additional improvement. This issue was especially relevant because the exercise population was heterogeneous and included students, community volunteers, American Red Cross personnel, and participants with varying levels of prior emergency-management experience. As a result, the exercise may have served different educational purposes for different participants. Less-experienced individuals may have gained foundational knowledge, whereas more-experienced participants may have used the exercise to reinforce, contextualize, or apply knowledge they already possessed.

RQ2: Pre/Post Group-Level Differences

RQ2 asked whether post-exercise group-level knowledge and confidence scores were higher than pre-exercise baseline scores. The findings did not show statistically significant improvement. The core composite changed only from 4.10 to 4.13, and none of the five individual pre/post items demonstrated statistically significant group-level differences.

The absence of statistically significant differences is an important finding rather than simply a failure to demonstrate an effect. It indicates that this pilot study did not provide quantitative evidence that the post-exercise group had higher overall self-reported knowledge or confidence than the pre-exercise group.

This result is consistent with prior simulation research showing that measurable improvements in confidence and competence are not uniform across studies. Yuan et al. (2012), in a systematic review of high-fidelity simulation, found mixed evidence regarding improvements in confidence and competence and called for stronger objective measures and more rigorous research designs. Alharbi et al. (2024) similarly found that simulation can improve knowledge and skills while noting continuing questions regarding retention and transfer. Pek et al. (2023) also documented substantial variation in evaluation outcomes across full-scale exercises.

Several methodological factors may have reduced the likelihood of detecting change in the present study. First, the high baseline scores restricted the amount of possible upward movement. Second, the study population included participants with substantially different levels of previous experience. Third, pre-test and post-test responses could not be matched at the individual level. The two groups may therefore have contained different proportions of students, experienced volunteers, and other participants. Small individual gains could have been obscured by differences in group composition.

The nonsignificant findings should consequently not be interpreted as evidence that participants did not learn. Rather, they indicate that measurable group-level improvement was not demonstrated using the unmatched design and broad self-report measures employed in this pilot study. This distinction reinforces the need for matched responses and more sensitive or objective measures in subsequent research.

RQ3: Perceived Educational Value and Learning Transfer

RQ3 asked whether participants perceived the exercise as educationally valuable for applying ICS concepts, improving coordination and communication, and strengthening preparedness. The findings strongly supported perceived educational value. Post-exercise ratings were high for application of ICS concepts (M = 4.60), coordination and communication (M = 4.47), and intention to improve personal preparedness (M = 4.80).

These findings parallel previous research indicating that emergency exercises can positively influence perceived learning, usefulness, collaboration, and preparedness (Roud et al., 2021). They also align with Turan's (2026) findings that participation in a full-scale exercise can contribute to greater understanding of operational roles, decision-making, field procedures, and confidence.

The particularly strong preparedness finding is notable. All respondents to that item agreed or strongly agreed that the exercise led them to identify an action to improve personal preparedness. Qualitative responses reinforced this result, with participants describing plans to update emergency go-bags, continue American Red Cross training, and strengthen household preparedness.

From a learning-transfer perspective, these findings suggest movement from exposure to intended application. Baldwin and Ford (1988) conceptualized transfer as the generalization and maintenance of acquired knowledge and skills beyond the original learning environment. The present study did not follow participants longitudinally and

therefore cannot establish whether intended preparedness actions were actually completed. Nevertheless, the identification of specific future behaviors represents preliminary evidence of perceived transfer and provides a useful outcome for future longitudinal assessment.

RQ4: Qualitative Evidence of Applied Learning Transfer

RQ4 asked what themes emerged from qualitative reflection responses regarding applied learning transfer. The qualitative findings provided evidence of learning processes that were not fully reflected in the quantitative pre/post scores. Experiential learning-by-doing appeared in all seven reflection responses, while additional themes included personal preparedness, confidence and readiness, shelter complexity, interagency coordination, and disaster risk awareness.

These findings align closely with Kolb's (1984) experiential learning framework. The sheltering exercise provided a concrete experience; the reflection survey encouraged reflective observation; participants connected those experiences with concepts such as coordination, preparedness, logistics, and emergency response; and several identified future actions consistent with active experimentation.

The qualitative findings also correspond with prior disaster-simulation research. Ledbury et al. (2023) identified recurring learning related to communication, command, coordination, resources, equipment, and organizational response in mass-casualty simulations. Turan (2026) similarly found that full-scale exercise participation contributed to understanding of operational roles, decision-making, safety, intervention procedures, and confidence. The shelter complexity and coordination themes found in the present study reflect similar forms of contextual and operational learning.

The qualitative findings are particularly important because they demonstrate how learning may occur without producing substantial movement on broad Likert-type measures. A participant may rate knowledge of shelter functions highly both before and after an exercise yet develop a more nuanced understanding of how registration, feeding, staffing, communications, client needs, and organizational coordination interact in practice. Such contextualized understanding may be difficult to capture through a short self-report instrument.

Confidence and Actual Performance

The relationship between confidence and actual performance warrants additional consideration. Although several participants described greater confidence or readiness after the exercise, self-reported confidence does not necessarily correspond with demonstrated competence. Prior research has shown that learners' assessments of their own performance may differ from objective measures of ability (Blanch-Hartigan, 2011), and simulation research has found mixed evidence regarding simultaneous improvements in confidence and competence (Yuan et al., 2012).

In an emergency setting, an appropriate level of confidence may support willingness to assume assigned responsibilities, communicate decisions, and act under conditions of

uncertainty. However, confidence that exceeds actual competence could potentially contribute to errors in judgment, while insufficient confidence could contribute to hesitation or reluctance to act even when an individual possesses the necessary knowledge or skills. The present study did not measure actual operational performance and therefore cannot determine whether changes in perceived confidence were associated with better or worse performance during the sheltering exercise. Accordingly, the confidence findings should be interpreted as perceived readiness rather than evidence of operational competence.

This distinction has implications for emergency services education. Ideally, full-scale exercises should help learners develop confidence that is calibrated to demonstrated knowledge and performance. Combining self-reported confidence measures with evaluator observations, performance checklists, scenario-based assessments, or other objective measures would allow future research to examine whether confidence and performance develop together and whether discrepancies between the two changes through repeated exercise participation.

Applied Learning, Experiential Learning, and Knowledge Transfer

Taken together, the four research questions support the distinction between applied learning and experiential learning developed in the theoretical framework. The full-scale sheltering exercise functioned as the applied-learning environment because participants encountered emergency-management concepts in a practical context. Experiential learning describes the process through which they interpreted, reflected on, and learned from those experiences.

This distinction helps explain the mixed findings. RQ1 and RQ2 showed that broad self-reported knowledge and confidence changed little at the group level, while RQ3 and RQ4 showed strong perceived educational value and qualitative evidence of contextualized learning. Participants may therefore have developed a deeper understanding of how emergency-management concepts function operationally without substantially changing how they rated their general knowledge or confidence.

Dayberry and Fisher (2023) similarly found that applied emergency-preparedness experiences can help learners connect academic concepts with community preparedness and professional practice. More broadly, systematic reviews indicate that realistic simulation can support knowledge and skill development while also highlighting the difficulty of measuring long-term transfer using any single assessment method (Alharbi et al., 2024; Mahdi et al., 2023). The present findings reinforce the value of combining quantitative, perceptual, and qualitative evidence when evaluating applied emergency-services education.

Relationship to FEMA's Exercise Framework

The findings are also consistent with the logic of FEMA's Homeland Security Exercise and Evaluation Program. HSEEP treats exercises as opportunities to practice, evaluate capabilities, identify strengths and areas for improvement, and inform subsequent

preparedness activities (FEMA, 2020). From this perspective, educational value is not limited to producing higher post-test scores.

Participant reflections illustrated this broader evaluative function. Respondents described recognizing the number of teams required to operate a shelter, understanding logistical demands they had not previously considered, appreciating the importance of collaboration, and identifying areas for additional training and personal preparedness. These outcomes correspond with HSEEP's emphasis on learning from exercise performance and using observations to strengthen future preparedness.

The findings also suggest that educational evaluation should extend beyond traditional exercise assessment focused primarily on organizational capabilities. When exercises are used in higher education, assessment should also examine what learners understand, apply, retain, and intend to use in future situations. Combining HSEEP-informed evaluation with educational measures of learning transfer may therefore offer a more comprehensive approach to assessing full-scale exercises.

Interpretation of Exploratory Age-Based Differences

The exploratory age-based analyses showed significantly higher baseline scores among respondents ages 30 and older on the core composite and shelter-functions item. These differences should not be interpreted as evidence that age itself resulted in greater emergency-management knowledge. Age was used only as a proxy because participant-type data were incomplete, and the older group may have included a greater proportion of participants with prior Red Cross, emergency-management, volunteer, or professional experience.

Nevertheless, the finding reinforces the importance of prior experience in applied-learning environments. Baldwin and Ford (1988) identified learner characteristics and prior learning as important influences on training transfer. In the present study, more-experienced participants may have used the exercise primarily to reinforce and contextualize existing knowledge, whereas less-experienced participants may have encountered foundational concepts for the first time.

Because only three respondents ages 18–29 completed the post-test, meaningful conclusions about differential learning by age cannot be drawn. Future studies should collect and retain direct information about participant type and prior emergency-management experience rather than relying on age as a proxy.

Implications for Emergency Services Education

The combined findings from RQ1 through RQ4 have several implications for emergency services education. First, full-scale exercises appear to offer educational experiences that extend beyond simple knowledge acquisition. Participants encountered the interconnected nature of shelter operations, communication, coordination, logistics, and preparedness. This is consistent with research showing that disaster exercises can expose learners to operational issues that are difficult to reproduce through classroom instruction alone (Ledbury et al., 2023; Mahdi et al., 2023).

Second, the results reinforce the importance of structured reflection and debriefing. If experiential learning depends on transforming experience into conceptual understanding, participation alone is insufficient. Reflection should ask learners to identify what occurred, why it occurred, which emergency-management concepts were demonstrated, what difficulties emerged, and how the experience may influence future actions.

Third, educational assessment should include multiple forms of evidence. Self-reported knowledge and confidence provide useful information but should be supplemented by objective knowledge measures, performance checklists, evaluator observations, scenario-based decision tasks, and qualitative reflection. This recommendation is consistent with prior reviews calling for more rigorous and standardized evaluation of simulation exercises (Mahdi et al., 2023; Pek et al., 2023; Yuan et al., 2012).

Finally, full-scale exercises should be viewed as one part of a broader sequence of emergency-management education. Pre-exercise instruction can establish conceptual foundations; the exercise can provide opportunities for application; reflection and debriefing can support integration; and subsequent exercises or field experiences can examine whether knowledge and skills are retained and transferred.

Limitations

Several limitations should be considered when interpreting the findings. First, individual pre-test and post-test responses could not be reliably linked because some participants did not complete both instruments or could not reproduce their participant identifier. This prevented direct analysis of individual change and required the use of group-level comparisons.

Second, the relatively small sample limits statistical power and reduces the generalizability of the findings. The limitation was particularly important for the reflection survey and the younger post-test subgroup, where the number of respondents was very small.

Third, the study relied primarily on self-reported knowledge, confidence, and perceived learning rather than objective measures of performance. Consequently, the findings cannot determine whether participants who reported greater confidence also performed more effectively during shelter operations. Confidence and competence should therefore be interpreted as distinct constructs.

Fourth, participant-type data were incomplete, requiring age to be used as a supplemental proxy classification. Although the age-based analysis provided exploratory information, it cannot establish whether observed differences were related to age, student status, prior emergency-management experience, volunteer experience, or other factors.

Fifth, only seven participants completed the qualitative reflection survey. These responses provided useful participant-level evidence but should be interpreted as illustrative rather than representative of the entire exercise population.

Finally, inclement weather reduced community attendance at the exercise. As a result, participants had fewer opportunities than anticipated to interact directly with members of the public, which may have reduced the realism of some aspects of shelter operations and limited opportunities to observe client-facing communication and service delivery.

Implications for Future Research

Future studies should recruit larger samples and use a reliable unique participant-identification system that allows pre-exercise and post-exercise responses to be matched while preserving confidentiality. A simple numeric code provided to participants on a card, sticker, or exit material could improve matching reliability. Matched data would allow researchers to assess individual changes in knowledge and confidence and would provide greater statistical power for examining subgroup differences.
Future research should also distinguish directly among students, trained volunteers, American Red Cross personnel, community participants, and other participant types and should document prior emergency-management, ICS, and sheltering experience. This would make it possible to determine whether the effects of full-scale exercises differ according to prior knowledge or professional background.

Objective measures should be incorporated alongside self-report instruments. Performance-based assessment could include evaluator ratings, performance checklists, scenario-based decisions, role execution, communication effectiveness, client-flow management, ICS application, resource coordination, and other observable indicators of competence.

Future research should also examine the relationship between confidence and objectively measured performance. Longitudinal assessment could determine whether confidence becomes more accurately calibrated to performance as participants gain experience through repeated exercises. This would help establish whether increased confidence contributes to more effective emergency performance, whether excessive confidence creates risks, or whether low confidence inhibits appropriate action despite adequate competence.

Follow-up assessment several weeks or months after an exercise could also determine whether perceived learning, preparedness intentions, and practical skills are retained or translated into actual behavior. Such longitudinal designs would provide stronger evidence of learning transfer than immediate post-exercise measures alone.

Replication is particularly important because this was a pilot study conducted within a single full-scale sheltering exercise. The purpose of the present study was not to establish definitive evidence of exercise effectiveness but to generate preliminary findings and identify methodological improvements for more rigorous research. Future

matched, replicated, and longitudinal studies can better determine which outcomes are most responsive to full-scale exercises and which participants benefit most.

Overall Interpretation

Overall, the four research questions demonstrate that learning transfer in a full-scale sheltering exercise is multidimensional. RQ1 showed that participants entered with relatively high baseline knowledge and confidence. RQ2 found no statistically significant group-level pre/post improvement. RQ3 demonstrated strong perceived educational value and preparedness-related impact. RQ4 identified qualitative evidence of experiential and applied learning, including shelter complexity, coordination, preparedness, confidence, and future application.

These findings should therefore not be interpreted as showing either that the exercise definitively produced learning gains or that it failed to produce learning because the quantitative comparisons were nonsignificant. Instead, the study illustrates the complexity of measuring learning transfer in realistic exercise environments. Quantitative scores remained largely unchanged, while perceptual and qualitative evidence documented meaningful learning experiences.

This pattern is consistent with prior research showing that disaster simulations and full-scale exercises are valued as learning environments while the measurement of competence, behavioral transfer, and long-term outcomes remains methodologically challenging (Ledbury et al., 2023; Mahdi et al., 2023; Pek et al., 2023; Roud et al., 2021; Yuan et al., 2012). The present pilot study therefore contributes to the literature by demonstrating how multiple forms of evidence can be combined to examine the movement from emergency-management theory toward applied practice.

Conclusion

This pilot study examined learning transfer associated with participation in a full-scale sheltering exercise. The quantitative pre/post comparison did not show statistically significant improvement in the five-item core composite or individual knowledge and confidence measures. However, participants reported high perceived educational value after the exercise, particularly in the areas of ICS application, coordination and communication, and personal preparedness. Qualitative reflections further demonstrated experiential learning, recognition of shelter complexity, increased preparedness awareness, and perceived readiness for future response activities.

These findings are consistent with prior research showing that full-scale and simulation-based exercises can provide meaningful learning experiences while measurable gains in competence, behavior, or long-term transfer are more difficult to demonstrate consistently (Ledbury et al., 2023; Mahdi et al., 2023; Pek et al., 2023; Roud et al., 2021; Yuan et al., 2012). The present study therefore reinforces an important distinction in the exercise literature: strong participant perceptions and evidence of contextual learning do not necessarily correspond with statistically significant changes on short self-report measures. At the same time, nonsignificant quantitative findings should not be interpreted as evidence that learning did not occur, particularly when qualitative and

post-exercise evidence indicates changes in understanding, preparedness intentions, and awareness of operational complexity.

The findings also support the theoretical distinction between applied learning and experiential learning. The full-scale sheltering exercise provided an applied environment in which participants encountered emergency management concepts in practice, while reflection and interpretation helped transform that experience into learning. This pattern is consistent with Kolb's (1984) experiential learning framework and with broader research emphasizing the importance of realistic practice, reflection, and contextualized application in professional education.

For emergency services education, the implications are practical. Full-scale exercises can supplement classroom instruction by exposing learners to operational demands that are difficult to reproduce through lecture, readings, or written assessment alone. However, their educational value should be evaluated using multiple forms of evidence. Self-reported knowledge and confidence are useful but should be complemented by objective knowledge measures, performance observations, structured debriefing, qualitative reflection, and follow-up assessment of retained learning and behavior.

The pilot nature of this study also highlights important methodological priorities for future research. Larger samples, reliable unique participant identifiers, matched pre/post responses, direct measures of prior experience, and objective indicators of performance would strengthen evaluation of learning transfer. Future studies should also examine whether changes in confidence correspond with actual competence and whether preparedness intentions lead to sustained behavioral change.

Overall, the study suggests that full-scale sheltering exercises can provide valuable applied-learning opportunities, particularly by helping participants connect emergency management concepts with realistic shelter operations, coordination, preparedness, and decision-making. More rigorous and replicated research is needed to determine the extent to which these experiences produce measurable, sustained, and transferable gains in professional performance.

References

Achora, S., & Kamanyire, J. K. (2016). Disaster preparedness: Need for inclusion in undergraduate nursing education. *Sultan Qaboos University Medical Journal, 16*(1), e15–e19. https://doi.org/10.18295/squmj.2016.16.01.004

Alharbi, A., Nurfianti, A., Mullen, R. F., McClure, J. D., & Miller, W. H. (2024). The effectiveness of simulation-based learning (SBL) on students' knowledge and skills in nursing programs: A systematic review. *BMC Medical Education, 24*, Article 1099. https://doi.org/10.1186/s12909-024-06080-z

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology, 41*(1), 63–105. https://doi.org/10.1111/j.1744-6570.1988.tb00632.x

Blanch-Hartigan, D. (2011). Medical students' self-assessment of performance: Results from three meta-analyses. *Patient Education and Counseling, 84*(1), 3–9. https://doi.org/10.1016/j.pec.2010.06.037

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

Burke, L. A., & Hutchins, H. M. (2007). Training transfer: An integrative literature review. *Human Resource Development Review, 6*(3), 263–296. https://doi.org/10.1177/1534484307303035

Chambers, A., Khan, I., Repchuck, R., Muir, S., Hanson, H., & Khan, Y. (2025). Enhancing the design, conduct and evaluation of public health emergency preparedness exercises: A rapid review. *BMC Public Health, 25*, Article 2366. https://doi.org/10.1186/s12889-025-23270-6

Cooke, M., Irby, D. M., & O'Brien, B. C. (2010). *Educating physicians: A call for reform of medical school and residency*. Jossey-Bass.

Dayberry, L., & Fisher, J. (2023). Applied learning on a study abroad: Teaching community emergency preparedness in the Balkans. *Journal of Applied Learning in Higher Education, 9*(1), 4–28. https://doi.org/10.57186/jalhe_2023_v9a1p4-28

Duff, J. P., Morse, K. J., Seelandt, J., Gross, I. T., Lydston, M., Sargeant, J., Dieckmann, P., Allen, J. A., Rudolph, J. W., & Kolbe, M. (2024). Debriefing methods for simulation in healthcare: A systematic review. *Simulation in Healthcare, 19*(1S), S112–S121. https://doi.org/10.1097/SIH.0000000000000765

Erickson, H. L. (2007). *Stirring the head, heart, and soul: Redefining curriculum, instruction, and concept-based learning* (3rd ed.). Corwin.

Farris, D., & McCreight, R. (2014). The professionalization of emergency management in institutions of higher education. *Journal of Homeland Security and Emergency Management, 11*(1), 73–94. https://doi.org/10.1515/jhsem-2013-0074

Federal Emergency Management Agency. (2009). *Evacuee support planning guide*. U.S. Department of Homeland Security. https://www.fema.gov/pdf/emergency/disasterhousing/evacuee_support_guide.pdf

Federal Emergency Management Agency. (2010). *Guidance on planning for integration of functional needs support services in general population shelters*. U.S. Department of Homeland Security. https://www.fema.gov/pdf/about/odic/fnss_guidance.pdf

Federal Emergency Management Agency. (2016). *Emergency Support Function #6—Mass care, emergency assistance, temporary housing, and human services annex*. U.S. Department of Homeland Security. https://www.fema.gov/sites/default/files/2020-07/fema_ESF_6_Mass-Care.pdf

Federal Emergency Management Agency. (2017). *National Incident Management System* (3rd ed.). U.S. Department of Homeland Security. https://training.fema.gov/emiweb/is/is700b/handouts/national_incident_management%20system_third%20edition_october_2017.pdf

Federal Emergency Management Agency. (2020). *Homeland Security Exercise and Evaluation Program (HSEEP)*. U.S. Department of Homeland Security. https://www.fema.gov/sites/default/files/2020-04/Homeland-Security-Exercise-and-Evaluation-Program-Doctrine-2020-Revision-2-2-25.pdf

Federal Emergency Management Agency. (2023). *Mass care and human service providers*. U.S. Department of Homeland Security. https://www.fema.gov/cbrn-tools/key-planning-factors-chemical-incident/kpf5/1/1-1

Federal Emergency Management Agency. (n.d.-a). *Emergency Management Professional Program*. National Disaster & Emergency Management University. https://training.fema.gov/programs/empp/

Federal Emergency Management Agency. (n.d.-b). *Full-scale exercises*. Emergency Management Institute. https://emilms.fema.gov/is_0360/groups/434.html

Federal Emergency Management Agency. (n.d.-c). *IS-0406: Operating a shelter*. Emergency Management Institute. https://emilms.fema.gov/is_0406/

Federal Emergency Management Agency. (n.d.-d). *National Incident Management System (NIMS)*. Emergency Management Institute. https://training.fema.gov/nims/

Federal Emergency Management Agency. (n.d.-e). *Tabletop exercises*. Emergency Management Institute. https://emilms.fema.gov/is_0362a/groups/180.html

Freshwater, M. J. (2018). *Preparing nursing students to respond to disasters: Faculty perspectives* [Doctoral dissertation, Jacksonville State University]. JSU Digital Commons. https://digitalcommons.jsu.edu/etds_dissertations/1/

Giddens, J. F., Caputi, L., & Rodgers, B. (2015). *Mastering concept-based teaching: A guide for nursing educators*. Elsevier.

Institute of Medicine. (2003). *Health professions education: A bridge to quality*. The National Academies Press. https://doi.org/10.17226/10681

Jach, E. A., & Trolian, T. L. (2019). Defining applied learning and related student outcomes in higher education. *New Directions for Higher Education, 2019*(188), 7–11. https://doi.org/10.1002/he.20340

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Labrague, L. J., & Hammad, K. (2024). Disaster preparedness among nurses in disaster-prone countries: A systematic review. *Australasian Emergency Care, 27*(2), 88–96. https://doi.org/10.1016/j.auec.2023.09.002

Ledbury, K., Glasgow, S., & Tallach, R. (2023). Learning from simulating mass casualty events: A systematic search and a comprehensive qualitative review. *Disaster Medicine and Public Health Preparedness, 17*, e242. https://doi.org/10.1017/dmp.2022.205

Levett-Jones, T., & Lapkin, S. (2012). The effectiveness of debriefing in simulation-based learning for health professionals: A systematic review. *JBI Library of Systematic Reviews, 10*(51), 3295–3337. https://doi.org/10.11124/jbisrir-2012-20

Loke, A. Y., Guo, C., & Molassiotis, A. (2021). Development of disaster nursing education and training programs in the past 20 years (2000–2019): A systematic review. *Nurse Education Today, 99*, Article 104809. https://doi.org/10.1016/j.nedt.2021.104809

Mahdi, S. S., Jafri, H. A., Allana, R., Battineni, G., Khawaja, M., Sakina, S., Agha, D., Rehman, K., & Amenta, F. (2023). Systematic review on the current state of disaster preparation simulation exercises (SimEx). *BMC Emergency Medicine, 23*, Article 52. https://doi.org/10.1186/s12873-023-00824-8

Pek, J. H., Quah, L. J. J., Valente, M., Ragazzoni, L., & Della Corte, F. (2023). Use of simulation in full-scale exercises for response to disasters and mass-casualty incidents: A scoping review. *Prehospital and Disaster Medicine, 38*(6), 792–806. https://doi.org/10.1017/S1049023X2300660X

Ropponen, P., Tomietto, M., Pramila-Savukoski, S., Kuivila, H., Koskenranta, M., Liaw, S. Y., & Mikkonen, K. (2025). Impacts of VR simulation on nursing students' competence, confidence, and satisfaction: A systematic review and meta-analysis of randomised controlled trials. *Nurse Education Today, 152*, Article 106756. https://doi.org/10.1016/j.nedt.2025.106756

Roud, E., Gausdal, A. H., Asgary, A., & Carlström, E. (2021). Outcome of collaborative emergency exercises: Differences between full-scale and tabletop exercises. *Journal of Contingencies and Crisis Management, 29*(2), 170–184. https://doi.org/10.1111/1468-5973.12339

Sanchez Cristal, N., Metcalf, N., Kreisberg, D., & Little, C. M. (2019). Integrating simulation-based exercises into public health emergency management curricula. *Disaster Medicine and Public Health Preparedness, 13*(4), 777–781. https://doi.org/10.1017/dmp.2018.137

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.

Sheikhbardsiri, H., Yarmohammadian, M. H., Khankeh, H. R., Nekoei-Moghadam, M., & Raeisi, A. R. (2018). Meta-evaluation of published studies on evaluation of health disaster preparedness exercises through a systematic review. *Journal of Education and Health Promotion, 7*, Article 15. https://doi.org/10.4103/jehp.jehp_159_17

Turan, M. (2026). Experiential learning in disaster response: Implications from the ECO full-scale avalanche exercise in Erzurum, Türkiye. *Disaster Medicine and Public Health Preparedness, 20*, e43. https://doi.org/10.1017/dmp.2026.10317

United Nations Office for Disaster Risk Reduction. (2017a). *Disaster*. https://www.undrr.org/terminology/disaster

United Nations Office for Disaster Risk Reduction. (2017b). *Disaster management*. https://www.undrr.org/terminology/disaster-management

U.S. Fire Administration. (2026). *Fire and Emergency Services Higher Education initiative*. Federal Emergency Management Agency. https://www.usfa.fema.gov/nfa/about/feshe/

Weiner, E., Irwin, M., Trangenstein, P., & Gordon, J. (2005). Emergency preparedness curriculum in nursing schools in the United States. *Nursing Education Perspectives, 26*(6), 334–339. https://pubmed.ncbi.nlm.nih.gov/16429998/

Welch, B. L. (1947). The generalization of “Student’s” problem when several different population variances are involved. *Biometrika, 34*(1–2), 28–35. https://doi.org/10.1093/biomet/34.1-2.28

Yuan, H. B., Williams, B. A., & Fang, J. B. (2012). The contribution of high-fidelity simulation to nursing students’ confidence and competence: A systematic review. *International Nursing Review, 59*(1), 26–33. https://doi.org/10.1111/j.1466-7657.2011.00964.x

Appendix A

INFORMED CONSENT TO PARTICIPATE IN RESEARCH
Study Title: From Theory to Practice: Learning Transfer in a Full-Scale Sheltering Exercise
Principal Investigator: Chris Lindquist, Utah Valley University, Department of Emergency Services
Principal Investigator: John Fisher, Utah Valley University

Purpose and Procedures

You are invited to take part in a research study about how students apply emergency management principles during a Full-Scale Sheltering Exercise on April 16 at the UCCU Center. This study is research and your participation is voluntary. The purpose is to measure learning before and after the exercise and to improve emergency services education.

If you agree, you will:
• Complete a short paper pre-test at registration (about 5 minutes)
• Complete a short paper post-test when exiting the exercise (about 5 minutes)
• Complete a brief online post-exercise reflection survey (about 5 minutes)

Your total time in the research activities is about 15 minutes.

Voluntary Participation

Taking part in this research is **separate from participating in the sheltering exercise**, which is a normal educational activity. You will participate in the exercise whether or not you join the research study. If you choose not to participate, your test and survey data will not be included in the study.

Your decision will not affect your grades, standing, or relationship with Utah Valley University. You may skip any question or stop at any time without penalty.

Risks, Benefits, and Confidentiality

This study involves minimal risk. You may feel mild test anxiety when completing assessments. There is also a small risk of loss of confidentiality. No names will be

collected. Instead, numeric identifiers will be used. Only limited demographic information will be requested.

Data will be collected on paper and through Qualtrics and stored on secure UVU-managed servers. Only the research team will have access to identifiable data, and instructors will not access research data until after final grades are submitted. Data will be kept for three years and then securely destroyed.

You may benefit by receiving feedback about your learning. The results may help improve emergency services curriculum and training for future students.

Additional Information

There is no compensation and no extra credit for participating. The research was determined exempt under federal regulations for normal educational practices (45 CFR 46.104(d)(1)).

If you have questions about the study, contact:
John Fisher, Principal Investigator
Phone: 208-227-6229
Email: [john.fisher@uvu.edu]

If you have questions about your rights as a research participant, contact:
Utah Valley University Institutional Review Board (IRB)
Phone: [801-863-8000]
Email: [irb@uvu.edu]

Statement of Consent

By initialing below (paper form) or selecting “I have read and agree to participate” (online survey), you confirm that:

• You are 18 years of age or older
• You have read this information
• Your questions have been answered
• You voluntarily agree to participate in this research study

____ Participant Initials (Paper Pre-Test)

☐ I have read and agree to participate in this research study (Online Survey)

Appendix B

PRE-EXERCISE SURVEY

This survey is part of a research study evaluating the educational impact of the full-scale sheltering exercise. Participation is voluntary and will not affect your grade, standing, or role in the exercise. The survey takes about **1–2 minutes**. Responses are confidential and will be analyzed in de-identified form.

I have reviewed the informed consent. Initial here to participate: _____
Participant ID (required for matching)

Participant ID: _____
(Enter the ID provided to you. Do not use your name or student ID.)

Section I: Demographic Information

1. **Age: _____**
2. **Gender:**
   ☐ Female
   ☐ Male
   ☐ Prefer not to say
3. Who are you? Student ____ School ____ Community member ____ Other _____

Major / Program of Study: _____

Using the scale 1-5 (with 5 as highest), indicate your agreement with each statement.

1. **I can explain the purpose and basic structure of the Incident Command System (ICS).**
   ☐1 ☐2 ☐3 ☐4 ☐5
2. **I can describe how multiple agencies coordinate roles and information during an emergency sheltering operation.**
   ☐1 ☐2 ☐3 ☐4 ☐5
3. **I understand the core functional areas of emergency shelter operations (e.g., registration, dormitory, feeding, supplies, health services, information).**
   ☐1 ☐2 ☐3 ☐4 ☐5
4. **I am confident I could perform my assigned role effectively in a sheltering exercise or real sheltering event.**
   ☐1 ☐2 ☐3 ☐4 ☐5
5. **I am personally prepared for an emergency (e.g., I have or could quickly assemble a kit and a basic emergency plan).**
   ☐1 ☐2 ☐3 ☐4 ☐5

POST-EXERCISE SURVEY

Thank you for participating. This survey evaluates the educational impact of the sheltering exercise. Participation is voluntary and takes about **2–3 minutes**. Responses are confidential and de-identified.

I have read the informed consent. By continuing, I confirm my consent to participate.

Participant ID (same as pre-test): _____

(Enter the ID provided to you. Do not use your name or student ID.)

Section I: Demographic Information

1. **Age: _____**
2. **Gender:**
   ☐ Female
   ☐ Male
   ☐ Prefer not to say
3. Who are you? Student ____ School ____ Community member ____ Other _____

Major / Program of Study: _____

Using the scale 1-5 (with 5 as highest), indicate your agreement with each statement.

1. **I can explain the purpose and basic structure of the Incident Command System (ICS).**
   ☐1 ☐2 ☐3 ☐4 ☐5
2. **I can describe how multiple agencies coordinate roles and information during an emergency sheltering operation.**
   ☐1 ☐2 ☐3 ☐4 ☐5
3. **I understand the core functional areas of emergency shelter operations (e.g., registration, dormitory, feeding, supplies, health services, information).**
   ☐1 ☐2 ☐3 ☐4 ☐5
4. **I am confident I could perform my assigned role effectively in a sheltering exercise or real sheltering event.**
   ☐1 ☐2 ☐3 ☐4 ☐5
5. **I am personally prepared for an emergency (e.g., I have or could quickly assemble a kit and a basic plan).**
   ☐1 ☐2 ☐3 ☐4 ☐5

6. **This exercise improved my ability to apply ICS concepts in a realistic setting.**
☐1 ☐2 ☐3 ☐4 ☐5

7. **This exercise improved my ability to coordinate and communicate effectively with others during shelter operations.**
   ☐1 ☐2 ☐3 ☐4 ☐5
8. **Because of this exercise, I intend to take at least one concrete action to improve my personal preparedness within the next 30 days.**
   ☐1 ☐2 ☐3 ☐4 ☐5

Appendix C

Informed Consent Acknowledgment

You are invited to participate in a research study examining how students translate theoretical emergency management knowledge into practical skills through participation in a full-scale sheltering exercise. This study is conducted in an established educational setting and focuses on experiential learning outcomes.

Participation is **voluntary**. You may skip any question or stop at any time without penalty. Responses will be used for research and educational improvement purposes. No identifying information will be reported. Risks are minimal and involve only normal reflection on your learning experience. There is no direct compensation; however, your input may improve future training experiences.

By proceeding with this survey, you acknowledge that:

- You are 18 years of age or older.
- You have read and understand the information above.
- You voluntarily agree to participate.

☐ **I agree to participate in this research study.**
(You must check this box to continue.)

Section I: Demographic Information

1. **Age:** _____
2. **Gender:**
   ☐ Female
   ☐ Male
   ☐ Prefer not to say
3. Who are you? Student ____ School ____ Community member ____ Other _____
4. **Major / Program of Study:** _____

Section II: Experiential Learning Reflection

(Please limit each response to one to two sentences.)

1. What did you learn?

Identify one principle, concept, or value (for example: Incident Command System structure, communication clarity, interagency coordination, leadership under stress, ethical responsibility, etc.) that you understand better because of this exercise. Briefly explain what you learned and how it applies beyond this exercise (personally or professionally).

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2. How did you learn it?

Describe how specific activities during the full-scale sheltering exercise (e.g., assigned roles, communication tasks, problem-solving under time pressure, interaction with other agencies, unexpected challenges) helped you understand this principle or concept. Mention one positive or challenging aspect of the experience.

3. Why does it matter to you?

Explain why this principle, concept, or value is important in emergency response and in your broader life or career. Consider both short-term and long-term relevance.

4. What will you do in light of it?

State one specific action or goal you intend to pursue as a result of what you learned (for example, improving communication skills, studying ICS roles more deeply, seeking leadership opportunities, practicing stress management). Briefly note one potential challenge and how you might address it.

Thank You

Thank you for contributing to this research. Your reflection helps us better understand how experiential learning bridges the gap between theory and practice in emergency management education.

Peer Learning for Applied Engineering Technology Education

Goksu Avdan
Missouri Western State University

Abstract

This study examines the implementation and student perceptions of a flexible peer learning approach in applied engineering technology education, with the goal of combining peer collaboration with student autonomy in a practical, workplace-like learning environment. The approach was used in MET 132 (Manufacturing Methods) and MET 372 (Programmable Logic Controllers) through in-class assignments and laboratory-based activities. Unlike traditional peer learning models with assigned groups, students were given full autonomy to collaborate freely with classmates or work independently. Activities were also designed as open-book and open-note, allowing students to use course materials, previous examples, digital resources, and other approved resources. Data sources included instructor reflections and student responses to open-ended survey questions. The findings showed that students generally valued the flexible structure and reported that peer collaboration helped them discuss questions, confirm their understanding, solve problems more efficiently, and experience workplace-like collaboration. Although some challenges were noted, including unequal peer support and occasional difficulty following multiple discussions, students generally viewed flexibility and freedom of choice positively. These findings suggest that combining peer collaboration with student agency can provide a practical applied learning environment while allowing students to select the learning approach that best supports their individual needs. Overall, flexible peer learning offers a student-centered instructional approach that may support applied technical learning, collaboration, and preparation for professional workplace environments.

Keywords: Peer learning, applied learning, engineering technology, collaborative learning

Introduction

Applied learning, often grounded in experiential learning theory, is widely recognized as an important approach in higher education because it connects knowledge, experience, reflection, and application (Kolb & Kolb, 2006). In practice, applied learning may include field trips, internships, clinical practica, mentored research, and other related experiences. It connects classroom knowledge with practical experience, professional skills, and real-world problem solving. From the engineering technology perspective, applied learning is especially important because students are expected to develop not only theoretical understanding but also the ability to apply technical concepts in laboratory, project-based, and workplace-like settings, which is also important for local workforce development. Furthermore, recent STEM and engineering education literature describes several instructional methods that support applied learning, including experiential learning, project-based learning, collaborative learning, service learning, internships, and hands-on technical activities in STEM fields (Remington et al., 2023; Tembrevilla et al., 2024). These approaches are often used to increase student engagement, support learning outcomes, strengthen problem-solving ability, and prepare students for the professional workforce.

Peer learning is one applied learning strategy that encourages students to learn with and from one another. Rather than relying only on instructor-led explanations, students can discuss course concepts, compare problem-solving approaches, explain ideas and technical procedures, and support each other during classroom and laboratory activities (Boud & Cohen, 2014; Topping et al., 2017). Peer learning can help students become more active participants in the learning process while also improving communication, teamwork, and critical thinking. In engineering technology courses, many assignments require both conceptual understanding and practical application (Litzinger et al., 2011). Therefore, peer learning may provide an important structure for students to develop technical knowledge through interaction, discussion, and shared problem solving with their classmates.

In our study, the peer learning approach differs from many traditional peer learning and peer assessment models because students were given a high level of autonomy. Prior peer learning studies often examine structured discussion settings, including assigned group-size conditions and controlled peer interaction arrangements, while peer assessment research frequently includes structured roles, feedback procedures, rubrics, or scaffolding (Corrégé & Michinov, 2021; Double et al., 2020). In contrast, in our study, students were allowed to freely collaborate with any classmates in the classroom during selected in-class assignments and laboratory activities. Students who preferred to work alone were also allowed to do so because of the full autonomy provided by the instructor. Additionally, the assignments were open book and open notes, allowing students to access their course materials and other learning resources while completing their work. They were also allowed to use digital sources because many books in today's university environment are available online, rather than as hardcover books, which students do not prefer as much anymore. This design was intended to better reflect real workplace conditions, where employees often collaborate with colleagues, consult technical documents, review previous examples, and use

available resources to solve real-world problems. By combining peer collaboration, student choice, and open-resource learning, our approach aimed to create a more realistic and flexible applied learning environment.

It is important to note that student agency is an important component of this approach because students are given meaningful choices in how they engage in the learning process. Student agency has been associated with active engagement, autonomy, and greater ownership of the learning process (Jääskelä et al., 2020). Rather than requiring participation in predetermined groups, students can decide whether collaboration is beneficial, whom to collaborate with, and when independent work is more appropriate. This flexibility allows students to take greater ownership of their learning and still maintain access to peer support when needed.

Finally, the objective of this study was to examine student perceptions of a flexible peer learning approach implemented in engineering technology courses. Specifically, the study explored how students perceived the use of peer collaboration, open-book and open-note assignments, and freedom of choice during in-class and laboratory activities. The study also aimed to identify students' perceived benefits, challenges, and suggested improvements related to the flexible peer learning approach. By focusing on student experiences, our pedagogical research provides a practical reflection on how the peer learning approach can be used as an applied learning strategy in engineering technology education.

Methods

This study was designed as a qualitative classroom-based reflection on the implementation of a flexible peer learning approach in applied engineering technology education. This qualitative approach was selected because the purpose of our study was to better understand how students experienced peer learning, how they perceived the freedom to collaborate, and how this instructional method influenced their engagement during in-class assignments and laboratory activities.

As shown in Figure 1, the framework begins with an instructional design based on flexible peer learning, open-book/open-note activities, and access to digital resources. This structure supports student autonomy by allowing students to choose peers, collaborate freely, or work independently. During the learning process, students discuss questions, compare ideas, confirm answers, and solve problems. These activities are intended to support perceived engagement, confidence, technical understanding, and workplace-like preparation, while student responses and instructor reflections provide feedback for future improvement of the peer learning approach.

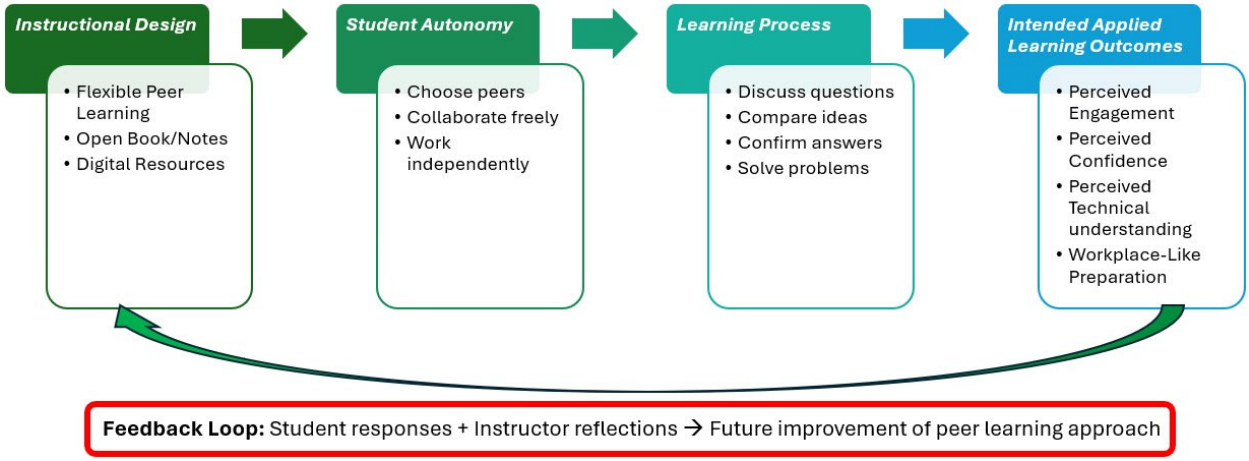


Figure 1. Peer learning framework for applied engineering technology education.

The peer learning method was applied in selected engineering technology courses through in-class assignments and laboratory-based activities. During these activities, students were allowed to collaborate freely with classmates rather than being placed into fixed instructor-assigned groups. This meant that students could ask questions, compare ideas, explain procedures to one another, and work with different classmates depending on the activity and their learning needs. At the same time, students who preferred to complete the work independently were allowed to do so. This flexibility was an important part of the instructional design because it gave students ownership of their learning process and avoided forcing collaboration when individual work was preferred. The assignments were mostly completed on paper using a traditional format and included open-ended, multiple-choice, true/false, and matching questions, depending on the topic covered in each chapter. The questions were drawn either from the textbooks or from the instructor's own set of original questions. In MET 372, some laboratory activities also required the use of Allen-Bradley RSLogix 500 software for programmable logic controller applications. For MET 132, laboratory assignments were designed from scratch by the instructor for each topic, while for MET 372, extensive support was drawn from the instructor's manual accompanying the programmable logic controller textbook (Petruzella, 2005). In both courses, students were informed about the peer learning approach at the beginning of the semester. It is important to note that only assignments completed during class time were included in the peer learning approach, as the instructor could not directly observe peer interactions occurring outside the classroom.

For MET 132, lectures were conducted in Wilson Hall classrooms, while laboratory activities were held in the Manufacturing Bay at the Houlne Center. For MET 372, both lecture and laboratory activities were conducted at the Houlne Center in the Manufacturing Bay and Industrial Bay. MET 132 included nine students, eight of whom responded to the survey (88.9% response rate), whereas MET 372 included six students, all of whom responded to the survey (100% response rate). Overall, 14 of the 15 enrolled students completed the survey, resulting in an overall response rate of 93.3%.

In addition to flexible peer collaboration, the learning activities were designed as open-book and open-note assignments. Students were allowed to use course materials, notes, textbooks, previous examples, digital sources, and other approved resources while completing their work. This approach was intended to simulate real workplace environments, where engineers, technicians, and other professionals are rarely expected to solve problems without access to references, documentation, digital resources, or colleagues. By combining peer interaction with access to learning resources, the classroom environment was designed to support applied problem solving, practical decision-making, and professional-style learning.

The data sources for this study included instructor reflections and student responses to open-ended questions collected after the implementation of the peer learning approach during the 2025–2026 academic year. Responses were recorded without direct identifiers and were therefore treated as de-identified. Participation in the survey had no relationship to students' course grades. All procedures were approved by the Missouri Western State University's Institutional Review Board (Protocol ID: 163). For this specific protocol, the selected classes were MET 132 (Manufacturing Methods) and MET 372 (Programmable Logic Controllers), which are freshman- and junior-year classes, respectively. The instructor reflections focused on how the method was introduced, how students interacted during class and laboratory sessions, and what practical benefits or challenges were observed during implementation. The instructor reflections were based on general classroom observations throughout the semester and were largely positive; however, these observations were not collected using a formal observation protocol or structured classroom diary.

Student responses provided direct insight into their experiences with peer collaboration, open-book and open-note activities, digital resource use, and the freedom to choose whether to work with classmates or independently. The open-ended portion of the survey was also revised based on input from a faculty member in the Department of Education. These questions were designed to capture students' perceived benefits, challenges, and suggested improvements related to the flexible peer learning approach after its classroom implementation.

The first open-ended question was included to identify which aspects of peer collaboration students found most helpful. This question allowed students to describe whether collaboration supported their understanding, confidence, problem-solving process, classroom engagement, or ability to confirm/support their answers with classmates.

Question #1 → "What aspect of peer collaboration helped you the most, if any?"
The second open-ended question was included in providing students with an opportunity to describe any negative or limiting aspects of peer collaboration. Since peer learning may not benefit all students in the same way, this question helped identify whether collaboration created confusion, distraction, unequal participation, or other barriers to learning.

Question #2 → "What aspects of peer collaboration, if any, hindered your learning?" The third open-ended question was included to gather student suggestions for improving the implementation of peer collaboration in the classroom. This question was important because the study focused not only on evaluating the current approach but also on identifying practical ways to improve the peer learning structure in future course offerings.

Question #3 → "What would you change about how collaboration works in this class?" The responses to these open-ended questions were reviewed to identify common themes related to the perceived benefits, challenges, and possible improvements of the flexible peer learning approach. A formal qualitative coding framework was not employed; instead, responses were manually reviewed and similar responses were grouped according to recurring ideas within each survey question. This information was then used to organize the qualitative findings and support the discussion of the strengths and limitations of the flexible peer learning approach.

Finally, to supplement the qualitative student responses, descriptive academic performance data were also examined for the in-class exercises and laboratory assignments completed under the flexible peer learning approach. For each student, the total points earned across applicable activities were divided by the total points possible and converted to a percentage (%). Scores of zero were retained because they represented missed or unsubmitted activities that were included in the students' course grades. Formally excused assignments were excluded from both the earned and possible points because students were not required to complete those activities. Midterm and final examination scores were excluded because the peer learning approach was not implemented during those assessments. Final course letter-grade distributions were reported only to provide overall course-performance context. Because the study did not include a pre- and post-assessment design or a comparison/control group, these performance data were interpreted descriptively and were not considered causal evidence of the effectiveness of the peer learning approach.

Results and Discussion

The results of this qualitative classroom-based reflection are organized around the three open-ended survey questions used to examine students' experiences with the flexible peer learning approach. As previously noted, student responses were collected from two engineering technology courses: MET 132 (Manufacturing Methods) and MET 372 (Programmable Logic Controllers), which are freshman- and junior-level courses, respectively. Therefore, the responses provide insight into how students at different academic levels experienced peer collaboration during in-class assignments and laboratory activities. Overall, the responses suggest that students viewed peer collaboration positively, especially because it helped them discuss problems, confirm their understanding, consider different perspectives, and work through technical tasks with classmates.

Perceived Benefits of Peer Collaboration

The first open-ended question asked students what aspect of peer collaboration helped them the most, if any. In both courses, students emphasized that collaboration helped them talk through questions, reach answers, and feel much better about their work. In MET 132, students described the benefits as “talking about the questions”, “getting to the answers”, and receiving a “reassuring answer”. Overall, these responses indicate that students valued peer collaboration for completing assignments, confirming their thinking, and gaining reassurance during technical coursework and classroom problem solving.

Several MET 132 students also connected peer collaboration to efficiency and real-world preparation. One student stated that peer collaboration “helped me quite a bit, because collaboration is what you need out there in the field”. Another student explained that peer collaboration helped them “get work more efficiently”, while another summarized the benefit by stating, “two brains is better than one”. These responses support the applied learning purpose of the instructional method. In engineering technology education, students are expected to develop technical knowledge, but they are also expected to communicate, solve problems, and work with others in professional settings. The student comments suggest that they understood the practical value of collaboration beyond the classroom.

The MET 372 responses also showed strong support for peer collaboration. Students in this course emphasized peer assistance, different experience levels, and collaborative problem solving. One student explained that “the professor wasn’t always available, so being able to talk amongst peers allowed us to solve our own problems”. This response is important because it shows how peer collaboration can support student independence. Rather than waiting for the instructor to answer every question, students were able to use classmates as learning resources. Other MET 372 students noted that collaboration helped them see “different experience levels”, generate “multiple ideas”, and gain “a different perspective on the problem”. One student added that discussion with classmates helped them more clearly understand the question, which led to stronger critical thinking and the correct answer.

These responses suggest that students perceived peer collaboration as helpful for understanding and applied problem solving. Students described “working through problems together”, “talking through problems”, and “working it out with people”. From the instructor’s perspective, this indicates that flexible peer learning helped create a more active classroom environment. Instead of passively waiting for instructor feedback, students were able to explain ideas, compare approaches, and test their understanding through discussion. These findings align very well with the purpose of applied learning in MWSU’s mission because students were completing technical tasks while also practicing the communication and collaborative problem-solving skills expected in workplace environments.

Challenges and Barriers to Learning

The second open-ended question asked students what aspects of peer collaboration, if any, hindered their learning. Overall, most students did not report major barriers. Several students responded with “none” or stated that collaboration did not hinder their learning. For example, one MET 132 student wrote that collaboration “didn’t really hinder my learning but helped improve my learning a bit”. Similarly, a MET 372 student stated, “I didn’t notice anything being hindered by collaborating”. Another MET 372 student explained that peer collaboration “allows people to talk with others like a real-world scenario” and did not hinder their learning at all.

These responses suggest that the flexible nature of the method may have reduced some common problems associated with required group work. Since students were not forced to work in assigned groups, they could decide when collaboration was useful and when they preferred to work independently. One MET 372 student specifically noted that collaboration did not hinder learning because “work can be done alone if needed”. This response supports one of the central features of the method: *students had autonomy*. They were allowed to collaborate freely, but they were also allowed to work alone. However, a few responses identified possible challenges. One MET 132 student stated that peer collaboration sometimes hindered their learning because “it seemed like I had to help more than they helped me”. This response points to a common limitation of peer learning: *unequal contribution*. While helping classmates can support a student’s own understanding, it may also become frustrating if the support feels one-sided. Another MET 372 student noted that “too many topics at once sometimes” made it harder to follow along. A related response suggested that if another student was confused and was brainstorming out loud, it could make figuring out the problem slower.

These comments show that peer collaboration can be beneficial, but it still requires some instructor awareness. Flexible peer collaboration gives students freedom, but it may also lead to uneven participation or unfocused discussion if students are not guided when needed. Therefore, the instructor’s role remains very important at this stage. The instructor does not need to assign groups or control every interaction, but occasional monitoring, clarification, and redirection may help keep collaboration productive. Another practical issue raised by a MET 132 student was attendance, as the student suggested that having everyone come to class would improve the collaborative environment. This comment highlights that peer learning depends partly on student presence and participation.

Suggestions for Improving Collaboration

The third open-ended question asked students what they would change about how collaboration works in the class. Most students indicated that they would not change anything. MET 132 students responded with comments such as “nothing”, “works perfectly as is”, and “wouldn’t change anything”. MET 372 students gave similar responses, including “nothing”, “I like it how it is”, and “I would want to change nothing about collaboration in class”. These responses suggest that students generally accepted the flexible peer collaboration environment and did not feel that major changes were necessary.

Several responses also supported the importance of optional collaboration setting. One MET 372 student stated, “Collaboration is optional. If you prefer to work alone, it is okay. I wouldn’t change it”. This comment directly supports the main difference between the current approach and more traditional peer learning models. In many traditional peer learning activities, students are assigned to groups and expected to work within a fixed structure (Double et al., 2020). In this study, students had the freedom to decide whether to collaborate, whom to collaborate with, and when collaboration was useful. This autonomy may explain why students reported few concerns and suggested few changes.

At the same time, two students suggested that collaboration should be encouraged more. One MET 132 student wrote, “Encourage it more”, and one MET 372 student similarly stated, “Encourage it more 100%”. These comments suggest that while students appreciated the optional structure, some may still benefit from stronger instructor encouragement to collaborate. This does not mean that collaboration should become mandatory or fully controlled. Instead, the instructor could briefly remind students that peer discussion is welcome, encourage them to compare ideas, or invite them to ask classmates before requesting instructor help. This would preserve student autonomy while making collaboration a more visible and intentional part of the classroom culture.

From the instructor’s general classroom observations, students appeared to use the flexible structure as intended by moving between independent work and peer discussion depending on their needs and the activity. Peer interaction was generally positive and was commonly observed when students compared answers, discussed procedures, or sought assistance from classmates. These observations were informal and are therefore used to provide classroom context rather than as systematically collected behavioral data.

Student Performance During Peer Learning Activities

In-Class Exercise Performance

Descriptive performance results were examined separately for MET 132 and MET 372 to provide a more detailed account of student performance during the in-class activities. In MET 132, the mean student performance across the in-class exercises was 81.4% (SD = 16.2%), with individual student averages ranging from 41.6% to 93.3%. The relatively large standard deviation and broad score range indicate substantial variation in student performance. This variation may reflect differences in students’ prior preparation, engagement with the peer activities, ability to apply course concepts independently, or consistency in completing the exercises. Although the overall mean suggests that students generally performed at a satisfactory level, the lower individual averages indicate that the flexible peer learning approach did not result in uniformly strong performance across all students.

In MET 372, the mean in-class exercise performance was 96.4% (SD = 1.8%), with individual student averages ranging from 92.8% to 97.5%. Compared with MET 132, the

smaller standard deviation and narrower score range suggest considerably more consistent performance among students in this course. This pattern may be related to differences in course content, student preparation, class size, task structure, or the extent to which students were already familiar with the concepts addressed in the activities. The higher and more consistent scores in MET 372 may also indicate that students were better able to work collaboratively and apply the expected procedures during the in-class exercises. However, these possible explanations cannot be confirmed from the available data.

The contrast between the two courses is therefore important for interpreting the findings. While MET 372 showed both higher average performance and less variation, MET 132 displayed greater differences among students. This suggests that the implementation of flexible peer learning may have operated differently across the two instructional contexts. In MET 132, peer learning activities may have provided opportunities for students to clarify concepts and support one another, but some students may still have required additional guidance or structured intervention. In MET 372, the consistently high scores may indicate that the activities were well aligned with students' existing knowledge and course expectations. Nevertheless, the results should be interpreted as descriptive rather than causal. The study did not include a pre-intervention assessment, comparison group, or control group, and therefore cannot determine whether the observed performance was caused by the flexible peer learning approach. Other factors, including differences in course difficulty, student characteristics, assessment design, and instructor support, may also have contributed to the observed results.

Laboratory Assignment Performance

Laboratory assignment performance was also examined separately for both courses. In MET 132, the mean student laboratory performance was 71.1% (SD = 22.7%), with individual averages ranging from 33.4% to 96.5%. In MET 372, the mean laboratory performance was 92.9% (SD = 13.3%), with individual averages ranging from 65.7% to 98.9%. Scores of zero resulting from missed or unsubmitted laboratory activities were retained in the analysis, whereas formally excused assignments were excluded. The wider variation observed in MET 132 therefore reflects the actual course-performance record, including missed assignments. The higher average and smaller relative variation in MET 372 suggest more consistent laboratory performance among students in that course. This difference may reflect variation in course content, student preparation, assignment expectations, or the extent to which students engaged with peers during laboratory activities. Similar to the in-class exercise results, these findings provide descriptive evidence of student performance during laboratory activities conducted under the flexible peer learning approach but do not establish a causal relationship between the approach and student learning.

Final Course Letter-Grade Distribution

Final course letter grades were also examined to provide additional context regarding overall student performance. In MET 132, five of the nine students earned an A (55.6%), two earned a B (22.2%), one earned a C (11.1%), and one earned an F (11.1%). In MET

372, five of the six students earned an A (83.3%) and one earned a B (16.7%). Because final course grades also included assessments in which the peer learning approach was not implemented, these distributions are presented only as overall course-performance context and are not interpreted as direct evidence of the effectiveness of the flexible peer learning approach.

Summary of the Findings

Overall, the findings suggest that flexible peer learning can serve as a practical applied learning strategy in engineering technology education. Students reported that collaboration helped them discuss questions, confirm answers, solve problems, work more efficiently, and consider different perspectives. These outcomes are especially relevant in engineering technology courses, where students must connect technical knowledge with hands-on application.

The responses also show that the method's flexibility was a major strength. Students were not placed into assigned groups, and they were not required to collaborate if they preferred to work independently. This freedom appears to have reduced resistance to peer learning and allowed students to use collaboration when it was most helpful. The open-book and open-note structure further supported the applied learning environment by allowing students to use available resources, including course notes, textbooks, previous examples, online materials, electronic textbooks, and other approved digital resources, similar to real technical workplaces where employees consult documents, examples, digital resources, and colleagues.

Limitations

This study has several limitations. First, although descriptive performance data from in-class exercises and laboratory assignments were included, the study did not include pre- and post-assessments, a comparison/control group, or competency-based evaluations. Therefore, the performance results cannot establish learning improvement attributable to the flexible peer learning approach. Workplace readiness was also not directly assessed. Second, because the open-ended questions specifically referred to peer collaboration, students who chose to work independently may not have interpreted the questions as fully applicable to their experiences. Future studies will consider using more neutral wording to better capture the experiences of both collaborating and independently working students. Third, because optional peer collaboration, student autonomy, choice of collaborators, independent work, and access to open resources were implemented together, the present study cannot determine the individual contribution of each instructional component to students' reported experiences. Fourth, the responses were collected from two engineering technology courses at one institution, which may limit the generalizability of the findings to other courses, programs, or academic settings. Finally, because students had full autonomy to choose whether and with whom to collaborate, the level and quality of peer interaction may have varied across students.

Conclusions and Future Works

In conclusion, this study provides a practical classroom-based reflection on the use of a flexible peer learning approach in applied engineering technology education. The findings suggest that allowing students to freely collaborate with classmates, work independently when it's preferred, and use open-book, open-note, and approved digital resources can create a more realistic and student-centered learning environment. Student responses indicated that peer collaboration helped them discuss questions, confirm their understanding, solve problems more efficiently, and experience a learning process that reflects real workplace expectations. Although some challenges were identified, such as unequal peer support and the possibility of unfocused discussions, the overall responses showed a very strong student support for our approach. Therefore, flexible peer learning may serve as a practical instructional strategy for supporting applied learning and student autonomy while providing a classroom environment that reflects aspects of workplace collaboration.

Future work should examine the peer learning approach using a larger sample across additional engineering technology courses and academic levels. Future studies may extend the descriptive performance analysis reported here by incorporating pre- and post-assessments and comparison groups to better evaluate the impact of this approach on learning outcomes. In addition, future implementation may explore light instructional structures, such as brief reflection prompts or instructor check-ins, while still preserving student autonomy and optional collaboration. This approach could also be applied in other manufacturing engineering technology courses, such as robotics-based laboratory assignments in Computer Integrated Manufacturing course (Avdan, 2026). Future studies may also investigate how artificial intelligence (AI) tools can be integrated to further support peer learning strategies (Noroozi et al., 2025), especially as the current direction of education literature shifts toward AI-assisted learning, and technology-supported collaboration.

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References

Avdan, G. (2026). FANUC Robotics Labs for Industry 5.0 Manufacturing A Flipped Learning Approach in Computer Integrated Manufacturing (CIM) Course. *Proceedings of the 11th North American International Conference on Industrial Engineering and Operations Management (IEOM)*.

Boud, D., & Cohen, R. (2014). *Peer learning in higher education: Learning from and with each other*. Routledge.

Corrégé, J.-B., & Michinov, N. (2021). Group size and peer learning: Peer discussions in different group size influence learning in a biology exercise performed on a tablet with stylus. *Frontiers in Education*, *6*, 733663.

Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020). The impact of peer assessment on academic performance: A meta-analysis of control group studies. *Educational Psychology Review*, *32*(2), 481–509.

Jääskelä, P., Poikkeus, A.-M., Häkkinen, P., Vasalampi, K., Rasku-Puttonen, H., & Tolvanen, A. (2020). Students' agency profiles in relation to student-perceived teaching practices in university courses. *International Journal of Educational Research*, *103*, 101604.

Kolb, A. Y., & Kolb, D. A. (2006). Learning styles and learning spaces: A review of the multidisciplinary application of experiential learning theory in higher education. *Learning Styles and Learning: A Key to Meeting the Accountability Demands in Education*, 45–91.

Litzinger, T., Lattuca, L. R., Hadgraft, R., & Newstetter, W. (2011). Engineering education and the development of expertise. *Journal of Engineering Education*, *100*(1), 123–150.

Noroozi, O., Schunn, C., Schneider, B., & Banihashem, S. K. (2025). Advancing peer learning with learning analytics and artificial intelligence. *International Journal of Educational Technology in Higher Education*, *22*(1), 62.

Petruzella, F. D. (2005). *Programmable logic controllers*. McGraw-Hill Higher Education.

Remington, T. F., Chou, P., & Topa, B. (2023). Experiential learning through STEM: Recent initiatives in the United States. *International Journal of Training and Development*, *27*(3–4), 327–359.

Tembrevilla, G., Phillion, A., & Zeadin, M. (2024). Experiential learning in engineering education: A systematic literature review. *Journal of Engineering Education*, *113*(1), 195–218.

Topping, K., Buchs, C., Duran, D., & Van Keer, H. (2017). *Effective peer learning: From principles to practical implementation*. Routledge.

Perceived Mentoring Needs Among Faculty Members at a Metropolitan University - A Needs Assessment Pilot

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Abstract

Background: Faculty development is directly related to student success. While faculty-to-student mentoring is common in academia, especially in applied learning practices, a less common phenomenon is faculty-to-faculty mentoring. To facilitate the process of mentoring within and between faculty, it is necessary to understand their perceived needs. **Purpose:** The purpose of this study is to identify and evaluate the perceived mentoring needs of faculty members within a metropolitan higher education institution. Identifying the specific areas where faculty members require guidance and support provides valuable data for designing an effective, faculty-to-faculty mentoring program that would prove beneficial to support both students and faculty. **Methods:** Utilizing a survey technique, an electronic needs assessment questionnaire consisting of six major domains including effective classroom teaching, scholarship knowledge and skills, contributions to the institution and profession, college and university resources, career development skills, and leadership/management was distributed with respondents self-reporting their perceived mentoring needs. **Results:** 52 respondents completed the questionnaire from an initial 110 responses, representing a response rate of 10.9% of the university faculty. Faculty members expressed different mentorship needs based upon teaching experience and professional goals. The results provided insight into specific mentorship needs for faculty based on years of experience. **Conclusion**: The findings illuminate the multi-faceted mentoring needs of faculty. For the mentorship to be effective, consideration of the mentee's experience and professional goals should guide the development of mentoring programs.

***Keywords*:** faculty development, faculty mentoring needs, higher education

Introduction

A fundamental role of colleges and universities is to prepare learners to begin careers in their chosen field of study. The concept of applied learning, connecting classroom theory and experiential learning practices, assists in that preparation. Applied learning and faculty mentorship are closely associated as mentoring can significantly enhance the quality and relevance of applied learning experiences, closing the gap between academic understanding and real-world application (Francis & Abraham, 2025; NCFFD, 2026). As faculty-to-student mentorship models continue to be prominent in university settings (Nuis et al., 2023), the need increases for faculty-to-faculty mentorship across universities to ensure proper role modeling for students. Formal mentorship programs that provide training for mentorship roles and provide guidelines to support both faculty and students are fundamental for success in academia (Reibel et al., 2025). Faculty-to-faculty mentoring provides role modeling in classroom teaching, service, and research (Fountain & Newcomer, 2016; Rinfret, et al., 2023; Schwartz, 2023) as well as guidance through the tenure and promotion process (Ashley, et al., 2023; Schwartz, 2023**).** While the university's ability to support students' success is dependent upon the effectiveness of faculty mentoring, faculty-to-faculty mentorship is also essential to role development and retention for both new and experienced faculty. Current research on the perceived mentoring needs of faculty is limited especially when comparing across different levels of faculty experience. In the area of classroom teaching, there is also limited research regarding perceived mentoring needs due to changes in teaching strategies following the increased movement to online/ hybrid strategies and with the introduction of AI.

There is no consistent structure within mentorship programs across academic institutions (Schwartz, 2023; Zehara et al., 2023; Dyosini, 2025). In their review of mentorship practices, outcomes, and challenges within teacher education programs, Mwesigwa and Nakato expressed the need for "structured, evidence-based mentorship initiatives" (2026, p. 26) that consider a consistent structure, institutional support, and mentor training. Without strong mentorship models to follow, universities need to consider the development of mentoring programs that cater to the diverse needs of faculty across various disciplines as well as those that are tailored to meet the specific needs of individual faculty members.

Literature Review

Faculty at colleges and universities are considered experts in their fields; however, there is no consistent practice when preparing and mentoring new faculty members for the academic environment (Schwartz, 2023; Zehra et al., 2023; Dyosini, 2025; Mwesigwa & Nakato, 2026). Faculty-to-faculty mentoring is an integral part of the university culture, allowing new employees the opportunity to transition to their new role, and creating a safe learning environment for all faculty members (Glover et al., 2021; Kowalski, 2019; Rogers, et al., 2020). According to Wold et al. (2023), mentoring is an essential component for the success of the organization, decreasing attrition rates by supporting both new and experienced educators.

Faculty Characteristics

While it is reasonable to expect faculty members who are new to academia to have mentoring needs, experienced faculty, both those who are new to the university and those who have been at the university, may also have mentoring needs. When there is a formalized process, it is often tailored to a new faculty member, leaving experienced faculty on their own to navigate a new campus and environment. Experienced faculty members may not have the same mentoring needs as a new faculty member; therefore, it is essential to determine the perceived mentoring needs for all faculty members to ensure positive outcomes and acknowledge that needs vary. Midlevel or senior level faculty may need mentoring in career transitioning, acquiring competencies such as scholarly independence, educational skills, academic advancement or professional networking both on and off campus (Office of the Provost, 2016).

For faculty who come from practice disciplines, the transition from practitioner to faculty member may be challenging (Cole et al., 2020; Groth et al., 2023; Rogers et al., 2020; Scott-Herring & Singh, 2017), as the requirements of academia are distinctly different from those in the practice setting. While they may be experts in their field of practice, they are novices when it comes to navigating the nuances of academia. The lack of understanding what is needed to create a safe and rigorous learning environment can cause difficulties in transitioning to the faculty role. Adding a new language unique to academia and current learning practices can be overwhelming for this new group of faculty members.

Mentoring Levels

Faculty-to-faculty mentorship is not limited to the departmental level but can also occur at the college and university levels. While mentorship at the department level is essential, mentorship within the college and/or university level provides the opportunity to inquire how other departments or colleges manage situations found within the academic setting. Consistently addressing mentoring needs across the academic campus offers positive benefits, including greater confidence and comfort (Scott-Herring & Singh, 2017), higher career satisfaction, increased self-efficacy, and an expanded professional network that may lead to grant opportunities, more research time, publications, and a shorter time frame to tenure (Sarabinpour et al., 2023).

Tenure and Promotion

Tenure and promotion are individual efforts; knowing how and when to get involved in the academic community is not always intuitive. Thus, individuals who have not actively engaged in the academic community may struggle to secure tenure and promotion (Loya, 2022). Actively participating in the academic environment is enhanced through the guidance of a mentor who can provide direction for success. In the faculty-to-faculty mentorship relationship, guidance can be provided on effective classroom teaching techniques, enhancing scholarly activities, which often require faculty to engage with student mentorship, and identifying service activities at the department, college, and university levels as well as within the community and professional organizations. According to Schwartz (2023), formal faculty mentorship programs can

increase effective classroom teaching, research productivity, and in turn can promote a more supportive scholarly community.

Mentorship

When a faculty member begins their position, if a formalized mentorship program is not in place, they may find an informal mentor. While informal mentorship has benefits, it can lead to inconsistency in the information shared between faculty members (Glover et al., 2021; Zehra et al., 2023), as the needs of the mentee go unrecognized. The mentor's availability to the mentee should also be considered, as many have responsibilities in teaching, service, and scholarship themselves (Zehra et al., 2023). Heavy workloads of both the mentor and the mentee have a direct impact, hindering the overall mentorship experience. Mentors often take on this role without extra pay or reassignment time. The literature supports that work overload, time management constraints, as well as mismatched mentor-mentee pairings can create significant mentorship challenges (Busby & Draucker, 2024; Dyosini, 2025; Mwesigwa & Nakato, 2026; Wold et al., 2023). Providing education to mentors about the mentoring process offers positive outcomes for both mentor and mentee (Francis & Abraham, 2025; Scott-Herring & Singh, 2017).

Establishing a mentor-mentee professional relationship requires an aspect of personal or professional connection (Cole et al., 2020; Lunsford et al., 2018; Zehra et al., 2023). Mentoring is considered a long-term relationship, and the roles of the mentor include teacher, tutor, and facilitator. Mentors act as role models and provide feedback regarding career advancement and professional growth. Mentors assist new faculty members in their transition to the university setting, provide guidance on teaching methods, and bridge the gap between theory and practice. Mentors provide a broad range of support encompassing various areas, including professional, personal, and relational aspects (Cole et al., 2020; Kowalski, 2019; Nuis et al., 2023; Scott-Herring & Singh, 2017; Zehra et al., 2023).

Summary

Understanding the intricacies of faculty-to faculty mentoring is important to the establishment of a successful mentoring program that leads to job satisfaction, increased retention rates, and collaboration. A successful faculty-to-faculty mentoring program supports classroom teaching and research productivity giving guidance through the tenure and promotion processes thus supporting longevity. More importantly, in relation to the concept of applied learning, faculty-to-faculty mentoring provides an avenue for the faculty member to become an active learner supported in their assimilation into new roles. Faculty-to-faculty mentoring provides knowledge and skill development in the mentorship process through role modeling that supports both the development of future mentoring skills to be utilized in guiding other faculty but also in creating a safe experiential learning environment for students. As stated in the literature, formal mentorship programs that provide training and skill development to the mentor offer positive outcomes for both mentors and mentees. Identifying specific areas where faculty members require guidance and support, provides data that can guide the development of an effective mentoring program.

Methods

The purpose of this research was to pilot a needs assessment to identify and evaluate the perceived mentoring needs of faculty members within a midwestern, metropolitan higher education institution. The process used a survey technique with a questionnaire providing both open-ended and closed-ended questions. The study was reviewed by the University's Institutional Review Board and was determined to be exempt category research.

Measures

The questionnaire was developed to assess the perceived mentoring needs of full-time faculty. Published literature on developing needs assessment questionnaires guided the development of the tool (Sleezer et al., 2014). The content was based on a review of the literature regarding mentoring needs of higher education faculty, and their duties and responsibilities in teaching, service, and scholarship. The questionnaire was reviewed for content validity early in the process of development. The feedback received was used to refine the survey questions. The questionnaire consisted of six major domains with statements in which respondents self-reported their perceived mentoring needs using three options: "Yes" (need /interest), "No" (no need), and "Unsure" (interest in further discussion). The major domains included: Effective Classroom Teaching; Scholarship Knowledge and Skills); Contributions to the Institution and Profession (Service); College and University Resources; Career Development Skills; Leadership/Management. Additional narrative comments were encouraged at the end of each of the six domains. The questionnaire additionally included questions on previous mentorship experience, perceived strengths and weaknesses of mentorship participation, and willingness for future participation.

Participants

Full-time faculty members from various university departments were invited to participate in an anonymous Qualtrics questionnaire which was distributed via the university email blast. No identifying information was collected to ensure anonymity, and no incentives were provided for participation. Participants were presented with an informed consent form at the beginning of the survey, highlighting the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. Respondents were assured their data would be solely used for research purposes. Participants provided their consent to participate and completed the survey by selecting yes or no on the first question of the survey. Specific demographics of age and gender were not collected to avoid indirect identification of the participants.

Data Collection/Analysis

Questionnaire responses were gathered over a four-week period in 2025 from April 30th to May 28th and compiled into a dataset. Responses and data collected through the anonymous Qualtrics questionnaire were imported into the Statistical Package for the Social Sciences (SPSS, version 28). The quantitative data was analyzed using descriptive statistics. The narrative responses to open-ended questions pertinent to mentoring needs were presented following the corresponding domains.

Findings

Initial data was collected from 110 respondents, however, of those 110 respondents only 52 completed the majority of survey questions representing a response rate of 10.9% of the university's 476 full-time faculty.

Participant Demographics

The largest percentage of participants were from the College of Math and Science (48%) followed by the College of Education and Professional Studies (28%) and the College of Liberal Arts (13%). Among the respondents, 9.5% had 0-5 years of teaching experience, 20.6% had 6-10 and 11-15 years equally, and 49.2% had a total of more than 16 years of teaching experience.

The university's Executive Director of Institutional Research was interviewed to obtain current full-time faculty demographics in order to more accurately extrapolate the study results. In the 2024-2025 academic year, the university employed 476 full-time faculty members. Of those faculty, 102 had 0-5 years of experience (21%), 90 had 6-10 years of experience (18.9%), 99 had 11-15 years of experience (20.7%), and 185 had 16+ years of experience (38%) (W. Scheideler, personal communication, July 16, 2025). Comparing statistics obtained from the questionnaire respondents to those of the university statistics in regards to teaching experience, a smaller percentage of those with 0-5 years of experience (9.5% to 21% respectively) completed the questionnaire, and a larger percentage of those with 16+ years of experience (38% to 49.2% respectively) responded to the questionnaire. Those faculty with 6-10 years and 11-15 years of experience were nearly equal in percentage of the reported university faculty to questionnaire respondents.

Mentorship Experiences

Respondents were asked if they had previously participated in a cross-campus mentorship program either at UCO or another university. Of those who responded, approximately 86.7% had not participated in a cross-campus mentorship program prior to joining the surveyed university. Only a small portion (13.3%) indicated past participation. For the cross-campus mentorship program at the surveyed university, the result shows that 26.7% of participants participated; however, 50.7% of respondents stated they were unaware of the program's existence, 8 % reported disinterest when the opportunity was available, and 14.7% noted that the program had not been offered during their time at the university. Respondents who had previously participated in a cross-campus mentorship program were asked to identify their roles. More than half of those who responded to the question indicated they were mentees, 55.0% and 30.0% of participants transitioned from being mentees to mentors. Participants were then asked to identify their willingness to participate in a cross-campus mentorship program. Among the valid responses, 40.0% indicated a willingness to participate in a cross-campus mentorship while 49.3% expressed uncertainty. Only 10.7% declined participation.

The remainder of the needs assessment questionnaire was divided into the areas of Effective Classroom Teaching, Scholarship Knowledge and Skills, Contributions to the Institution and Profession, College and University Resources, Career Development Skills, and Leadership/Management. Narrative questions were asked in each of these categories, and respondents were allowed to provide open-ended feedback. Responses have been categorized based on years of experience and their perceived needs for mentoring in each area. Participants were divided into four experience groups: 0–5 years, (7.7%); 6–10 years, (23.1%); 11–15 years, (19.2%); 16+ years, (50%).

Perceived Mentoring Needs

Effective Classroom Teaching

Table 1 summarizes the perceived mentoring needs related to effective classroom teaching and presents the highest “yes” responses per year of experience group. Results of perceived needs in all other areas are presented similarly throughout the text. Respondents self-reported their perceived mentoring needs related to effective classroom teaching across 11 statements. The highest mentoring needs area among all participants was developing online/alternative teaching strategies (50.0%), followed by using technology to assist student learning (46.2%), assessment and evaluation strategies (38.5%), handling disruptive students (38.5%), and transformative teaching/learning skills (36.5%). The mentoring areas with lower reported needs include developing presentation skills (9.6%), followed by curriculum design/syllabus planning (19.2%) and providing feedback to learners (19.2%).

Early-career faculty (0–5 years) consistently show a high interest in mentoring across multiple areas, including technology use (75%), assessment strategies (75%), and exam construction (75%). This reflects mentoring needs in foundational competence in teaching. The 6-10 years group shows a high perceived need in transformative teaching (50%) and curriculum design (50%), while the 11–15 years group expressed mentoring needs in classroom management (60%) and portfolio development (30%). The 16+ group shows high interest in developing online strategies (50%) and technology integration (42%).

Mentoring Focus Area	*Yes (n, %)*	*No (n, %)*	*Unsure (n, %)*	*Highest Yes Group*
Developing online/alternative teaching strategies	26 (50.0%)	20 (38.5%)	6 (11.5%)	16+ years (50%), 11–15 (60%)
Using technology to assist student learning	24 (46.2%)	22 (42.3%)	6 (11.5%)	0–5 years (75%) & 16+ years (42%)
Assessment and evaluation strategies	20 (38.5%)	28 (53.8%)	4 (7.7%)	0–5 years (75%)
Handling disruptive students	20 (38.5%)	26 (50.0%)	6 (11.5%)	11–15 years (60%)
Transformative teaching/learning skills	19 (36.5%)	28 (53.8%)	5 (9.6%)	6–10 years (50%)
Developing a teaching portfolio	14 (26.9%)	31 (59.6%)	7 (13.5%)	11–15 years (30%) & 16+ (26.9%)
Creating a welcoming learning environment	14 (26.9%)	33 (63.5%)	5 (9.6%)	0–5 years & 16+ (50%, 27%)
Constructing exams and analyzing test items	13 (25.0%)	35 (67.3%)	4 (7.7%)	0–5 years (75%)
Curriculum design / syllabus / lesson planning	10 (19.2%)	37 (71.2%)	5 (9.6%)	6–10 years & 0–5 years (50%)
Providing feedback to learners	10 (19.2%)	38 (73.1%)	4 (7.7%)	0–5 years (50%)
Developing presentation skills	5 (9.6%)	42 (80.8%)	5 (9.6%)	0–5 years (50%)

Table 1. *Summary of Perceived Mentoring Needs in Effective Classroom Teaching (n=52)*

Open-ended Responses. Faculty included other qualitative responses and comments related to effective classroom teaching mentoring needs: dealing with incivility; handling plagiarism, and unauthorized use of AI in student papers; orientation regarding on-campus resources and how to access; research/statistics; improving courses' evaluation process; standardizing labs, tests, and course syllabi based on international standards.

Scholarship Knowledge and Skills

Table 2 summarizes the perceived mentoring needs related to professional/scholarship knowledge and skills. Respondents self-reported their perceived mentoring needs across 12 statements related to scholarship. The top reported areas across different experience levels were: turning teaching into academic scholarship (59.6%); finding funding opportunities (58.8%); grant writing resources (51%); involving students in scholarship (51%). Areas of understanding authorship, responding to reviewers, and dissemination strategies had the lowest reported mentoring needs **(**25% or lower).

Early-career faculty (0–5 years) reported the highest need across almost all categories, especially in grant writing (75%), IRB processes (75%), creative research development (75%), and understanding research and funding (75%). The 6-10 years group expressed the lowest mentoring need among all participants in the scholarship area. The 11 to 15 years group expressed high mentoring needs related to the areas of preparing expert review articles (55.6%), finding funding opportunities (77.8%), and involving students in scholarship (55.6%). Senior faculty (16+ year**s)** reported overall

lower mentoring need; however, they expressed a notable mentoring need in turning teaching into scholarship (57.7%) and computer technologies for research (53.8%).

Mentoring Area	*Yes (n, %)*	*No (n, %)*	*Unsure (n, %)*	*Highest Yes Group*
Turning teaching into academic scholarship	31 (59.6%)	18 (34.6%)	3 (5.8%)	0–5 years (75%)
Finding funding opportunities	30 (58.8%)	18 (34.6%)	3 (5.8%)	11–15 years (77.8%)
Grant writing resources	26 (51.0%)	19 (36.5%)	6 (11.5%)	0–5 years (75%)
Involving students in scholarship	26 (51.0%)	22 (42.3%)	3 (5.8%)	0–5 years (75%)
Computer technologies for research	24 (47.1%)	23 (44.2%)	4 (7.7%)	11–15 years (55.6%)
Creatively developing new research directions	21 (41.2%)	28 (53.8%)	2 (3.8%)	0–5 years (75%)
Preparing review articles or expert opinions	17 (34.0%)	28 (53.8%)	5 (9.6%)	11–15 years (55.6%)
Disseminating work (publication/presentation)	15 (29.4%)	31 (59.6%)	5 (9.6%)	16+ years (34.6%)
Understanding authorship and publication	11 (21.6%)	34 (65.4%)	6 (11.5%)	0–5 & 6–10 years (25%)
Responding to reviewers/revising manuscripts	11 (21.6%)	32 (61.5%)	8 (15.4%)	0–5 years (50%)
IRB submission and processes	14 (28.0%)	33 (63.5%)	3 (5.8%)	0–5 years (75%)
Expanding understanding of research discipline	13 (25.5%)	35 (67.3%)	3 (5.8%)	0–5 years (75%)

Table 2. *Summary of Perceived Mentoring Needs Related to Scholarship (n=52)*

Open-ended Responses. Other scholarship interests reported by faculty include: constructing budgets for grants; balancing research productivity and managing a heavy teaching load; receiving support and guidance from a preceptor; administration in activities related to scholarship; processes of external committee participation. One participant commented, “I have some skills. Hard to get traction.

Contributions to the Institution and Profession

Table 3 summarizes the perceived mentoring needs related to contributions to the institution and profession (service). Respondents self-reported their perceived mentoring needs across eight areas. The top reported mentoring areas across different experience levels included: constructing relationships at the university (48.0%); enhancing personal visibility (local/national), managing projects and programs (34.0%); designing a program evaluation plan (32%). Joining professional organizations and chairing committees had the lowest overall interest. However, early-career faculty (0–5 years) showed high interest in mentoring support for chairing committees (66.7%), joining professional organizations (66.7%), and conference participation (66.7%). The top perceived mentoring needs regarding service among the 6–10 years group are**:** advising student-led organizations (41.7%) and attending professional conferences

(33.3%). The 11–15-years group expressed a high percentage of perceived mentoring needs across several categories, like constructing university relationships (88.9%), enhancing personal visibility (77.8%), designing evaluation plans (55.6%), and managing programs (66.7%). Senior faculty 16+ years expressed the lowest mentoring need in the area of service; however, 19.2% reported mentoring needs in managing projects, and 7.7% are unsure.

Mentoring Area	*Yes (n, %)*	*No (n, %)*	*Unsure (n, %)*	*Highest Yes Group*
Constructing university relationships	24 (48.0%)	22 (44.0%)	4 (8.0%)	11–15 years (88.9%)
Enhancing personal visibility (local/national)	20 (40.0%)	26 (52.0%)	4 (8.0%)	11–15 years (77.8%)
Managing projects and programs	17 (34.0%)	30 (60.0%)	3 (6.0%)	0-5 years 100%)-11–15 years (66.7%)
Designing a program evaluation plan	16 (32.0%)	30 (60.0%)	4 (8.0%)	11–15 years (55.6%)
Chairing a committee/task force	11 (22.0%)	34 (68.0%)	5 (10.0%)	0–5 years (66.7%)
Advising student-led organizations	13 (26.0%)	35 (70.0%)	2 (4.0%)	6–10 years (41.7%)
Attending professional conferences	12 (24.0%)	36 (72.0%)	2 (4.0%)	0–5 (66.7%),
Joining professional organizations	5 (10.0%)	43 (86.0%)	2 (4.0%)	0–5 years (66.7%)

Table 3. *Contributions to the Institution and Profession (Service) (n=50)*

College and University Resources

Table 4 summarizes the perceived mentoring needs related to college and university resources. Faculty reported their perceived mentoring needs related to college and university resources across four statements or categories. The top reported mentoring areas across different experience levels are: reserving university space (40%), followed by obtaining student activity supplies (38.8%), and tenure & promotion guidance (34%).

The early career faculty (0-5 years) reported consistent mentoring needs across almost all categories (66.7%). The 6-10 years group expressed the lowest mentoring needs in this category. Faculty with 11–15 years of experience report a high mentoring need in obtaining supplies for student activities (87.5%) and understanding tenure & promotion (55.6%). Senior faculty (16+ years) reported high interest in mentoring for reserving space (34.6%) and printing support (32%).

Mentoring Area	*Yes (n, %)*	*No (n, %)*	*Unsure (n, %)*	*Highest Yes Group*
Reserving University Space (n=50)	20 (40.0%)	26 (52.0%)	4 (8.0%)	16+ years (34.6%)
Obtaining Supplies for Student Activities (n=49)	19 (38.8%)	28 (57.1%)	2 (4.1%)	11–15 years (87.5%)

Tenure & Promotion Criteria (college level) (n=50)	17 (34.0%)	33 (66.0%)	0 (0.0%)	11–15 years (55.6%)
Printing (e.g., Posters, 3D) (n=49)	16 (32.7%)	30 (61.2%)	3 (6.1%)	16+ years (32.0%)

Table 4. *College and University Resources*

Career Development Skills

Table 5 summarizes perceived mentoring needs related to career development knowledge and skills. Respondents self-reported their perceived mentoring needs related to career development across eight statements. The most commonly reported needs across different experience levels are: prioritizing activities toward tenure and promotion (36%); the relative importance of teaching, scholarship, and service; capturing and documenting academic work; balancing work and life (28%).

Early career faculty (0–5 years) showed high perceived mentoring needs across nearly all categories, especially in the areas of balancing personal and professional life (100%) and prioritizing activities toward tenure (100%). This group also scored highest in needs like dossier preparation (66.7 %) and documenting academic work (66.7%). It is noted that the 6-10 years group reported a lower perceived mentoring needs related to career development. The 11–15 years group expressed interest in career goal setting (44.4%) and learning communities. Senior faculty (16+ years) expressed lower overall needs in career development; however, 26.9% expressed a need in understanding academic balance.

Mentoring Area	***Yes (n, %)***	***No (n, %)***	***Unsure (n, %)***	***Highest Yes Group***
Prioritizing activities toward tenure & promotion	18 (36.0%)	30 (60.0%)	2 (4.0%)	0–5 years (100%)
Relative importance of teaching, scholarship & service	16 (32.0%)	33 (66.0%)	1 (2.0%)	16+ years (26.9%)
How to capture/document academic work	15 (30.0%)	32 (64.0%)	3 (6.0%)	0–5 years (66.7%)
Balancing personal & professional life	14 (28.0%)	35 (70.0%)	1 (2.0%)	0–5 years (100%)
Dossier preparation skills	13 (26.0%)	34 (68.0%)	3 (6.0%)	0–5 years (66.7%)
Joining a journal club / learning community	11 (22.0%)	35 (70.0%)	4 (8.0%)	16+ years (23.1%)
Setting long- & short-term career goals	9 (18.8%)	35 (70.0%)	4 (8.0%)	11–15 years (44.4%)
CV preparation skills	8 (16.0%)	38 (76.0%)	4 (8.0%)	16+ years (19.2%)

Table 5. *Summary of Perceived Mentoring Needs in Career Development (n=50)*

Leadership/Management

Table 6 summarizes the perceived mentoring needs related to leadership/management/ interpersonal skills. Respondents self-reported their perceived mentoring needs across six areas. The top needs expressed by all respondents are: negotiating skills (50%); conflict resolution (46%); academic administration processes (42%); creating and managing a budget (38.0%).

Early career faculty (0–5 years**)** consistently reported high mentoring needs in the leadership area, particularly in time management (66.7%). The 6-10 years group expressed a need for mentoring related to negotiating skills (50%) and receiving and using feedback (41.7%). The 11–15-year group expressed the highest need in academic administration skills (87.5%) and budget management (77.8%). Senior faculty (16+ Years) reported needs in conflict resolution and negotiation (42.3%).

Mentoring Area	***Yes (n, %)***	***No (n, %)***	***Unsure (n, %)***	***Highest Yes Group***
Negotiating skills	25 (50.0%)	23 (46.0%)	2 (4.0%)	16+ years (42.3%)
Conflict resolution	23 (46.0%)	24 (48.0%)	3 (6.0%)	16+ years (42.3%)
Academic administration processes	21 (42.0%)	27 (54.0%)	1 (2.0%)	11–15 years (87.5%)
Creating and managing a budget	19 (38.0%)	30 (60.0%)	1 (2.0%)	11–15 years (77.8%)
Receiving and using feedback	16 (32.0%)	28 (56.0%)	6 (12.0%)	6–10 & 11–15 years (41.7%)
Time management skills	15 (30.0%)	34 (68.0%)	1 (2.0%)	0–5 (66.7%).

Table 6. *Summary of Perceived Mentoring Needs in Leadership/Management (n=50)*

Discussion

Demographically, over 86% of the participants claimed no prior mentoring process while 49% of the participants had greater than 16 years of experience possibly indicating that mentorship programs were not as available during the early years of their tenure. Over half of the participants responded that they were unaware of a mentorship program on campus, however, a large number were willing to participate in a mentorship program. Positively, 30% of the participants that that had been mentored previously had transitioned into the role of mentors. Responses indicated that a well-publicized and available mentoring program tailored to the various stages of their academic careers would be supported.

The highest overall perceived needs of all participants relating to effective classroom teaching indicated a need for understanding online and alternative teaching strategies and acquiring skills to facilitate student learning through technical support. Qualitative statements indicated concern with response to student incivility, plagiarism, and unauthorized AI use as well as assistance in building skills towards classroom organization. It is important to consider different instructional approaches in the

changing classroom environment as well as changing student characteristics (Shet, 2024). The concept of AI-giarism, concerning misuse of AI tools in an academic context, is having a rising impact on academic integrity (Chan, 2024). Mentoring can assist in decision-making in preemptive strategies to combat these growing changes.

Perceived needs for mentoring in the area of professional scholarship knowledge and skills were shared equally between learning how to turn teaching into academic scholarship and guidance in involving students in scholarship. Adebesi (2022) states that as more research is needed to advance knowledge and innovation in all fields of study, both students and faculty mentors can benefit from participating in undergraduate research. Participation in undergraduate research is an example of applied learning where mentoring is an essential component. Involving students in scholarship is tied into the tenure and promotion process. Qualitatively a need for balancing teaching load and scholarship was made evident supporting the quantitative data. This is reflected in the literature regarding concern over time constraints and heavy workloads.

Creating relationships and developing personal visibility both on campus and within the community were expressed needs requiring mentoring for contributions to the institution and profession (service) which is a strong component for the tenure and promotion process in most higher education institutions. Reiterated again within the perceived mentoring needs for career development were both the tenure and promotion processes as well as finding a balance between workplace and life experience. While college and university resources were focused more practically at obtaining space or student supplies, there was a high need to be mentored on finding resources for tenure and promotion.

The following discussion addresses the years of experience categories separately.

0-5 Years of Experience

Early career faculty (0-5 years) lack familiarity with the academic environment, its expectations, and professional demands. As a result, they view mentoring essential for their professional development. Based on the findings of this survey, early career educators indicated a need for mentoring in many categories including technology use, assessment strategies, and exam construction. As new educators they were interested in turning teaching into academic scholarship through grant writing, involving students in scholarship, creating new research directions, and learning more about the IRB submission and processes while expanding their understanding of the research discipline. This group of respondents would also like to understand the process of chairing a committee or a task force and attending professional conferences. As the tenure and promotion process was new to early career educators, they expressed a need to prioritize activities that lead to tenure and promotion including capturing/documenting academic work, balancing their personal and professional lives, time management skills, and preparing their dossier.

6-10 Years of Experience

Early mid-career (6-10 years) educators identified areas of perceived mentoring needs for effective classroom teaching regarding the implementation of transformative learning within the classroom, curriculum design, and lesson planning. Understanding authorship and publication were areas of concern within scholarship. Responses to perceived mentoring needs of contributing to the institution and professional organizations was primarily related to advising student groups. This group expressed a high interest in mentoring regarding receiving and using feedback. It was noted that among the early mid-career educators that the perceived mentoring needs reflected upon personal growth concerning tenure and promotion.

11-15 Years of Experience

Considering effective classroom teaching, the mid-career (11-15 years) educators had mentoring needs for developing online and alternative teaching strategies, developing a teaching portfolio, and handling disruptive students. Mentoring assistance in publication, funding opportunities, and computer technologies for research prevailed. These faculty have completed the tenure process and eligible for promotion. These individuals are more comfortable with academic requirements. Mid-career faculty may now be moving into leadership roles and this role expansion leads to a desire to learn more about activities that will build not only their own capabilities, but activities that will benefit others in the academic environment. Mentoring in academic administration processes and creating and managing a budget were high ranking concerns.

16+ Years of Experience

Faculty members in their mid-late career (16+ years) are discovering new ways to teach and have the desire to become more proficient in newer technologies which is reflective of constant changing technologies available and changing student perspectives toward the teaching-learning process. These educators identified mentoring needs in the areas of on-line teaching and transformative teaching skills. Dissemination of work through publications and presentations remain a high perceived mentoring need. Regarding leadership/management, guidance in the skill of negotiation and conflict management were identified.

Limitations

The needs assessment reported the perceived mentoring needs and experiences of a cross-sectional cohort of full-time faculty at a mid-western, metropolitan university with a Carnegie Classification as a Research Institution. The extent to which the expressed mentoring needs are comparable to those of similar universities or higher education institutions with different faculty demographics, resources, or culture is unknown. A decrease in the number of completed questionnaires was related to a distribution error. Correcting and expanding distribution of the questionnaire to other institutions within the same classification would enable a broader generalizability. Additionally, the skew in teaching experience may limit the generalizability of these findings to a broader, more representative faculty population.

Recommendations and Conclusion

Mentoring needs of faculty may change with years of experience. The results showed that perceived mentoring needs of early-career faculty span across the categories of teaching, scholarship, and service. As years of experience increase, the mentoring needs of faculty transition from establishing who they are as educators to building their scholarship and grant writing activities. Once faculty accomplish these milestones, their focus then moves to using computer technologies for research and finding ways to publish and disseminate research findings. Later in their career, educators feel the need to revive their focus on education and investigate ways to improve their online teaching as well as incorporate transformative teaching strategies using technologies, in addition to seeking new funding opportunities.

The general recommendations based on the needs assessment results include a) conducting mentoring needs assessment for all faculty joining higher education institutions, not just those new to academia, b) developing customized mentoring programs by career stages and departments and/or college-specific mentoring groups, and c) providing faculty development opportunities on mentoring skills.

Similar needs assessment studies are needed at various universities with different demographics, resources, research designations, and cultures. A comparative analysis among the various universities could highlight mentorship needs that had not been considered in this study. Future research targeting early-career faculty mentoring needs and their knowledge about their role expectations, and professional demands in academic settings is also needed to tailor mentorship programs that fit the needs of new educators.

Mentoring is an essential component for organizational success, retention, and overall satisfaction of faculty members. In higher education, for a mentoring program to be effective, it should be based on the assessed needs recommendations of faculty at each stage of their career development.

References

Adebesi, Y. (2022). Undergraduates students' involvement in research:Values, benefits, barriers and recommendations. *Annals of Medicine and Surgery*, 81, 1-5. https://doi.org/10.1016/j.amsu.2022.104384

Ashley, A., Fowler, L., & Hausegger, L. (2023). Integrating mentoring with P&T processes: A case study from the school of public service at Boise State. *Journal of Public Affairs Education*, *29*(4), 481–496. https://doi.org/10.1080/15236803.2023.2249742

Busby, K. R. & Draucker, C. B. (2024). Institutional factors that affect faculty mentoring in academic nursing programs. *Journal of Professional Nursing,* 54, 164-170. https://doi.org/10.1016/j.profnurs.2024.07.006

Chan, C. (2024). Students' perceptions of "AI-giarism": Investigating changes in understandings of academic misconduct. *Education and Information Technologies*, 30, 8087-8108. https://doi.org/10.1007/s10639-024-13151-7

Cole, B., Zehler, A., & Arter, S. (2020). Role-reversal mentoring: Case study of an active approach to faculty growth. *Journal of Nursing Education, 59*(11), 627-630. https://doi.org/10.3928/01484834-20201020-05

Dyosini, T. (2025). Mentorship as a professional development tool: Addressing early childhood female teachers' lived experiences and perceptions. *Journal of Education,*102, 87-110. https://doi.org/10.17159/2520-9868/i102a05

Fountain, J., & Newcomer, K. E. (2016). Developing and sustaining effective faculty mentoring programs. *Journal of Public Affairs Education*, *22*(4), 483–506. https://doi.org/10.1080/15236803.2016.12002262

Francis, C. & Abraham, M. (2025). Mentoring practices and their impact across educational and professional contexts: a systematic literature review *International Journal of Scientific Development and Research, 10*(8), a610-a615. ISSN:2455-2631

Glover, H.A., Hitt, A., Zills, G., Darby, W., Hall, C., & Kirkman, T. (2021). Nurturing novice faculty: Successful mentorship of nurse practitioners. *The Journal of Nurse Practitioners, 17,* 1271-1275. https://doi.org/10.1016/j.nurpra.2021.07.015

Groth, S.M., Duncan, R., Lassiter, J., & Madler, B.J. (2023). Onboarding orientation for novice faculty: A quality improvement pilot project. *Teaching and Learning in Nursing, 18,* 212-218. https://doi.org/10.1016/j.teln.2022.07.010

Johnson, W.B. (2016). On being a mentor. A guide for higher education faculty (2nd ed.). Routledge.

Kowalski, K., (2019). Differentiating mentoring from coaching and precepting. *Journal of Continuing Education in Nursing, 50*(11), 493-494. https://doi.org/10.3928/00220124-20191015-04

Loya, K.I. (2022). Navigating institutional expectations of faculty work: Making meaning of the message. *The Journal of Faculty Development, 36*(2), 54-59.

Lunsford, L., Baker, V., & Pifer, M. (2018), Faculty mentoring faculty: career stages, relationship quality, and job satisfaction. *International Journal of Mentoring and Coaching in Education*, *7*(2), 139-154. Doi: 10.1108/ijmce-08-2017-0055.

Mwesiga, F. & Nakato, N. (2026). Mentorship in teaching education programs: A review of practices, outcomes, and challenges. *Acta Pedagogia Asiana 5*(1), 15-29. https://doi.org/10.53623/apga.v5i1.679

National Center for Faculty Development and Diversity (NCFDD) (2026, June 05). Solutions for faculty mentoring: What is faculty development? https://www.ncfdd.org/resources/what-is-faculty-development/

Nuis, W., Segers, M., & Beausaert, S. (2023). Conceptualizing mentoring in higher education: A systematic literature review. *Educational Research Review, 41,* 1-22. https://doi.org/10.1016/j.edurev.2023.100565

Office of the Provost. (2016). Guide to best practices in faculty mentoring. Columbia University. https://provost.columbia.edu/

Reibel, Y.G., Jiang, Z., Arnett, M.C. (2025) "Mentor Like Minnesota: Outcomes of an undergraduate research mentorship program." *Journal of Dental Hygiene (Online) 99*(2), 48-54.

Rinfret, S.R., Young, S.L., & McDonald, B.D. (2023), The importance of mentorship in higher education: An introduction to the symposium. *Journal of Public Affairs Education*, *29*(4), 398-403. https://doi.org/10.1080/15236803.2023.2260947

Rogers, J., Ludwig-Beymer, P., & Baker, M. (2020). Nurse faculty orientation. *Nurse Educator, 45*(6), 343-346. https://doi.org/10.1097/NNE.0000000000000802

Sarabinpour, S., Niemi, N.M., Burgess, S.J., Smith, C.T., Bisson Filho, A.W., Ibrahim, A., & Clark, K. (2023). The faculty-to-faculty mentorship experience: a survey on challenges and recommendations for improvements. Proc R. Soc. Royalsocietypublishing.org/journal/rsbp. https://doi.org/10.1098/rsbkp.2023.0983

Schwartz, M. G., (2023) "Practical guidelines for development of a university-wide faculty mentorship program using a multimodal mentoring network model", *To Improve the Academy: A Journal of Educational Development, 42*(1): 2. doi: https://doi.org/10.3998/tia.1370

Scott-Herring, M., & Singh, S. (2017). Development, implementation, and evaluation of a certified registered nurse anesthetist preceptorship-mentorship program. *The Journal of Continuing Education in Nursing, 48*(10), 464-473. https://doi.org/10.3928/00220124-20170918-08

Shet, A. (2024). New horizons in teaching: A comparative review of online and traditional teaching methods. *International Journal for Multidisciplinary Research, 6*(3), 1-8. E-ISSN 2582-2160

Sleezer, C. M., Russ-Eft, D. F., & Gupta, K. (2014). A practical guide to needs assessment (3rd ed.). Wiley.

Wold, C., Moon, A., Schwan, A. Neville, A. & Outka, J. (2023). The importance of pairings in mentorship programs. *Critical Questions in Education, 14*(2) Summer, 120-139. EJ13822022 EISSN-2327-3607

Zehra, T., Tariq, M., Rheman, R., & Zuberi R.W. (2023). Basics of faculty-to-faculty mentoring: A process to identify support and challenges. *PLoS ONE, 18*(6), 1-7. https://doi.org/10.1371/journal.pone.0287127

Rethinking Formative Feedback in HyFlex and Applied Contexts: A Distributed, Time-Decoupled, and Multi-Touch Design Framework

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Abstract

In applied learning, we aspire to design a course structure with formative feedback as close as possible to the point of applied learning. However, in practice, logistics do not always allow this clean and simple integration. HyFlex learning environments further challenge instructional design by allowing students to tackle learning activities asynchronously, away from other students who choose the in-person class experience.

This study examines the design strategies for learning and formative feedback in four undergraduate applied learning courses in manufacturing and engineering technology. A cross-case analysis examines how learning is configured when students engage with preparation, application, feedback, and reflection at different times and through different modalities.

Findings demonstrate a learning support structure distributed across instructional structures and activities, time-decoupled, with multi-touch exposure. While these patterns emerge in HyFlex classes, they apply to many traditional applied learning course environments. This paper proposes a conceptual framework that serves as a design lens for partially asynchronous applied learning environments.

Keywords: Applied Learning, HyFlex, Formative Feedback, Asynchronous Learning

Introduction

Applied learning frameworks rightly emphasize iterative formative feedback cycles to enable student learning (Ash & Clayton, 2009; Kolb, 1984; Nicol & Macfarlane-Dick, 2006). In addition to the general desirability of feedback being timely to the point of learning (Nicol & Macfarlane-Dick, 2006), theories of situated cognition suggest that knowledge develops through participation in authentic activity, with learning and application occurring together rather than in separate phases (Brown et al., 1989; Herrington & Oliver, 1995) Unfortunately, applied learning environments are not always conducive to embedded learning or to immediate feedback. Teacher-to-student ratios during class activities limit instructor availability for individualized support to all students simultaneously. Expectations for students to study or prepare outside of class, and even student practical experiences in the community, are common examples of situations that can decouple instructor feedback from the immediate point of student activity.

HyFlex and partially asynchronous learning environments further disrupt the immediate-feedback scheme by allowing students to engage with content, tasks, and feedback at different times and through different modalities. This shift makes visible a set of structural features that are often present but less apparent in traditional settings: learning is not a single event or phase, but a system of multiple, distributed engagements—a multi-touch process that supports the integration and application of knowledge.

This paper examines how learning and formative feedback are structured under these conditions and proposes a framework for understanding and designing distributed, time-decoupled, and multi-touch learning environments in HyFlex and applied learning contexts.

Literature Review

Formative Feedback Foundations

Nicol and Macfarlane-Dick (2006), in their work on student self-regulation, proposed that “Good quality external feedback is information that helps students troubleshoot their own performance and self-correct.”

Drawing on earlier discussions by Sadler (1998) and Black and Wiliam (1998), Nicol and Macfarlane-Dick (2006) summarize formative assessment as “assessment that is specifically intended to generate feedback on performance to improve and accelerate learning.” Formative feedback is therefore a subset of a broader formative assessment process, which includes additional steps such as goal alignment, instrument development, and data collection. Because this study focuses specifically on the step of providing students with quality feedback, we typically use the term "formative feedback" rather than "assessment."

Formative feedback is not limited to teacher-provided feedback. Peer-review, peer discussion groups, automated quiz feedback, self-reflection (Black & Wiliam, 1998; Morris et al., 2021; Nicol & Macfarlane-Dick, 2006; Sadler, 1998; Zhu & Bonk, 2025),

and now generative AI mentors can provide different feedback avenues (Kestin et al., 2025; Shaya et al., 2026; Zhu & Bonk, 2025).

Nicol and Macfarlane-Dick (2006), reviewing the literature, concluded that “There is considerable research evidence to show that effective feedback leads to learning gains.” The meta-analysis by Black and Wiliams (1998) demonstrated that “feedback produced significant benefits in learning and achievements.” However, researchers are quick to point out the variety and variability of quality of various approaches and modes of feedback (Black & Wiliam, 1998; Crooks, 1988; Morris et al., 2021; Sadler, 1998).

Experiential and Applied Learning

Grounded in Dewey (1938) and Kolb’s experiential learning cycle (1984), the applied learning literature emphasizes iterative feedback and learning cycles that are foundational to today’s applied learning design. Ash and Clayton (2009) further incorporated the DEAL model, suggesting questions to support students in guided critical reflection.

Self-directed or Self-regulated Learning

Nicol and Macfarlane-Dick state “A central argument is that, in higher education, formative assessment and feedback should be used to empower students as self-regulated learners” (2006). Zimmerman, the father of self-regulated learning scholarship, states that “Self-regulation refers to self-generated thoughts, feelings, and behaviors that are oriented to attaining goals” (Zimmerman, 2002). Formative feedback plays a critical role in helping self-regulated students understand goals appropriate to their learning needs and thus make wise choices (Nicol & Macfarlane-Dick, 2006). “Students are self-regulated to the degree that they are metacognitively, motivationally, and behaviorally active participants in their own learning process” (Zimmerman & Schunk, 2008).

While self-regulated learning focuses primarily on the metacognitive, motivational, and behavioral processes, self-directed learning is more directly concerned with learner control over educational decisions (Brookfield, 2017). Zhu and Bonk provide an example of supporting self-directed learning needs. They share 15 guidelines for developers of open online “MOOCs or similar online classes. Some of the topics include: Helping students set their own learning goals, offering flexible timelines, embedding tasks and activities to form a learning community, etc. (Zhu & Bonk, 2025).

HyFlex and asynchronous learning foundations

HyFlex learning refers to learning environments in which students may choose, at any time during the course, whether to participate in person or online. Some HyFlex courses may require synchronous online attendance, but in most HyFlex cases, asynchronous participation provides the intended flexibility. Brian Beatty (2019) is generally credited with originating the terms “Hybrid-Flexible” and “HyFlex.” One of the four main principles of HyFlex instruction outlined by Beatty is “Equivalency,” defined as providing learning activities in all participation modes (e.g. synchronous and asynchronous) which lead to equivalent learning outcomes. There may be slight differences in resources available to

in-person students or the method of student submission, but the assignment should lead to the same outcome. This principle is important to our consideration of the design for learning and feedback in active learning HyFlex classes, since the asynchronous learner will not have immediate access to instructor feedback.

Among the research targeting HyFlex learners, Broadbent et al. (2021) compared fully online with blended (HyFlex) learners with respect to their preparedness for self-regulated learning. They isolated learner measures of self-efficacy, time management, and effort regulation, finding these elements to be, to a certain extent, predictors of success. They also demonstrated the positive effect of formative feedback on later performance.

Existing scholarship explains the value of formative feedback, reflection, and self-regulation, but offers less guidance on how to structure formative feedback when participation and feedback become partially asynchronous. This study seeks to address this design challenge.

Methodology

This study employs a practice-based, cross-course interpretive analysis of learning activities and formative feedback structures in applied learning environments in five applied engineering and manufacturing courses.

The purpose of the study is not to evaluate the effectiveness of a specific intervention, but to examine how learning and formative feedback may be structured across applied learning and HyFlex or partially asynchronous conditions. Concepts and frameworks that emerge from this study are derived from repeated cycles of designing, teaching, observing, and refining instruction over time. This approach aligns with reflective traditions in the scholarship of teaching and learning (Ash & Clayton, 2009; Kolb, 1984), in which instructional practice, reflection, and iterative refinement serve as a basis for improving course design (Poole, 2019).

Context and Courses

Table 1 summarizes the learning elements in the course designs of five applied learning courses administered by the author for undergraduate students in Mechanical Engineering Technology and Robotics and Automation Engineering Technology. (Two different CAD classes are similar in structure and represented by one line of the table.) “HyFlex” mode refers to times when students have the choice to attend in person, attend synchronously with the scheduled class, or work on assignments asynchronously. With the exception of the Industrial Robotics course, the instructor has taught these courses for 15 years. HyFlex modalities have been integrated in only the last three years.

All five classes have strong elements of applied learning as the primary method of instruction. Even when HyFlex options were introduced into the courses, labs were kept as in-person requirements—except for CAD classes, since students may set up their own software if they are comfortable working independently.

Course Topic & Scheduled Lect/Lab Hours per Week	***Modality (Synchronous, Asynchronous, or HyFlex)***	***Timing of Learning Activities***	***Feedback Timing***	***Key Tensions or Constraints***
CNC Programming *4 hrs in Lab*	HyFlex developmental lab time In-person machining of projects	Pre-project prep activities + simulation feedback on program geometry + Post-project reporting reflection (informs subsequent project work)	Immediate feedback with prep quizzes and program simulations. Instructor review of projects with iterative opportunities to improve prior to machining. Immediate in-lab feedback during machining. Delay of instructor feedback on submitted documentation and reflection.	Ensuring student integrates preparation into the project application. Asynchronous prep students miss early instructor interaction and review.
Automation with PLCs *3 hrs in Lab* *1 hr flexible Lecture**	In-person lab time Asynchronous lecture activities	Formative guidance embedded into labs, grows into real-world application projects + Formative “on-your-own” lecture activity sheets + Post-lab extended learning with assigned media content and quizzes	Immediate instructor assistance and feedback in lab. Immediate competency checks with iterative opportunities to improve. Immediate quiz results. Delay on some activity sheets that have no automatic review.	Managing accountability for asynchronous activities.
CAD courses (2D or 3D) *6 hrs in Lab*	Hyflex choice (in-person or asynchronous)	Independent work through formative tutorials + application problems. Opportunities to improve project work.	Variable feedback timing: Immediate review for synchronous students, Asynchronous students' time with the instructor is delayed by appointment, required biweekly.	Fully scored competency grades are time-consuming for the instructor to mark-up and cause delays.

Industrial Robotics Lab *2 hrs in lab + 2 hrs prep or lab appointment*	Mostly synchronous	Initial formative applications. Student-driven real-world application team projects.	Immediate instructor feedback during synchronous lab time (embedded, informal). Reflection accompanies milestone reporting and final reporting.	Attempting to improve structured formative cycles, reflection, and feedback points.

Table 1. Learning activities and formative feedback strategies for selected applied learning courses. *Times reflect actual student activity hours scheduled in the lab, which may incorporate catalog "lecture" time for active learning classes. Catalog hours may vary.

Data sources

The study draws from the course design structures implemented and documented in syllabi, course learning management systems, and assignments.

Interpretive cross-course analysis

Table 1 compares the courses in terms of modality, timing of learning activities, timing of feedback, and key tensions or constraints noted by the instructor.

Framework Development Process

Comparison of learning structures across courses in Table 1 revealed several recurring patterns. First, formative feedback was rarely confined to a single activity and instead appeared across preparatory activities, application tasks, reflection opportunities, and reinforcement activities. Second, feedback sometimes occurred, by necessity, separately from the original learning activity. Third, successful learning often depended on students engaging independently with resources and feedback opportunities. Finally, important concepts were revisited through multiple encounters across activities and contexts.

Results

Emergent Design Patterns

Recurring patterns from the five courses were synthesized into five course design dimensions:

- **Distributed** - Formative feedback and learning supports are distributed across multiple instructional activities, resources, and interactions rather than concentrated in a single instructional event. Learning activities may be engaged at different stages of the learning process (such as prep activities, post-activities, or embedded within an active learning project).
- **Time-decoupled** - Course activities are not bound by a specific shared time (such as a class meeting time or time within the class meeting). Asynchronous engagement means feedback is also asynchronous, not immediate.

- **Self-directed** - Learners control the pacing of their learning activities. Students must practice self-regulation and time management.
- **On-demand** - Learners access specific learning activities and resources when they are ready for them. The instructor must provide course organization such that learners know the resources exist, are appropriate, and are available.
- **Multi-touch** - Important learning objectives are encountered repeatedly through multiple activities, feedback opportunities, and applications, allowing students to reinforce and extend learning over time.

Figure 1 depicts the five design dimensions comprising the Distributed Formative Feedback (DFF) Design Lens. The framework is intended as a design lens rather than a process model. The five design dimensions are intended to support existing iterative applied learning processes commonly represented by experiential and reflective learning models, such as Kolb's experiential learning cycle and Ash and Clayton's DEAL framework.

The DFF Design Lens does not propose a new model of learning. Rather, it provides a way for instructors to examine how learning activities, resources, feedback opportunities, and reflection may be structured to support formative feedback across different times and modalities.

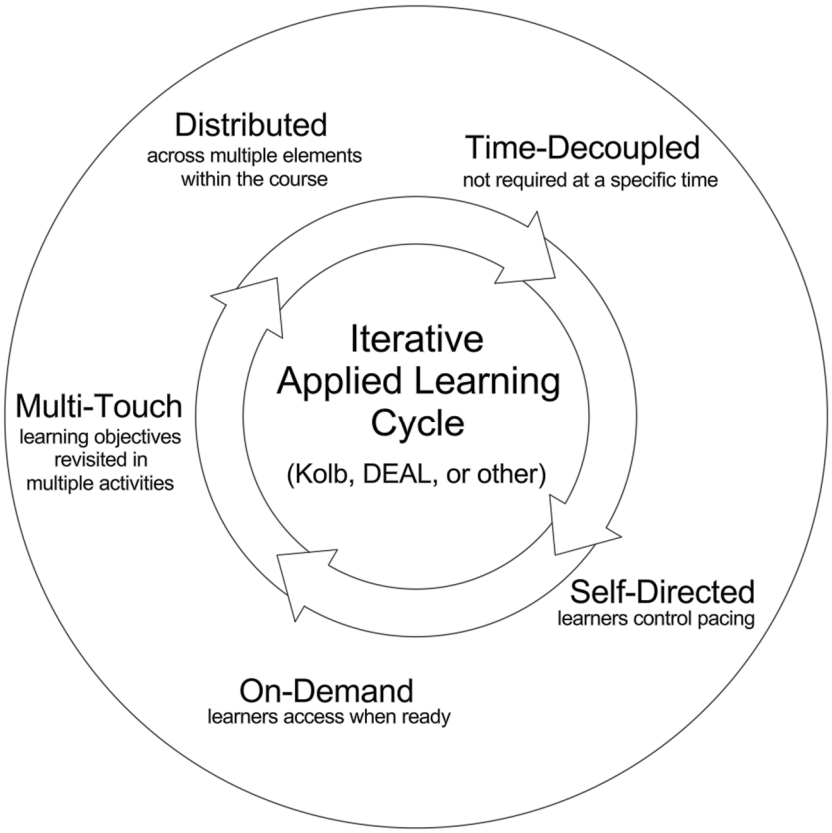


Figure 1. Distributed Formative Feedback (DFF) Design Lens

Discussion

Interpreting the Design Lens Framework

In Figure 1, the iterative applied learning cycle remains the central driver of the course, but is flexibly supported by the five design dimensions in the outer ring. The framework is intended as a design lens, not a new theory of learning. It serves as a means for the instructor to think through provision for all the layers of multi-touch experiential learning and feedback helpful to the execution of a HyFlex class.

Distributed Formative Support

Learning activities and feedback are often built into multiple stages and activities distributed within the course. Across the courses in Table 1, learning is distributed across multiple instructional components:

- preparation materials
- new content embedded into activities and application tasks
- student reflections
- iterative improvements of work after feedback (from peers or instructor)
- post-lab activities that reinforce and extend learning

Learning elements are not isolated strategies. They collectively support the applied learning course design strategy. Feedback from instructors, course software, automated quizzes, peer interactions, and self-reflection may all contribute to distributed formative feedback throughout the course.

Time-decoupled Formative Support

While our traditional concept of iterative reflective learning favors immediate feedback (Zhu & Bonk, 2025) , or as close to the point of learning as possible, the fact is that, even before implementing HyFlex opportunities in these courses, learning and formative feedback were sometimes difficult to synchronize among students. Not all students are working on the same learning activity at the same time. Even when students would be expected to be working on the same activity at the same time (such as all the automation lab students working on the same PLC lab assignment, or all in-person CAD students working on the same learning assignment prior or application project), the teaching materials are often self-paced, such that some students get ahead of others who are not rushed beyond their comfortable learning pace.

Self-directed Learning

Decoupled activities require students to practice greater self-direction, since the instructor is not there to help time and lead students along in lock-step. Greater expectations of self-direction may require instructors to better prepare students for this responsibility (Nicol & Macfarlane-Dick, 2006; Zhu & Bonk, 2025).

On-demand Learning Activities and Resources

This design dimension reminds the instructor of the need to provide materials sufficient for students to access the learning materials they need at the moment they need it.

This includes organizing the materials in a manner that students will know the resources exist and may be of assistance.

Multi-Touch Learning

“Multi-touch” refers to repeated interactions with key ideas through preparation, application, feedback, and reflection, rather than one-time exposure. Learning is reinforced and sometimes augmented. An example would be in the PLC class:

- A student first encounters a type of PLC instruction in a lab application.
- The student applies the PLC instruction again in a later lab problem.
- The student works a practice problem applying the instruction on a worksheet “on-your-own” lecture assignment.
- The student learns alternative industry terminology related to this instruction while working through the professional subscription media assignment.

Applying the DFF Design Lens: CNC Course Example

Table 2 provides an illustration of Distributed Formative Feedback Design applied to the CNC course.

DFF Design Lens Dimension	Examples in the CNC Course
Distributed	Prep worksheets, CNC projects, Tooling U; Project test and build with instructor
Time-Decoupled	Independent preparation before project
On-Demand	Students revisit videos and references
Self-Directed	Students troubleshoot programs independently
Multi-Touch	Concept encountered in worksheet, project, and reinforcement assignment

Table 2. Distributed Formative Feedback (DFF) Design Lens applied to the CNC class

Applying the DFF Design Lens: Automation Course Redesign

The automation course provides an example of how the DFF Design Lens can guide course redesign or adjustment.

Prior to offering HyFlex options, the course was already equipped with teaching videos, quizzes, study worksheets, and Tooling U online learning modules, all appropriate for students across all HyFlex modalities.

However, the need to support HyFlex students highlighted gaps in distributed, time-decoupled learning support necessary for asynchronous participation: Asynchronous HyFlex students miss out on the on-the-spot feedback available in our in-person active-learning classrooms. Before HyFlex, lecture meeting time for the automation class was

often used for student groupwork and interaction with the instructor to provide peer assistance and feedback. This group experience was awkward to video-capture and replicate for HyFlex students to similar benefit.

DFF Design Lens Dimension	Examples in the Automation Course
Distributed	Prep worksheets assigned each week, PLC implementation and testing in the lab, Tooling U; Project test and build with instructor
Time-Decoupled	Students work the weekly prep activity and Tooling U on their own time
On-Demand	Students check out videos, references, and Tooling U whenever they want to between class meetings.
Self-Directed	Students troubleshoot programs independently or with one team member during lab time. The instructor is available to assist if needed, and to check work.
Multi-Touch	Concepts encountered in worksheets show up in lab project implementation. Similarly, elements first encountered in a lab might reappear in a Tooling U assignment.

Table 3. Distributed Formative Feedback (DFF) Design Lens Applied to the Automation Course

Instead of in-person group work, the instructor created online resources (worksheets and videos) accompanied by quizzes, allowing students to self-check their worksheet activities or study guides. Although these quizzes do not provide feedback on higher-order critical thinking or creative work, they help students check basic understanding of technical building blocks, applications, and terminology. Scheduled self-check quizzes also help motivate participation, and self-directed students often experience positive reinforcement when meeting this goal.

Higher-order critical thinking occurs during lab projects that involve PLC programming and implementation.

Although developed from HyFlex and partially asynchronous course designs, the DFF Design Lens may also help instructors examine formative feedback structures in traditional applied learning environments, internships, laboratories, and other settings where feedback naturally becomes distributed across time and activities.

Limitations and Opportunities

The purpose of this study was to explore options for meeting the partially asynchronous delivery and feedback demands encountered in HyFlex or hybrid applied learning, experiential workplace learning, and other educational situations affected by in-person scheduling limitations. This design framework was developed based on the diverse designs of five courses. The study results could be further strengthened by:

- Testing of transfer to other types of courses.
- Collection of data to gauge successful learning from the multi-touch formative feedback structures.

- More robust incorporation of reflection opportunities.

One limitation of the current framework is that it focuses on the organization and accessibility of formative supports rather than differences in pedagogical impact among feedback sources. Future work might examine how instructor, peer, automated, and self-reflective feedback contribute differently to distributed and time-decoupled learning systems.

Another limitation of time-decoupled course elements is the increased placement of self-regulated learning responsibility on students. There is opportunity to further strengthen and support student self-regulation of learning.

Conclusion

The Distributed Formative Feedback (DFF) Design Lens framework was designed to meet the particular needs of the courses it serves, but it demonstrates a robust, flexible structure that instructors can draw on when it is difficult to embed synchronized learning and feedback directly within applied learning experiences, or when learning needs reinforcement. The DFF Design Lens suggests avenues through which instructors may expand formative feedback opportunities for students across a variety of participation modes.

References

Ash, S., & Clayton, P. (2009). Generating, Deepening, and Documenting Learning: The Power of Critical Reflection in Applied Learning. *Journal of Applied Learning in Higher Education*, *01*(Fall), 25–48. https://doi.org/10.57186/jalhe_2009_v1a2p25-48

Beatty, B. J. (2019). Hybrid-Flexible Course Designs: Implementing Student-Directed Hybrid Classes. In *Hybrid-Flexible Course Design* (1st ed.). EdTech Books. https://doi.org/10.59668/33

Black, P., & Wiliam, D. (1998). Assessment and Classroom Learning. *Assessment in Education: Principles, Policy & Practice*, *5*(1), 7–74. https://doi.org/10.1080/0969595980050102

Broadbent, J., Sharman, S., Panadero, E., & Fuller-Tyszkiewicz, M. (2021). How does self-regulated learning influence formative assessment and summative grade? Comparing online and blended learners. *The Internet and Higher Education*, *50*, 100805. https://doi.org/10.1016/j.iheduc.2021.100805

Brookfield, S. D. (2017). Self-Directed Learning. In *The SAGE Encyclopedia of Out-Of-School Learning* (pp. 688–691). SAGE Reference.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, *18*(1), 32. https://doi.org/10.2307/1176008

Crooks, T. J. (1988). The Impact of Classroom Evaluation Practices on Students. *Review of Educational Research*, *58*(4), 438–481. https://doi.org/10.3102/00346543058004438

Dewey, J. (1938). *Logic: The Theory of Inquiry.* Holt, Rinehart and Winston. https://unitus.org/FULL/DewLog38.pdf

Herrington, J., & Oliver, J. (1995). Critical characteristics of situated learning: Implications for the instructional design of multimedia. *ASCILITE 1995 Conference (University of Melbourne, Melbourne)*. https://researchportal.murdoch.edu.au/esploro/outputs/conferencePaper/Critical-characteristics-of-situated-learning-Implications/991005540189907891

Kestin, G., Miller, K., Klales, A., Milbourne, T., & Ponti, G. (2025). AI tutoring outperforms in-class active learning: an RCT introducing a novel research-based design in an authentic educational setting. *Scientific Reports*, *15*(1), 17458. https://doi.org/10.1038/s41598-025-97652-6

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Morris, R., Perry, T., & Wardle, L. (2021). Formative assessment and feedback for learning in higher education: A systematic review. *Review of Education*, *9*(3). https://doi.org/10.1002/rev3.3292

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: a model and seven principles of good feedback practice. *Studies in Higher Education*, *31*(2), 199–218. https://doi.org/10.1080/03075070600572090

Poole, T. (2019, December 3). *How do I reflect in and on my SoTL practice?* Trishapoole.Info. https://www.trishapoole.info/news/how-do-i-reflect-in-and-on-my-sotl-practice

Sadler, D. R. (1998). Formative Assessment: revisiting the territory. *Assessment in Education*, *5*(1), 77–84.

Shaya, N., Abukhait, R., Nisar Khattak, M., & Cheng, C. (2026). Harnessing AI in Education for Sustainable Development: The Interplay of AI-Supported Blended Learning, Student Self-Regulation, and Cognitive Load. *Journal of Applied Learning and Teaching*, *9*(2). https://doi.org/10.37074/jalt.2026.9.2.7

Zhu, M., & Bonk, C. J. (2025). Guidelines and strategies for fostering and enhancing self-directed online learning. *Open Learning: The Journal of Open, Distance and e-Learning*, *40*(4), 382–398. https://doi.org/10.1080/02680513.2022.2141105

Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory Into Practice*, *41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Zimmerman, B. J. ., & Schunk, D. H. . (2008). *Self-regulated learning and academic achievement : theoretical perspectives*. Lawrence Erlbaum Associates, Taylor & Francis Group.

Structured Online Discussion as Applied Learning in Emergency Education

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Abstract

This study examines whether structured online discussion can function as an applied learning environment for emergency education. The study analyzed how undergraduate emergency students applied Incident Command System (ICS) management principles to emergency and non-emergency settings. This study employed a mixed methods approach, combining qualitative content analysis of student discussions with quantitative statistical analysis of rubric-based scores. The discussion assignment required students to select an ICS principle, define it, explain its use in routine and emergency contexts, make observations about its effectiveness, and respond to classmates. Using AI-assisted content analysis supported by a codebook and preliminary human reliability check, 94 initial student discussion posts were analyzed. Posts were scored across six dimensions: principle accuracy, non-emergency application, emergency application, cross-context comparison, critical observation, and practice grounding. Findings showed that students performed strongest on principle accuracy and application but lower on comparison and critical observation. Results suggest that structured discussion can support applied learning when prompts and rubrics explicitly require comparison, critique, and practice grounding.

Keywords: Incident Command System, emergency education, public health preparedness, online discussion pedagogy, applied learning, cognitive presence, rubric-based content analysis, AI-assisted analysis

Introduction

Emergency education must prepare students to do more than remember procedures or repeat definitions. Students need to understand how management principles operate in emergency practice and transfer across organizational settings. This is especially important for the Incident Command System (ICS), which provides a structured framework for leadership, communication, coordination, resource management, and decision-making during emergency incidents (Canton, 2019; Fisher, 2026; Haddow et al., 2020; Federal Emergency Management Agency, 2017). Although commonly taught as an emergency response system, ICS incorporates broader management principles—including unity of command, span of control, accountability, common terminology, and management by objectives—that are also relevant to routine organizational operations.

These principles are also relevant to public health and other complex emergencies, where hospitals, EMS, emergency management agencies, laboratories, government officials, and community partners must coordinate under conditions of uncertainty, limited resources, and time pressure. Thus, understanding how ICS principles operate across routine and crisis settings has implications beyond traditional public safety response.

Online discussion assignments are often used to encourage students to reflect on course concepts and apply them to practice. However, participation in a discussion does not automatically demonstrate applied learning. Students may provide definitions, agree with classmates, or offer examples without demonstrating deeper comparison, critique, or practice-based reasoning. Consequently, discussion quality must be examined rather than inferred from participation alone (Canton, 2019; Fisher, 2026; Nandi et al., 2012).

This study examines an online discussion assignment in an undergraduate emergency services course to determine how students demonstrated applied understanding of ICS management principles. Students selected an ICS principle, defined it, examined its application in emergency and non-emergency settings, made observations about its use, and responded to classmates' posts. The analysis included 94 student responses. Responses were evaluated across several dimensions of applied learning.

By examining variation across dimensions of student performance, the study provides evidence about the strengths and limitations of structured online discussion as a source of evidence of applied learning and identifies opportunities for improving assignment design.

Literature Review

Research on emergency management education, applied learning, and online pedagogy converges around a common instructional challenge: students must move beyond knowing disciplinary concepts to applying, comparing, and evaluating those concepts in realistic contexts. This challenge is particularly important in Incident Command System (ICS) education because ICS requires practitioners to translate

organizational principles such as command, coordination, communication, accountability, and resource management into action under changing conditions. At the same time, higher education increasingly uses online discussion as a means of engaging students with disciplinary problems, yet participation alone does not demonstrate meaningful application or higher-order thinking. Research on asynchronous discussion shows considerable variation in the quality and depth of student interaction, and systematic reviews have found limited consensus regarding the instructional conditions that consistently produce stronger learning outcomes (Fehrman & Watson, 2021; Nandi et al., 2012).

The literature relevant to the present study therefore intersects across four areas: ICS as an organizational framework for complex incidents; management and high-reliability perspectives on ICS; applied and experiential learning; and online discussion, cognitive presence, and assessment. Synthesizing these areas provides the conceptual basis for examining whether student discussion posts demonstrate transfer from conceptual understanding to practical application, comparison, critique, and practice-based reasoning. The central gap is not whether online discussions can generate interaction, but whether a structured discussion in emergency education can provide systematic evidence of how well students apply ICS management principles across routine and emergency contexts.

ICS as an All-Hazards Organizational Framework

ICS provides a standardized organizational structure for coordinating personnel, authority, communication, objectives, and resources during incidents. Within the broader National Incident Management System, ICS is designed to enable organizations and jurisdictions to work together during incidents that vary substantially in scale and complexity (Federal Emergency Management Agency [FEMA], 2017). FEMA training similarly emphasizes command relationships, manageable span of control, resource coordination, communications, and management by objectives as central elements of effective incident management (FEMA, 2019).

The significance of ICS extends beyond its use as an emergency-response organizational chart. Complex incidents require organizations with different responsibilities, professional cultures, and authority structures to coordinate under conditions of uncertainty and time pressure. Research on emergency management likewise emphasizes that effective response depends on both organizational structure and cross-agency collaboration rather than on hierarchy alone (Waugh & Streib, 2006). Public health emergencies, mass-casualty incidents, severe weather events, and other complex crises therefore present similar management problems involving authority, information flow, resource allocation, and interorganizational coordination.

Taken together, this literature suggests that ICS education should not be limited to students' ability to identify components of the system. Students must also understand why ICS principles matter, how they operate across organizational contexts, and how their consequences change when routine management problems occur under crisis

conditions. This need for conceptual transfer provides the first basis for examining ICS learning through an applied-learning framework.

ICS, Management Theory, and High-Reliability Practice

ICS principles also have roots in broader organizational and management theory. Classical management concepts such as unity of command, coordination, defined authority, and manageable supervisory structures parallel central ICS principles. Fayol's (1949) work, for example, emphasized unity of command, authority, discipline, and coordination as foundational organizational concerns. In ICS, these concepts become operational mechanisms for managing complex and rapidly changing incidents.

Research on high-reliability organizing further demonstrates that ICS combines formal structure with organizational adaptability. Bigley and Roberts (2001) found that ICS can provide clear authority and role structures while allowing emergency organizations to expand, contract, and reconfigure as incident conditions change. Their analysis is particularly important because it shows that structure and flexibility are not necessarily competing features of emergency organization; under appropriate conditions, formal structures can facilitate reliable adaptation in volatile environments.

The broader emergency-management literature similarly emphasizes that complex response depends on interorganizational coordination and collaborative leadership. Waugh and Streib (2006) argued that collaboration is fundamental to effective emergency management, while network perspectives on crisis governance demonstrate the importance of coordinating agencies that retain separate authorities and responsibilities (Moynihan, 2009). Thus, concepts such as unity of command, span of control, management by objectives, and accountability should be understood not merely as terminology but as mechanisms for solving recurring organizational problems.

This literature has an important educational implication. A student who can define unity of command has demonstrated conceptual knowledge, but a student who can explain why unclear reporting relationships create different consequences in routine operations and during an emergency demonstrates a more advanced level of understanding. The distinction between knowing a principle and transferring it to different organizational conditions leads directly to the concepts of applied and experiential learning.

Conceptual Framework: Applied Learning, Experiential Learning, and Cognitive Presence

The conceptual framework for this study integrates applied learning with elements of experiential learning theory and cognitive presence. These perspectives are related but should not be treated as interchangeable.

Applied Learning and Experiential Learning

Applied learning emphasizes the transfer of academic knowledge and skills to new, authentic, or practice-oriented problems. Jach and Trolian (2019) describe applied learning as an approach in which students connect academic learning with situations requiring them to transfer and use what they know. More recent scholarship likewise

emphasizes complex problem solving and the transfer of learning into meaningful contexts as defining features of applied learning (Jach et al., 2024). Applied learning therefore concerns not simply whether students encounter a practical example, but whether they can use disciplinary knowledge to interpret, address, or evaluate problems beyond straightforward recall.

Experiential learning places somewhat different emphasis on the learning process. Kolb's (1984) model conceptualizes learning as a cycle involving experience, reflection, conceptualization, and experimentation. Subsequent work by Kolb and Kolb emphasizes that experiential learning involves the transformation of experience through reflection and conceptual development rather than experience alone (Kolb & Kolb, 2017).

The concepts overlap but are not synonymous. Experiential learning centers on how learning develops through experience and reflection, whereas applied learning emphasizes the transfer and use of knowledge in authentic or practice-oriented contexts. An activity can contain elements of both, but application does not require a field placement or direct operational experience. Case analyses, simulations, problem-based assignments, and online activities can require students to transfer course concepts to realistic problems without reproducing the full experiential learning cycle. Prior research has, in fact, demonstrated that applied learning can occur in online environments when students are explicitly required to connect academic material to work, professional practice, or other authentic contexts (Fisher & Mittelman, 2013).

This distinction is important for the present study. The discussion assignment did not provide students with a direct emergency-response experience and therefore should not be characterized as equivalent to a field exercise or simulation. Rather, the assignment asked students to apply ICS principles to emergency and non-emergency situations, compare contexts, and make judgments about practice. Applied learning is therefore the primary construct being examined, while experiential learning theory helps explain why connecting concepts to practice and reflecting on their operation can deepen understanding.

In this framework, levels of student performance can be conceptualized as a progression. Accurately defining an ICS principle reflects conceptual understanding. Applying the principle to an organizational situation reflects transfer. Comparing its operation across routine and emergency settings requires more advanced analysis, while evaluating failures, consequences, or limitations requires critical practice-based reasoning. The present study uses these distinctions to examine variation in the depth of students' application rather than treating all examples or discussion participation as equivalent evidence of learning.

Online Discussion, Cognitive Presence, and Higher-Order Thinking

Online discussion provides one environment in which this application and reflection can occur, but the literature consistently cautions against equating participation with learning. Research examining asynchronous online discussion has found that

interaction quality varies substantially and depends on instructional design, facilitation, task structure, and the substance of student responses (Fehrman & Watson, 2021; Nandi et al., 2012). Consequently, the number of posts or replies provides limited evidence about whether students are engaging in application, analysis, or knowledge construction.

Cognitive presence provides a useful framework for making this distinction. Garrison et al. (2001) conceptualized cognitive presence as learners' construction and confirmation of meaning through sustained reflection and discourse. More recent research has continued to support its relevance to online higher education while also demonstrating that higher levels of cognitive engagement are not automatic consequences of online interaction. A systematic review by Sadaf et al. (2021) found that online cognitive-presence research has frequently examined discussion transcripts and that students' contributions tend to cluster more heavily in exploration and integration than in the highest levels of resolution. Similarly, Moore and Miller's (2022) systematic review found that the development of cognitive presence is associated with the design of instructional activities and the interaction of teaching, social, and cognitive presence.

Recent broader evidence reinforces the importance of instructional structure. Maranna et al. (2022), reviewing 121 studies, concluded that cognitive presence is influenced by factors including teaching presence, the structure of learning activities, and student characteristics. Their findings specifically support the use of authentic tasks that require students to apply knowledge to realistic scenarios. At the same time, research has cautioned that operational measures of cognitive presence and critical thinking should not be assumed to capture identical constructs, making clearly defined coding criteria important when evaluating written discussion (Kaczkó & Ostendorf, 2023).

Together, this literature suggests that effective online discussion depends on what students are required to do cognitively, not simply whether they participate. A reply that expresses agreement may demonstrate interaction but little evidence of application or critical inquiry. By contrast, a response that applies an ICS principle to a new setting, questions an assumption, identifies a failure point, compares organizational contexts, or integrates another management concept provides stronger evidence of cognitive engagement.

Structured Online Discussion as Applied Learning

The intersection of applied learning and cognitive presence provides the central conceptual rationale for the present study. Applied-learning scholarship emphasizes transfer from academic knowledge to authentic contexts, while cognitive-presence research emphasizes progressive meaning making through reflection and discourse. Online discussion can therefore provide a setting in which applied learning is demonstrated, provided that prompts require more than definition, recall, or participation.

This distinction is also supported by research on asynchronous discussion. Nandi et al. (2012) demonstrated that the quality of online interaction must be evaluated in relation

to the substance of student contributions rather than participation alone. Fehrman and Watson's (2021) systematic review similarly found that although asynchronous discussions are widely used in higher education, the literature does not establish a single set of best practices and identifies task structure, interaction, format, and instructional strategies as continuing areas of concern. More recent cognitive-presence reviews likewise indicate that authentic tasks, reflection, case-based learning, and structured instructional activities are among the approaches associated with deeper online inquiry (Maranna et al., 2022; Sadaf et al., 2021).

Synthesizing these findings suggests that the pedagogical value of online discussion is contingent rather than automatic. A structured discussion may provide evidence of applied learning when students are required to transfer disciplinary concepts to realistic situations, compare contexts, evaluate consequences, and engage substantively with peers. This proposition directly informs the present study's dimensions of principle accuracy, emergency and non-emergency application, cross-context comparison, critical observation, practice grounding, and substantive peer interaction.

Content Analysis and Rubric-Based Assessment

Because online discussions produce textual evidence of student reasoning, content analysis offers an appropriate approach for systematically examining differences in the depth and character of that reasoning. Krippendorff (2019) conceptualizes content analysis as a systematic approach for drawing replicable and valid inferences from communication, while Neuendorf (2017) emphasizes explicit coding categories and systematic procedures for transforming communication into analyzable data. These methodological principles are particularly relevant when written student responses are evaluated according to predefined dimensions.

Research on cognitive presence also supports the use of discussion transcripts as evidence for systematic analysis. Sadaf et al. (2021) found that discussion transcripts have been a prominent source of data in cognitive-presence research and that content analysis has been among the most commonly used analytic methods. However, the literature also demonstrates why coding criteria must be conceptually explicit: constructs such as application, integration, critical thinking, and cognitive presence can overlap without being identical (Kaczkó & Ostendorf, 2023).

For the present study, rubric-based content analysis therefore provides a bridge between the conceptual framework and the empirical analysis. The dimensions used to evaluate student posts are intended to represent progressively richer evidence of applied understanding: accurate conceptual explanation, application across contexts, comparison, critical evaluation, and connection to professional practice.

Synthesis and Research Gap

Several conclusions emerge from the literature. First, ICS is not merely a set of emergency-response procedures; it represents an organizational framework for addressing recurring problems of authority, communication, coordination, accountability, and resource management in complex environments (Bigley & Roberts, 2001; FEMA,

2017; Waugh & Streib, 2006). Second, applied-learning scholarship emphasizes students' capacity to transfer disciplinary knowledge into authentic or unfamiliar contexts, whereas experiential-learning theory explains a broader process through which experience, reflection, conceptualization, and experimentation contribute to learning (Jach & Trolian, 2019; Kolb & Kolb, 2017). Third, online-discussion research demonstrates that interaction alone is insufficient evidence of higher-order learning; the depth of cognitive engagement depends substantially on task design and the quality of student discourse (Fehrman & Watson, 2021; Maranna et al., 2022; Moore & Miller, 2022; Sadaf et al., 2021).

What remains less developed is research connecting these bodies of scholarship within emergency education. Existing work establishes the organizational importance of ICS, the value of authentic application, and the potential of structured online discourse to elicit higher-order reasoning. However, considerably less attention has been given to whether routine online discussion assignments can be systematically examined as evidence of how emergency-management students move from defining ICS concepts to applying, comparing, and critically evaluating them across emergency and non-emergency contexts. Likewise, peer participation is frequently treated as evidence of engagement without determining whether comments contribute substantively through application, questioning, challenge, or synthesis.

The present study addresses this gap by using a structured, rubric-based content analysis of student discussion posts to examine multiple dimensions of applied understanding. Rather than assuming that participation itself constitutes applied learning, the study evaluates the extent to which students demonstrate conceptual accuracy, transfer across contexts, comparison, critical observation, practice grounding, and substantive peer engagement. In doing so, the study connects research on ICS education, applied learning, and online cognitive presence to evaluate discussion as a source of evidence about students' developing ability to use management principles in practice.

Problem Significance

Although prior research demonstrates the value of applied learning, experiential learning, and structured online discussion, less attention has been given to how the quality of applied learning can be systematically evaluated within emergency services discussion assignments. Students may accurately define an Incident Command System (ICS) principle while varying considerably in their ability to apply it across emergency and non-emergency contexts, compare those contexts, critically evaluate its use, and connect it to professional practice. This distinction is important because participation or conceptual accuracy alone does not demonstrate deeper applied understanding (Fehrman & Watson, 2021; Garrison et al., 2001; Nandi et al., 2012).

The present study addresses this gap by examining multiple dimensions of applied understanding in student discussion responses, including principle accuracy, emergency and non-emergency application, cross-context comparison, critical observation, and practice grounding. By identifying where students demonstrate

stronger and weaker forms of applied understanding, the study provides evidence that can inform the design of discussion prompts, rubrics, and instructional strategies in emergency services education.

Research Questions

To guide the analysis, the study addressed the following research questions:

RQ1: How does student performance differ across principle accuracy, emergency and non-emergency application, cross-context comparison, critical observation, and practice grounding?

RQ2: Which ICS principles are most frequently selected and applied by students in their discussion responses?

RQ3: What patterns emerge in students' explanations of leadership, communication, and coordination when comparing routine operations with emergency response situations?

Methodology

Research Design and Data

This study used a mixed-methods, rubric-based content-analysis approach to examine how students applied Incident Command System (ICS) management principles in an online discussion assignment. Content analysis provides a systematic method for examining written communication and identifying patterns in textual data (Krippendorff, 2019; Neuendorf, 2017). The dataset consisted of 94 initial student discussion posts collected across six semesters.

The quantitative component included all 94 initial posts. Each initial post was treated as a separate unit of analysis and scored across six rubric dimensions to generate descriptive and inferential statistics. The qualitative component used selected student responses to illustrate patterns in how students explained, applied, compared, and evaluated ICS principles.

Assignment and Conceptual Basis

The assignment required students to select an ICS management principle, define it, explain its application in emergency and non-emergency settings, make observations about its use, and respond to classmates' posts. The analysis examined the extent to which student responses demonstrated evidence of applied learning rather than participation alone.

This approach was informed by experiential learning theory, which emphasizes learning through experience, reflection, conceptualization, and application (Kolb, 1984; Kolb & Kolb, 2017), and by applied-learning scholarship emphasizing the transfer of academic knowledge to authentic or practice-oriented contexts (Jach & Trolian, 2019).

Coding Framework

The 94 initial student posts were scored across six dimensions using a 0–3 rubric. Higher scores represented stronger evidence of conceptual understanding, application, comparison, evaluation, or practice-based reasoning.

Variable	Operational Definition
Principle Accuracy	Accuracy with which the student explained the selected ICS principle.
Non-Emergency Application	Specificity with which the student applied the principle to a non-emergency setting.
Emergency Application	Specificity with which the student applied the principle to an emergency setting.
Cross-Context Comparison	Depth with which the student compared emergency and non-emergency applications.
Critical Observation	Quality of the student's critique or evaluation of the principle and its use.
Practice Grounding	Extent to which the student connected the principle to realistic professional practice.

Scoring focused on the substance of each response rather than grammar, spelling, citation format, or writing style. The predefined rubric converted qualitative student responses into structured ordinal data that could be systematically summarized and compared (Krippendorff, 2019; Neuendorf, 2017).

Exploratory Applied Learning Composite

In addition to examining each rubric dimension independently, the six scores were summed to create an Exploratory Applied Learning Composite, with a possible range of 0 to 18. The composite was intended to provide a descriptive summary of performance across complementary dimensions of applied understanding: conceptual accuracy, application in emergency and non-emergency contexts, cross-context comparison, critical observation, and practice grounding.

The rationale for combining the dimensions was conceptual rather than psychometric. Together, the dimensions represent movement from accurate conceptual understanding toward transfer, comparison, evaluation, and connection to professional practice. The composite was therefore treated as an exploratory index of overall applied performance, not as a previously validated psychometric scale or latent measure of applied learning. Individual rubric dimensions remained the primary units of analysis.

Ethics, Deidentification, and Demographic Information

The study design was submitted to the Utah Valley University Institutional Review Board and received exempt approval because it involved existing course discussion data. Student posts were deidentified before analysis.

The analysis was limited to the content of student writing. Demographic characteristics such as age, gender, race, ethnicity, and major were not available in the discussion transcript and were neither inferred nor analyzed. Some students referred to professional or practice settings, including fire service, EMS, law enforcement, healthcare, military, business, and education. These references were considered only when evaluating Practice Grounding and were not treated as demographic classifications.

Researcher Positionality and Reflexivity

The researchers brought different professional and methodological perspectives to the study. Researcher 1 was the instructor of the course from which the student discussion posts were drawn and therefore had direct familiarity with the assignment, course content, and instructional context. Researchers 1 and 3 participated in the human review of the sample student posts. Researchers 2 and 3 contributed to manuscript review and interpretation, with Researcher 2 providing an emergency healthcare perspective. Because Researcher 1's instructional role and the researchers' professional backgrounds could influence interpretation of the student responses, the study used a predefined codebook, explicit scoring criteria, deidentified student data, and collaborative review to support consistency and reduce the influence of individual interpretation.

AI-Assisted Coding and Batch Analysis

ChatGPT was used as an AI-assisted rubric-scoring and statistical-analysis tool (OpenAI, 2026). The researchers established the codebook, six scoring dimensions, scoring anchors, unit of analysis, and interpretation criteria. ChatGPT assisted with distinguishing initial posts from peer comments, applying the predefined rubric, organizing responses into structured scores, identifying response patterns, and generating descriptive and inferential statistical summaries. AI-assisted analysis supplemented rather than replaced researcher judgment.

A single predefined codebook and the same scoring criteria were used throughout the coding process. Definitions of the six rubric dimensions, scoring anchors, unit of analysis, and instructions for distinguishing initial posts from peer comments were not altered during analysis.

The 94 initial posts were submitted for analysis as a large batch rather than individually in separate prompts. Each post nevertheless remained a separate unit of analysis and received an individual 0–3 score on each of the six rubric dimensions. Thus, the responses were processed together but scored separately using the same coding framework.

The study did not independently control or record model-level configuration parameters such as temperature or other backend settings, and therefore no claim is made that all underlying model configuration parameters remained identical throughout the analysis. Consistency was instead supported through standardized instructions, an unchanged codebook and scoring framework, human calibration, and subsequent comparison of scoring patterns.

Reliability and Consistency Assessment

Two researchers independently coded a purposive sample of 10 student posts using the same 0–3 codebook before the full AI-assisted analysis. The posts were deliberately selected from the beginning, middle, and end of the dataset so that the human review represented different positions within the large batch. The human-coded examples were subsequently provided as benchmark examples within the instructions used for the AI-assisted analysis.

The 10-post human-coded sample was compared with the pattern produced by the full 94-post AI-assisted analysis. The independently coded sample produced mean scores of 2.50 for Principle Accuracy, 2.50 for Non-Emergency Application, 2.50 for Emergency Application, 1.50 for Cross-Context Comparison, 1.80 for Critical Observation, and 2.60 for Practice Grounding. Corresponding means in the full AI-assisted analysis were 2.72, 2.60, 2.64, 2.14, 2.17, and 2.38, respectively. The mean scores for five of the six dimensions were within 0.37 points of the corresponding full-sample means. The largest difference occurred for Cross-Context Comparison, with means of 1.50 and 2.14.

Importantly, both analyses identified Cross-Context Comparison and Critical Observation as the two lowest-scoring dimensions, indicating a similar pattern in the relative strengths and weaknesses detected by the coding framework. The human-coded sample produced an overall exploratory composite of 74.4%, compared with 81.4% for the full sample, a difference of 7.0 percentage points.

These comparisons provide measurable evidence of similarity in aggregate scoring patterns, but they should not be interpreted as a formal inter-rater reliability coefficient. Because the original paired human and AI ratings for individual coding decisions were not retained, statistics requiring paired ratings, such as weighted Cohen’s kappa or Krippendorff’s alpha, could not be calculated retrospectively. In addition, because the human-coded examples were provided to the AI as benchmarks before the full analysis, the comparison represents a calibration and pattern-consistency check rather than a fully independent human-versus-AI validation study.

This consistency check was particularly relevant because large language models are probabilistic and can produce variation across similar inputs. Jang and Lukasiewicz (2023) documented inconsistencies in ChatGPT responses across semantically related inputs. Research on long-context language models has also demonstrated that performance can vary depending on the position of information within lengthy inputs, including reduced performance for information appearing in the middle of a long context (Liu et al., 2024). Deliberately selecting human-coded posts from the beginning, middle,

and end of the dataset therefore provided a preliminary assessment of whether the overall coding pattern appeared stable across different locations in the batch.

Content Validity

Content validity was addressed through alignment of the coding framework with both the assignment requirements and the study's conceptual framework. The six rubric dimensions represented distinct but related aspects of applied understanding: conceptual accuracy, transfer to emergency and non-emergency settings, comparison across contexts, evaluation of practice, and connection to professional experience.

The dimensions were informed by applied-learning and experiential-learning scholarship emphasizing conceptual transfer and application (Jach & Trolian, 2019; Kolb, 1984; Kolb & Kolb, 2017) and by cognitive-presence research emphasizing reflection, integration, application, and knowledge construction in online discourse (Garrison et al., 2001; Sadaf et al., 2021). Content validity was therefore supported through conceptual alignment rather than through a separate psychometric validation study.

Statistical Analysis

Descriptive statistics were calculated for each of the six rubric dimensions, including frequencies, percentages, means, standard deviations, and highest-level counts. Because the same 94 student posts received scores on all six dimensions, the resulting dataset constituted related repeated measures.

A Friedman test was used to determine whether student performance differed significantly across the six ordinal rubric dimensions. The Friedman test is appropriate for comparing related ordinal or non-normally distributed repeated measures (Friedman, 1937). When the omnibus test indicated significant differences, follow-up Wilcoxon signed-rank tests were used to compare paired dimensions. The Wilcoxon signed-rank test is appropriate for paired ordinal data when assumptions required for parametric comparisons are not met (SciPy Community, 2025).

Findings

The findings indicate that students demonstrated their strongest performance in accurately identifying and explaining ICS management principles and in applying those principles to both emergency and non-emergency contexts. Performance was comparatively lower on dimensions requiring deeper analysis, particularly cross-context comparison and critical observation, while practice grounding fell between these areas. Statistical testing confirmed significant differences among the six rubric dimensions, with Principle Accuracy producing the highest scores and Cross-Context Comparison Depth and Critical Observation Quality among the lowest. Students most frequently selected Unity of Command and Span of Control as the principles for their analyses. The following tables provide the descriptive statistics, statistical comparisons, and distribution of ICS principles represented in the 94 student responses.

Descriptive Statistics Across Six Rubric Dimensions

Table 1 presents descriptive statistics for the six rubric dimensions. Principle Accuracy had the highest mean score at 2.72 out of 3.00. Emergency Application Specificity and Non-Emergency Application Specificity also had high mean scores, at 2.64 and 2.60 respectively. Practice Grounding had a mean score of 2.38. The two lowest mean scores were Cross-Context Comparison Depth at 2.14 and Critical Observation Quality at 2.17.

The highest-level percentages followed a similar pattern. Principle Accuracy had the largest percentage of students scoring at the highest level, with 74 students, or 78.7%, receiving the top score. Emergency Application Specificity had 65 students, or 69.1%, at the highest level, and Non-Emergency Application Specificity had 60 students, or 63.8%, at the highest level. Cross-Context Comparison Depth and Critical Observation Quality had the lowest highest-level percentages, at 38.3% and 31.9% respectively.

Statistic	Principle Accuracy	Non-Emergency Specificity	Emergency Specificity	Comparison Depth	Critical Observation	Practice Grounding
Total Posts	94	94	94	94	94	94
Total Points	256	244	248	201	204	224
Maximum Points	282	282	282	282	282	282
Mean Score	2.72	2.60	2.64	2.14	2.17	2.38
Overall % of Possible Points	90.8%	86.5%	87.9%	71.3%	72.3%	79.4%
Standard Deviation	0.62	0.59	0.60	0.80	0.70	0.68
Highest-Level Count	74	60	65	36	30	46
Highest-Level %	78.7%	63.8%	69.1%	38.3%	31.9%	48.9%

Table 1. Descriptive Statistics for Six Rubric Dimensions

Differences Among Rubric Dimensions

A Friedman test was conducted to determine whether statistically significant differences existed among the six related rubric dimensions. The test showed a statistically significant difference, $\chi^2(5) = 182.49$, $p < .001$. Kendall's W was 0.388, indicating a moderate difference among the dimensions.

Follow-up Wilcoxon signed-rank tests with Holm correction were used to identify where the differences occurred. Table 2 summarizes the pairwise comparisons. The Wilcoxon signed-rank comparisons showed that Principle Accuracy was significantly higher than all five other rubric dimensions. Non-Emergency Application Specificity and Emergency Application Specificity were also significantly higher than Cross-Context Comparison Depth, Critical Observation Quality, and Practice Grounding. No significant difference

was found between Non-Emergency and Emergency Application Specificity, indicating similar performance across the two application contexts.

Cross-Context Comparison Depth and Critical Observation Quality did not differ significantly from one another and represented the two lowest-performing dimensions. Both were significantly lower than Practice Grounding. Overall, the pairwise comparisons indicate a consistent pattern of stronger performance in principle identification and application than in comparison and critical observation.

Comparison	Mean Difference	Holm-Adjusted p	Significant?
Principle vs. Non-Emergency	0.128	.0108	Yes
Principle vs. Emergency	0.085	.0342	Yes
Principle vs. Comparison	0.585	< .001	Yes
Principle vs. Observation	0.553	< .001	Yes
Principle vs. Grounding	0.340	< .001	Yes
Non-Emergency vs. Emergency	-0.043	.2049	No
Non-Emergency vs. Comparison	0.457	< .001	Yes
Non-Emergency vs. Observation	0.426	< .001	Yes
Non-Emergency vs. Grounding	0.213	< .001	Yes
Emergency vs. Comparison	0.500	< .001	Yes
Emergency vs. Observation	0.468	< .001	Yes
Emergency vs. Grounding	0.255	< .001	Yes
Comparison vs. Observation	-0.032	.4669	No
Comparison vs. Grounding	-0.245	< .001	Yes
Observation vs. Grounding	-0.213	< .001	Yes

Table 2. Pairwise Wilcoxon Signed-Rank Tests with Holm Correction

Principles Selected by Students

Students selected a range of ICS and management principles. Table 3 shows the number of student responses associated with each principle category.

Unity of Command was the most frequently selected category, appearing in 25 responses. Span of Control appeared in 21 responses. Together, these two categories accounted for 46 of the 94 responses. Chain of Command / Unity of Command appeared in 11 responses. Management by Objectives appeared in 7 responses. Resource Management and Accountability each appeared in 5 responses. Other categories appeared less frequently.

Principle Category	***Number of Posts***
Unity of Command	25
Span of Control	21
Chain of Command / Unity of Command	11
Management by Objectives	7
Resource Management	5
Accountability	5
Common Terminology / Communication	4
Organizational Flexibility	4
Unified Command	3

Incident Action Planning	2
Modular Organization	2
Integrated Communications	1
Normalcy Bias	1
Preparation	1
Unity / Unified Command	1
Missing Principle	1
Total	94

Table 3. Principle Categories Used in Student Responses

Qualitative Analysis of Student Responses

The qualitative component involved human review of selected student responses to identify patterns in how students explained, applied, compared, and evaluated ICS principles. Responses from the test sample were used to provide illustrative examples of these patterns.

- **Student A — leadership and coordination:** Student A contrasted routine environments, where employees may receive direction from multiple managers, with emergency settings, where clearer supervisory relationships reduce confusion. The student observed that when Unity of Command was established during emergency simulations, “teams operated more efficiently and communication was stronger.”
- **Student B — role clarity and accountability:** Student B similarly argued that Unity of Command is more consistently applied during emergencies because the consequences of unclear leadership are immediate. The student linked adherence to Unity of Command with “smooth operations and clear accountability,” while bypassing command structures produced confusion, duplicated effort, and risk.
- **Student D — communication and interagency coordination:** Student D provided a particularly strong example of how communication systems affect coordination. The student described how separating fire, EMS, and law-enforcement radio channels complicated multi-agency response and required dispatchers to patch channels together, slowing communication rather than streamlining it.
- **Student G — adaptive leadership and coordination:** Student G described routine operations as requiring a relatively small supervisory structure but explained that, as an incident escalates, additional command, medical, fire, relief, hospital, and utility resources must be coordinated. This illustrates students’ recognition that emergency leadership structures must expand as operational complexity increases.
- **Student K — urgency of command during emergencies:** Student K distinguished routine organizational structure from emergency command by emphasizing the need for rapid decisions and resource allocation. The student concluded that chain of command becomes more important when “lives are at stake” because it supports swift and coordinated action.

Together, these responses suggest three recurring patterns for RQ3: students viewed **leadership** as becoming more clearly defined and consequential during emergencies; **communication** as requiring clearer channels, terminology, and reporting relationships; and **coordination** as becoming more structured and adaptive as the number of personnel, agencies, and operational demands increases. In contrast, students often described routine settings as more flexible but also more susceptible to overlapping authority, mixed messages, and unclear responsibilities.

Discussion

The purpose of this study was to examine the extent to which student discussion responses demonstrated applied understanding of Incident Command System (ICS) management principles. The findings provide evidence that students were generally successful in accurately explaining ICS principles and applying them to both emergency and non-emergency contexts, but demonstrated less depth when asked to compare contexts, make critical observations, and connect principles to practice. These differences are important because applied learning involves more than accurate conceptual knowledge; it requires students to transfer, interpret, and evaluate disciplinary knowledge in situations beyond straightforward recall (Jach & Trolian, 2019; Jach et al., 2024). The findings therefore suggest that the discussion responses reflected multiple levels of applied understanding rather than a uniform level of performance.

RQ1: Differences Across Dimensions of Applied Understanding

The first research question examined differences in student performance across principle accuracy, emergency and non-emergency application, cross-context comparison, critical observation, and practice grounding. A clear pattern emerged. Students performed strongest in Principle Accuracy, followed by Emergency and Non-Emergency Application Specificity, while Cross-Context Comparison Depth and Critical Observation Quality were the weakest dimensions.

The statistical comparisons reinforce this pattern. Thirteen of the 15 pairwise Wilcoxon comparisons were statistically significant after Holm correction. Principle Accuracy was significantly higher than every other dimension. Emergency and Non-Emergency Application Specificity were also significantly higher than comparison depth, critical observation, and practice grounding. The only nonsignificant differences were between Emergency and Non-Emergency Application Specificity and between Cross-Context Comparison Depth and Critical Observation Quality.

These findings suggest a progression in the type of reasoning demonstrated in the student responses. Students were generally able to explain an ICS principle accurately and transfer it to a specific situation. Their similar performance in emergency and non-emergency applications is particularly noteworthy because it suggests that students were not restricted to reproducing familiar emergency-response examples. They could also recognize how principles such as unity of command, span of control, accountability, and communication operate in routine organizational settings. This type of transfer is

consistent with applied-learning scholarship emphasizing the use of academic concepts in new and practice-oriented contexts (Jach & Trolian, 2019; Jach et al., 2024).

The lower scores for comparison and critical observation indicate, however, that applying a concept to two situations is not the same as analyzing the relationship between those situations. Students could frequently provide an emergency example and a non-emergency example without fully explaining why the principle operated differently across the two environments or evaluating its limitations, consequences, or effectiveness. The distinction is consistent with the literature on cognitive presence, which indicates that online contributions commonly demonstrate exploration and integration more readily than the highest levels of critical inquiry or resolution (Sadaf et al., 2021).

The findings also support the argument that participation in online discussion should not be treated as equivalent to higher-order learning. Fehrman and Watson (2021) and Nandi et al. (2012) emphasize substantial variation in the quality of asynchronous discussion contributions. The present findings demonstrate similar variation within individual dimensions of the same assignment: students could demonstrate strong conceptual accuracy and application while showing comparatively less evidence of analysis and evaluation.

Practice Grounding occupied an intermediate position. Students demonstrated more practice-based reasoning than cross-context comparison or critical observation but less than principle identification and direct application. This pattern may reflect differences in students' professional backgrounds and opportunities to connect course concepts with prior experience. It also reinforces the importance of distinguishing applied learning from experiential learning. Students did not need direct operational experience to apply an ICS principle successfully, although professional experience could provide additional material for reflection and evaluation (Kolb & Kolb, 2017).

Instructionally, these findings suggest that future discussion prompts may need to make the analytical expectations more explicit. Asking students to provide examples appears capable of eliciting evidence of transfer, but deeper comparison may require prompts that specifically ask students to explain why a principle functions differently across contexts, identify tradeoffs, evaluate breakdowns, or determine circumstances in which a principle may be difficult to implement. This interpretation is consistent with research showing that cognitive presence is associated with the structure of instructional activities and the use of authentic tasks requiring application and reflection (Maranna et al., 2022; Moore & Miller, 2022).

RQ2: ICS Principles Selected by Students

The second research question examined which ICS principles students most frequently selected and applied. Unity of Command and Span of Control were the most common choices, accounting for 46 of the 94 responses. Chain of Command/Unity of Command represented another 11 responses, further demonstrating the prominence of command and supervisory relationships in students' selections.

This concentration suggests that students may perceive ICS primarily through its most visible organizational features: authority, reporting relationships, and supervisory structure. These principles are readily transferable because students can identify parallels in workplaces, schools, healthcare organizations, public agencies, and emergency services. They therefore offer accessible points of connection between ICS doctrine and students' existing organizational experience.

At the same time, the uneven distribution of principles is important. Principles involving resource management, accountability, communications, organizational flexibility, Unified Command, incident action planning, and modular organization appeared much less frequently. Consequently, the findings provide stronger evidence of students' applied understanding of command-related principles than of ICS as a whole.

The prominence of command-related concepts also reflects the organizational foundations of ICS described in the literature. Classical management principles emphasize authority, unity of command, coordination, and supervisory structure (Fayol, 1949), while ICS incorporates these concepts into an adaptable system for managing complex incidents. Bigley and Roberts (2001) demonstrated that ICS combines formal authority structures with the capacity to reorganize as operational demands change. Students' frequent selection of Unity of Command and Span of Control therefore suggests that they recognized important structural components of ICS, although less frequently selected principles may require greater instructional attention if students are expected to understand ICS as an integrated management system.

Future assignments could address this imbalance by distributing principles among students or requiring students to analyze more than one principle. Doing so could provide broader evidence of applied understanding across the ICS framework rather than allowing selections to concentrate around the most familiar management concepts.

RQ3: Patterns in Leadership, Communication, and Coordination

The third research question examined patterns in students' explanations of leadership, communication, and coordination when comparing routine operations with emergency response situations. Several related patterns emerged from the qualitative review.

First, students commonly described leadership in terms of clear authority and reporting relationships. In routine environments, they frequently recognized that overlapping supervision or unclear authority could result in conflicting instructions, inefficiency, or uncertainty about responsibility. In emergency situations, the same issues were described as more consequential because decisions must often be made rapidly and failures in command can affect responder and public safety.

Second, communication was closely connected to organizational structure. Students did not generally treat communication as an isolated interpersonal skill. Instead, they described communication as occurring through reporting relationships, common terminology, supervisory channels, and interoperable systems. Breakdowns in these

mechanisms were associated with confusion, delayed decisions, duplicated work, and coordination problems.

Third, students described coordination as increasingly important as situations became more complex. Routine operations were commonly portrayed as requiring relatively stable organizational arrangements, whereas emergencies required organizations to expand, integrate additional personnel or agencies, redistribute resources, and clarify responsibility. Students therefore demonstrated awareness that ICS structure is not simply hierarchical but must also adapt to changing operational requirements.

These patterns correspond closely with the organizational literature on ICS. Bigley and Roberts (2001) characterize ICS as a high-reliability organizational form that combines defined authority with structural flexibility. Waugh and Streib (2006) similarly emphasize that emergency management depends on collaboration and coordination across organizational boundaries. The student responses reflected elements of both perspectives: clear leadership was viewed as necessary for accountability and decision making, while communication and coordination were necessary for integrating personnel and organizations.

The comparisons between routine and emergency environments also provide evidence of applied learning because students were not merely defining ICS terminology. They were interpreting how organizational principles change in importance, implementation, and consequence across contexts. The findings should not be interpreted as demonstrating that the discussion assignment caused these understandings. Rather, the written responses provided evidence that students could use ICS concepts to reason about recognizable organizational problems involving authority, communication, coordination, and accountability.

Interpretation and Instructional Implications

Taken together, the three research questions reveal an important distinction between conceptual knowledge, application, and higher-order analysis. Students demonstrated substantial evidence of accurate conceptual understanding and contextual application. Evidence of deeper comparative and critical reasoning was present but less consistent.

This pattern contributes to the applied-learning and online-discussion literature by illustrating why discussion quality should be evaluated multidimensionally. A student may correctly define a concept and provide realistic examples while still demonstrating limited comparison or critique. Treating the entire discussion response as simply successful or unsuccessful would obscure these differences.

The findings are consistent with research suggesting that the educational value of asynchronous discussion depends substantially on task design rather than participation alone (Fehrman & Watson, 2021; Nandi et al., 2012). They also align with cognitive-presence research indicating that authentic tasks and structured activities can provide opportunities for application and integration, while more advanced forms of critical

inquiry may require additional instructional support (Maranna et al., 2022; Moore & Miller, 2022; Sadaf et al., 2021).
For emergency education, this distinction has practical significance. ICS competence requires practitioners to do more than recall terminology. They must recognize organizational problems, determine which principles apply, understand interactions among command, communication, and coordination, and evaluate the consequences of organizational decisions. Discussion assignments can provide written evidence of these capabilities when assessment distinguishes among conceptual accuracy, application, comparison, evaluation, and practice grounding.

The present findings therefore suggest several directions for instructional refinement. Prompts can retain emergency and non-emergency applications because students demonstrated relatively strong performance in both contexts. Greater emphasis, however, could be placed on requiring students to explicitly compare the two contexts, identify limitations or failure points, justify why a principle may be more consequential under particular conditions, and evaluate alternative approaches. Rubrics should likewise distinguish application from comparison and critical evaluation rather than treating all contextual examples as equivalent evidence of applied learning.

Overall, the study demonstrates the value of examining online discussion responses as differentiated evidence of student reasoning. The findings do not establish that structured discussion caused learning or that discussion is superior to other instructional approaches. Instead, the student responses provide evidence that many students could accurately explain and transfer ICS management principles across contexts while also identifying specific areas—particularly comparison and critical evaluation—in which demonstrated understanding was less developed.

Limitations and Future Research

This study has several limitations. First, the data came from one course discussion assignment conducted over several semesters. The findings may not generalize to other courses, institutions, student populations, or instructional formats. Replication across different emergency management courses and institutional settings would strengthen confidence in the applicability of the findings.

Second, the analysis was based on written discussion responses. Student writing may not fully represent what students know, believe, or could demonstrate in a simulation, tabletop exercise, field exercise, or actual emergency setting. The findings therefore represent evidence of applied understanding demonstrated through written discussion rather than direct evidence of operational performance.

Third, although the preliminary consistency assessment provided some support for the stability of aggregate AI-assisted scoring patterns, limitations associated with AI-assisted coding remain. Similarity between human-coded and AI-assisted aggregate results does not establish agreement at the individual response level or eliminate potential differences in interpretation. The coding process should therefore be understood as a systematic assessment of written responses rather than as an error-

free measure of student understanding. Future studies could further strengthen the methodology by using multiple independent human coders, larger reliability samples, and comparisons among human-only, AI-assisted, and AI-generated coding approaches.

Fourth, the study did not analyze demographic variables. Student responses were deidentified, and information such as age, gender, race, ethnicity, or major was not available and was not inferred. Some students referenced professional or practice contexts, but those references were used only to evaluate practice grounding. Consequently, the study cannot determine whether differences in professional experience, academic background, or other student characteristics were associated with performance across the rubric dimensions.

Finally, although 149 peer comments were collected as part of the discussion assignment, they were not included in the present analysis because of manuscript word limitations. As a result, the study does not examine the quality, substance, or cognitive contribution of peer-to-peer interaction. Future research should analyze these comments separately to determine whether peer responses extend, challenge, apply, or integrate classmates' ideas.

Future Research

Future research could extend this study by comparing discussion-based learning with scenario-based exercises, simulations, tabletop exercises, or case analyses. Another approach would be to revise the assignment using the instructional recommendations identified in this study and then compare patterns of student performance before and after the revision. Future studies could also examine whether stronger peer-comment requirements are associated with greater evidence of cognitive presence, particularly challenge, integration, and synthesis.

Research could further investigate whether students who demonstrate stronger cross-context comparison and critical observation in written work also perform better in applied emergency management simulations or field-based learning activities. Longitudinal research could examine whether students demonstrate increasingly sophisticated application and evaluation of ICS principles as they progress through an emergency management curriculum.

Overall, this study demonstrates how structured discussion responses can provide evidence of both the strengths and limits of students' applied understanding. Students generally demonstrated accurate understanding and application of ICS principles but were less consistent in comparing contexts and critically evaluating practice. These findings suggest that emergency management educators should distinguish between application and higher-order analysis rather than assuming that one necessarily leads to the other. Explicit prompts, examples, rubrics, and peer-response expectations may help elicit stronger evidence of comparison, evaluation, and practice-based reasoning. Strengthening these elements may provide students with additional opportunities to

demonstrate how ICS principles relate to leadership, communication, coordination, and decision making across routine operations and emergency-response contexts.

Conclusion

This study examined student responses to a structured online discussion assignment focused on the application of Incident Command System (ICS) management principles in emergency and non-emergency settings, including contexts relevant to public health operations. The central finding was that students demonstrated stronger performance in principle accuracy and application than in cross-context comparison and critical observation.

Results show that students demonstrated the ability to move beyond defining ICS principles by applying them to both emergency and non-emergency situations. However, their comparatively lower performance in cross-context comparison and critical observation indicates that application did not consistently extend to higher-order analysis. Thus, online discussion appears useful for demonstrating applied understanding, particularly when prompts and rubrics explicitly distinguish conceptual accuracy, application, comparison, and critical evaluation.

The results suggest that future discussion assignments should include more explicit prompts for comparison, critique, and evaluation, along with clearer expectations for substantive peer interaction. This distinction is important because the ability to apply a principle does not necessarily indicate the ability to analyze how that principle functions differently across contexts or critically evaluate its limitations and consequences.

The study is limited by its use of one course discussion assignment and by its reliance on written responses as evidence of student understanding. Although the preliminary consistency assessment provided additional support for the AI-assisted coding approach, interpretive limitations remain. Future research should replicate the study with larger samples, multiple human raters, and additional instructional formats such as simulations, tabletop exercises, and case analyses to further examine how students demonstrate application, comparison, and critical evaluation of ICS principles.

References

Bigley, G. A., & Roberts, K. H. (2001). The Incident Command System: High-reliability organizing for complex and volatile task environments. *Academy of Management Journal, 44*(6), 1281–1299. https://doi.org/10.2307/3069401

Canton, L. G. (2019). *Emergency management: Concepts and strategies for effective programs* (2nd ed.). John Wiley & Sons. https://www.wiley.com/en-us/emergency-management-concepts-and-strategies-for-effective-programs-2nd-edition-p-9781119066859

Fayol, H. (1949). *General and industrial management* (C. Storrs, Trans.). Sir Isaac Pitman & Sons.

Federal Emergency Management Agency. (2017). *National Incident Management System* (3rd ed.). U.S. Department of Homeland Security. https://www.fema.gov/sites/default/files/2020-07/fema_nims_doctrine-2017.pdf

Federal Emergency Management Agency. (2019). *IS-200.C: Basic Incident Command System for initial response*. Emergency Management Institute. https://training.fema.gov/is/courseoverview.aspx?code=IS-200.C

Fehrman, S., & Watson, S. L. (2021). A systematic review of asynchronous online discussions in online higher education. *American Journal of Distance Education, 35*(3), 200–213. https://doi.org/10.1080/08923647.2020.1858705

Fisher, J. R., & Mittelman, M. (2013). Applied learning in online education: A comparative study employing DEAL critical reflection. *Journal of Applied Learning in Higher Education, 5*, 3–13. https://doi.org/10.57186/jalhe_2013_v5a1p3-13

Fisher, J. R. (2026). *Principles of emergency services management*. Kendall Hunt Publishing Company. https://he.kendallhunt.com

Friedman, M. (1937). The use of ranks to avoid the assumption of normality implicit in the analysis of variance. *Journal of the American Statistical Association, 32*(200), 675–701. https://doi.org/10.1080/01621459.1937.10503522

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

Haddow, G. D., Bullock, J. A., & Coppola, D. P. (2020). *Introduction to emergency management* (7th ed.). Butterworth-Heinemann. https://www.elsevier.com/books/introduction-to-emergency-management/haddow/978-0-12-817139-4

Jach, E. A., & Trolian, T. L. (2019). Defining applied learning and related student outcomes in higher education. *New Directions for Higher Education, 2019*(188), 7–11. https://doi.org/10.1002/he.20340

Jach, E. A., Trolian, T. L., & Selznick, B. S. (2024). Applied learning as essential to the continued viability of higher education. *Journal on Excellence in College Teaching, 35*(3), 49–56. https://eric.ed.gov/?id=EJ1447373

Jang, M., & Lukasiewicz, T. (2023). Consistency analysis of ChatGPT. In H. Bouamor, J. Pino, & K. Bali (Eds.), *Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing* (pp. 15970–15985). Association for Computational Linguistics. https://doi.org/10.18653/v1/2023.emnlp-main.991

Kaczkó, É., & Ostendorf, A. (2023). Critical thinking in the Community of Inquiry framework: An analysis of the theoretical model and cognitive presence coding schemes. *Computers & Education, 193*, 104662. https://doi.org/10.1016/j.compedu.2022.104662

Kolb, A. Y., & Kolb, D. A. (2017). Experiential learning theory as a guide for experiential educators in higher education. *Experiential Learning & Teaching in Higher Education, 1*(1), 7–44. https://doi.org/10.46787/elthe.v1i1.3362

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Krippendorff, K. (2019). *Content analysis: An introduction to its methodology* (4th ed.). SAGE Publications. https://methods.sagepub.com/book/mono/content-analysis-4e/toc

Liu, N. F., Lin, K., Hewitt, J., Paranjape, A., Bevilacqua, M., Petroni, F., & Liang, P. (2024). Lost in the middle: How language models use long contexts. *Transactions of the Association for Computational Linguistics, 12*, 157–173. https://doi.org/10.1162/tacl_a_00638

Maranna, S., Willison, J., Joksimovic, S., Parange, N., & Costabile, M. (2022). Factors that influence cognitive presence: A scoping review. *Australasian Journal of Educational Technology, 38*(4), 95–111. https://doi.org/10.14742/ajet.7878

Moore, R. L., & Miller, C. N. (2022). Fostering cognitive presence in online courses: A systematic review (2008–2020). *Online Learning, 26*(1), 130–149. https://doi.org/10.24059/olj.v26i1.3071

Moynihan, D. P. (2009). The network governance of crisis response: Case studies of Incident Command Systems. *Journal of Public Administration Research and Theory, 19*(4), 895–915. https://doi.org/10.1093/jopart/mun033

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

Neuendorf, K. A. (2017). *The content analysis guidebook* (2nd ed.). SAGE Publications. https://methods.sagepub.com/book/mono/the-content-analysis-guidebook-2e/toc

OpenAI. (2026). *ChatGPT* [Large language model]. https://chatgpt.com/

Sadaf, A., Wu, T., & Martin, F. (2021). Cognitive presence in online learning: A systematic review of empirical research from 2000 to 2019. *Computers and Education Open, 2*, 100050. https://doi.org/10.1016/j.caeo.2021.100050

SciPy Community. (2025). *scipy.stats.wilcoxon*. SciPy documentation. https://docs.scipy.org/doc/scipy-1.16.1/reference/generated/scipy.stats.wilcoxon.html

Waugh, W. L., Jr., & Streib, G. (2006). Collaboration and leadership for effective emergency management. *Public Administration Review, 66*(s1), 131–140. https://doi.org/10.1111/j.1540-6210.2006.00673.x

Teaching That Connects: Lessons from a Community-Engaged Learning Course

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Abstract

This article draws on three years of implementation of a community-engaged undergraduate and graduate course, Bilingual Language Acquisition and Education (BLAE), to identify five transferable lessons for instructors designing experiential learning partnerships. Co-taught by faculty from linguistics and education, the course embedded university students in a Latinx dual-language (DL) primary school community, where they conducted bilingual language assessments, implemented literacy activities, and presented findings at a school-site poster session. Although the course focuses on bilingual education, the authors frame each lesson broadly, inviting instructors across disciplines to consider how community-anchored, applied learning experiences cultivate deeper intellectual engagement than instruction alone can achieve. Additional lessons address how authentic participation supports professional identity development and how structured reflection transforms experience into transferable understanding. This contribution argues that meaningful community engagement requires prioritizing relationship-building over transactional interactions, designing for reciprocity rather than charity, and treating students and community members as genuine research partners.

Introduction

Over three consecutive spring semesters– 2024, 2025, and 2026– our interdisciplinary team designed and taught a community-engaged course that brought university students into sustained partnership with a local dual-language (DL) primary school serving a predominantly Latinx community. Our course, Bilingual Language Acquisition and Education (BLAE), was co-taught by two professors – one from linguistics, one from education– alongside a doctoral teaching assistant from the education program, reflecting the collaborative, cross-disciplinary spirit that shapes the course itself.

The student-facing, BLAE course unfolds in two phases; however, preparation begins before the semester even starts. The faculty members who teach this class have already spent several months building a relationship with school administration, the district dual-language coordinator, and teachers. Based on the needs the school partners shared, we tailored the topics to cover in class and the corresponding activities to support active engagement with the theoretical concepts students will learn. During the first six weeks of the semester, students engage deeply with theory: reading research literature, examining foundational texts, and participating in seminar discussions on language acquisition and bilingual education. In the second phase, spanning eight weeks, the work moves outward. Students first explore the neighborhood surrounding the school before entering DL classrooms to observe instruction and build relationships with teachers and students. This sequencing is intentional: students come to know the community before they come to serve it. The semester culminates in a conference-style research poster session held at the school site, where university students present their findings directly to the teachers, administrators, and university partners who shaped the work alongside them. Table 1 shows the weekly course progression BLAE follows.

Week #	Activity
Weeks 1-5	Coursework, reading and discussions around bilingual language acquisition Model active reading strategies Familiarizing university students with partner school curriculum to connect to in planning
Week 6	Tour of the Partner School Meet with Partner School Administrators and DL teachers DL Classroom observations
Weeks 7-13	University students engaging in literacy lessons and bilingual language development assessment activities with partner DL students on at the partner school site; 75 minutes, twice a week
Week 14	In pairs and groups, university students review data and prepare poster presentations on their chosen topic (related to their interests and educational or career goals)
Week 15	Conference-style poster presentation at the partner school site (school, district and university partners in attendance

Table 1. *The 15-Week BLAE Course Program*

The purpose driving this design is well established in the community-engaged literature: integrating real-world community issues into academic coursework fosters civic values, equity commitments, social justice, and, importantly, a meaningful link between academic knowledge and community needs (Fenwick, 2014; Morton et al., 2023; Zimmerman, 2019). Our goal was straightforward– move students beyond learning *about* bilingual education toward learning *through* authentic engagement and relationships with young bilingual learners, teachers, and the community.

What emerged exceeded that goal. Across the three semesters, all students enrolled in the course, approximately forty undergraduate and graduate students from multiple disciplines – Education, Linguistics, Computer Science, Speech-Language Pathology, Classics– observed and were immersed in bilingual classrooms, explored the community and engaged with neighbors, planned and implemented bilingual literacy activities with the children, and as a concluding moment, stood in front of the teachers, administrators, and university faculty to share what the children's assessment data and their school and community interactions had revealed. The experience shifted how our students understood language and equity, took the discussion off the page and outside of the classroom, and expanded their own professional possibilities.

As course designers, we found ourselves learning alongside our students. The practices that proved most effective were not discipline-specific; they were rooted in active experience, shared purpose, and collaborative meaning-making. The five lessons that follow reflect what worked, what surprised us, and what we believe instructors can take forward when designing community-engaged learning.

Literature Review

Community-engaged coursework has a long institutional history in American higher education. Applied learning pedagogies that moved students beyond the classroom became more mainstream during the 1970s and 1980s (Cone & Harris, 1996), gained a firmer position in institutions of higher education after the founding of Campus Compact in 1985, and expanded rapidly through the 1990s (Bringle & Hatcher,2000; Stanton et al., 1999). During that expansion, "service learning" became the field's governing term, and its working definition was formalized: an organized service activity that meets identified community needs, paired with structured reflection that deepens students' understanding of course content (Bringle & Hatcher, 1995). Kuh (2008) later positioned such coursework among a small set of high-impact educational practices that demand sustained effort, meaningful interaction across difference, and application of learning in unscripted settings.

This article uses community-engaged applied learning (Morley & Jamil, 2021) rather than service learning, a choice that is not merely semantic. "Service" names an outcome the university is not positioned to verify, because only those who are served can declare themselves recipients of it. The term we use describes what students in our course actually do: they apply classroom learning in a community-engaged space, alongside partners who define what that space needs.

The literature is candid about how these courses fail, and those documented failures shaped our design. Eyler and Giles (1999) found that most applied learning programs at universities functioned as isolated assignments– extra credit, or a substitute for some other requirement. Hour-counting designs, in which students discharge a predetermined number of service hours across a semester (Bennett et al., 2003), treat engagement as a quantity rather than a relationship, and episodic volunteering will not cultivate allies or form genuine connections among people in a community (Butin, 2015). Clayton et al. (2010) name the full range of what university-community relationships can become– exploitative, transactional, or transformational– and make clear that the transformational end is reached by design rather than by good intention. Butin (2010) identifies the most persistent of these design failures as the charity model, in which students arrive with knowledge to deposit, and community members are positioned as beneficiaries rather than experts.

The literature identifies reciprocity sustained over time as the ideal. Bringle and Hatcher (2002) frame campus-community partnerships as requiring negotiated terms of engagement rather than assumed goodwill, and Jacoby (2015) documents how the quality of those relationships shapes the depth of what students learn. Saltmarsh and Hartley (2011) locate this obligation in the democratic purposes of higher education: universities are accountable not only for producing knowledge but for making it useful to the communities around them. Recent synthesis work links community-engaged learning to broader measures of student thriving in higher education (Guanlao et al., 2025). Ricke (2021) adds a practical caution–undergraduates often find community-engaged work unfamiliar and intimidating, and read it as extra labor unless instructors deliberately connect it to course objectives from the first week.

The mechanism that converts engagement into learning is reflection, and it must be built rather than assumed. Kolb's (1984) experiential learning cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation extends Dewey's (1957) argument that experience becomes educational only when it is examined, and positions students as constructors of knowledge rather than recipients of it. Ash and Clayton (2009) sharpen the point. Experience alone is an unreliable teacher, because students in applied settings can reinforce the assumptions they arrived with, reach simplistic conclusions about complex problems, and generalize inaccurately from limited encounters. Reflection becomes critical reflection only when it is deliberately structured.

Taken together, this body of work describes both a well-established rationale for community-engaged applied learning and a well-documented set of ways it goes wrong: partnerships that are transactional, designs that are episodic, benefit that flows in one direction, and reflection that is appended rather than built in. The five lessons that follow are our account of how our interdisciplinary course was designed against those specific risks, and what three years of implementation taught us about which design decisions mattered.

Lesson 1: Relationships Come First…and They Take Time

The most important factor in building a successful community-engaged course is time spent building and sustaining relationships. Strong partnerships do not grow from one-off volunteer events or add-on projects tacked onto existing curricula. As Butin (2007) argues, community-based learning succeeds only when it is grounded in trust and shared purpose rather than transactional interactions. The distinction matters because communities can often sense when university involvement is extractive. Genuine partnership requires something slower and harder to design: repeated presence, mutual accountability, and a willingness to follow the community's lead. With the support of an MOU from the partner school, IRB approval was secured through the appropriate university channels.

As previously discussed, before each semester began, we met several times with the school principal, bilingual teachers, instructional coaches, and district leaders to co-design goals and opportunities for student participation. These conversations were collaborative decision-making moments. What emerged was a set of shared commitments that neither side could have articulated or addressed alone. Table 2 (see Lesson #2) presents these commitments, and overall, they show that no activity in the course serves one partner alone. What is delineated as a learning objective for university students is, in every case, also a response to a need the school had already named for itself — its AVID mission, its dual language program, its summer professional development cycle.

Once we began visiting the school consistently, something shifted. The university students and our faculty team stopped feeling like guests and began functioning as members of the learning community. Teachers opened their classroom spaces, shared pedagogical challenges, and expressed hopes and goals for their young learners. Our students started building relationships with the children through read-alouds, games, and literacy lessons. Within a few weeks, the children anticipated our visits with joy.

This relational groundwork is not unique to education partnerships. Scholars of community-engaged scholarship across disciplines have documented how the quality of university-community relationships shapes the depth of student learning outcomes (Clayton et al., 2010; Jacoby, 2015). In urban planning and public policy programs, for example, students who build ongoing relationships with neighborhood organizations develop more nuanced understandings of systemic inequity than those completing discrete service hours (Bringle & Hatcher, 2002). The mechanism is the same across fields: trust opens doors that assignment sheets cannot.

What instructors can try: Begin every partnership with a co-planning conversation that asks, *What does this community need, and how can student participation support, contribute to, and celebrate (not disrupt) that work?*

Lesson 2: Design for Reciprocity, Not Charity

Reciprocity is not simply a virtue of community-engaged learning; it is a structural requirement. Engagement that flows in only one direction, from university to community,

reproduces the very inequities that service-learning courses often aim to address. A central risk we worked deliberately against was what Butin (2010) calls the “charity model” of service-learning: students arriving with knowledge to deposit in a community that receives it passively. This model, however well-intentioned, positions community members as beneficiaries rather than experts, and students as helpers rather than learners. The following table presents course objectives and how these meet partner needs.

Applied learning: classroom content to community Dual Language education context	Meeting with Administration, DL classroom observations, and participation in school events such as the Bilingual Vocabulary Parade support the school partner’s desire to integrate external partners into the fabric of the school goals, objectives, daily activities and celebrations of bilingualism
Experience in promoting biliteracy development	Supports the school partner’s AVID mission to have college student tutors on campus, engaging in academic pursuits with younger students, especially those who may be first generation college students
Experience in delivering linguistic assessments and analyzing data collected	Supports the school partner’s desire for data on morphosyntactic development in Spanish and in English among students in DL programs
Experience in Research and Conference presentation	Partner school teachers and administrators, along with district personnel attend the the poster session to learn about the data collected; the information gathered informs summer professional development for DL teachers

Table 2. *Course Learning Objectives with Connections to Community Partner Stated Needs*

As the trend of “service learning” continued to emerge in higher education, Eyler and Giles (1999) emphasized that learning deepens when students contribute to a shared goal rather than simply completing tasks for course credit. Our students provided real instructional and assessment support. They helped conduct bilingual language assessments and then returned that data to teachers in an end-of-semester poster session hosted at the school, attended by teachers, administrators, and university faculty. Instead of presenting only in the university classroom setting, in a poster session held at the partner school cafeteria, students presented to the school and community members who owned the results. This sharing of knowledge respected that the findings belonged to everyone, not just the university.

Furthermore, our collaboration aligned with the school’s intentions to expand college readiness and representation. The partner district's mission reflects the principles of the Advancement Via Individual Determination (AVID) framework, which promotes college and career readiness through purposeful instruction and a culture of high expectations (AVID Center, n.d.-a). Unlike many districts that begin AVID implementation in middle school, this partnership extends those principles into the primary grades, providing young learners with early and consistent exposure to a college-going culture. Every classroom has the teacher’s name and their alma mater listed. Throughout the

semester, university student partners provided young children with authentic models of college students, making higher education feel attainable, familiar, and within reach.

This reciprocal dimension of community engagement connects to a broader argument in the higher education literature about the purpose of the university itself. Saltmarsh and Hartley (2011) describe the “democratic purposes” of higher education; the idea that universities have an obligation not only to produce knowledge but to make that knowledge useful to the communities that surround them. When course design reflects this obligation, students learn something that syllabi rarely teach: that their academic work has stakes beyond the classroom.

Instructors can ask:
How will the community benefit from this work? What will we give back that is useful or enduring? Even small adjustments, such as hosting presentations on the partner site or inviting community members to provide feedback, can shift engagement from charity to collaboration.

Lesson 3: Community Engagement Generates Research Opportunities for Everyone

One of the most unexpected outcomes of this course was how naturally community engagement generated research opportunities for everyone involved, not just faculty. Students gathered bilingual assessment data, analyzed the findings across multiple DL students, and created research posters based on what they learned through direct, real-life experience. Several expressed interest in presenting at future conferences or pursuing graduate research related to bilingualism or community partnerships. Kolb’s (1984) experiential learning cycle helps explain why this worked: when students move through concrete experience, reflective observation, abstract conceptualization, and active experimentation, learning becomes organically cumulative rather than isolated or sporadic. Because the research process was grounded in lived encounters rather than hypothetical datasets, students described the work as genuine, meaningful, and confidence-building.

Teachers, too, became research participants in the fullest sense of the term. They identified questions they hoped to explore collaboratively: How are children using their home language in ways assessments do not capture? What does bilingual assessment reveal about a child that monolingual measures miss? We asked if they might be interested in co-presenting at conferences or participating in future publications. We later discussed facilitating brown-bag sessions for faculty and hosting a university-wide conversation about expanding community-engaged research across departments. This came into fruition this past spring when we presented at a regional schools-university partnerships conference, where we shared our joint work and goals for the future of our collaboration.

What instructors can try: From the start of a community partnership, invite students and community members into the research process as partners. Support them in designing questions, collecting data, interpreting findings from engagement sites, and

then sharing those findings back in the spaces they came from so that they can be used and applied to partner goals and objectives

Lesson 4: Real-world Professional Experiences

Many students in the course were not education majors, yet several found themselves unexpectedly drawn to roles in schools or bilingual services. Working alongside expert bilingual teachers revealed both the challenges and professional rewards of multicultural and multilingual education in ways that no case study or simulation could replicate. Several students went on to serve as substitute teachers or teaching assistants, filling genuine staffing needs and deepening their understanding of classroom realities. Others pursued opportunities abroad, including successfully earning competitive Fulbright English Teaching Assistantships in Uruguay, Argentina, Laos, Spain, and South Korea.

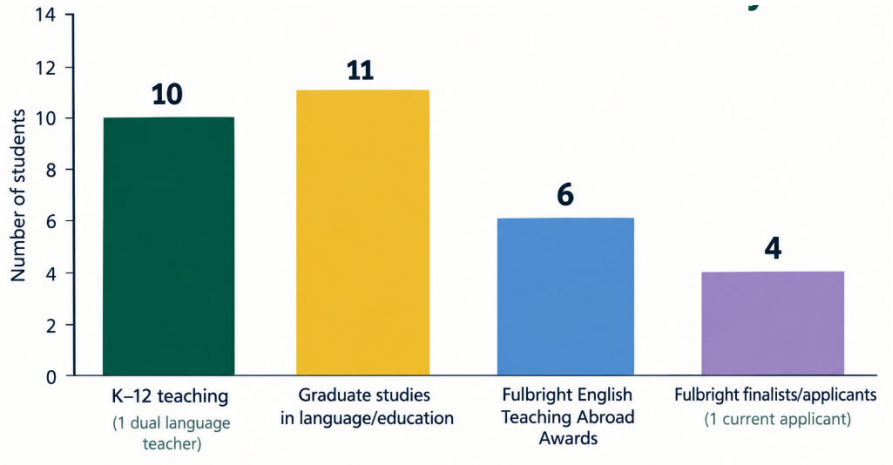


Figure 1. BLAE Graduates' Pose-Engaged Learning Educational and Professional Pathways

Note. This figure represents students who have taken the course, and subsequently graduated from the four-year institution; students who have not graduated are not represented in the graph.

Experiential learning also helped students see themselves differently as professionals. Kuh (2008) describes this as the power of high-impact educational practices: authentic tasks, where the stakes are real, and the feedback is immediate, help students imagine themselves in future roles with new clarity and confidence. When that happens, students do not simply learn content; they begin to revise their sense of who they are and what they might become. Students need to come into professional communities, even briefly and partially, in order to imagine themselves as members of those communities.

Although your field might not involve teaching in schools, every discipline has spaces where students can step into professional roles—clinics, nonprofits, cultural centers, local businesses, research labs, or municipal planning offices. In each case, the premise is the same: authentic participation in a professional community reshapes how students understand their role within it.

Instructors can ask:
What professional identities can students try on through real participation rather than hypothetical simulation?

Lesson 5: Exploration and Reflection

Finally, experience alone is not enough. Reflection, context, and purpose matter. Ash and Clayton (2009) argue that structured reflection transforms activity into understanding. Because our course addressed local issues such as multicultural communities, teacher shortages, bilingual assessment access, heritage language maintenance, and equity in education, students saw why their work mattered. Other fields have their own urgent questions—health access, environmental sustainability, humane technology, food insecurity, civic engagement. When students experience real problems with real partners, learning becomes not only richer but more human.

Through a Community Walk, *Conocer la Comunidad,* students engage directly with the urban community around the partner school. This is an experience university students engage in, in pairs and groups, on their own time, outside of class. A main objective is for students not to simply show up on the first day of engagement with partners at the school site; but, instead they have taken time to explore the community immediately surrounding the partner school. During their community walk(s), students note evidence of bilingualism in signage and businesses, attend a community event (athletics, church service, or school event) or patronize a local business) and, with all permissions, conduct a short interview of a resident of the community. In their reflections, students found that by and large, the community members do consider themselves to be part of a bilingual community. Community members report being glad, and even proud, that the school system is supporting the heritage language (Spanish) by running a robust dual language program for the next generation to attend, and in which to thrive. It is important for students (and faculty) to understand the context of interactions outside the walls of the academy, and in the case of this project, to understand the value that is placed on language, bilingualism, and heritage language maintenance in the immediate vicinity of where the community-engaged learning will take place.

Throughout the semester, students engage in pre- and post- questionnaires and reflections to gauge their learning, possible shifts in perspective, and to intentionally guide students to connect experiences with course content and with lived experiences in this applied learning context. Students keep field journals, where they log noticings related to their DL student partners' use of Spanish and use of English and any code-switching. They also reflect on their own use of Spanish and English in their interactions with DL students.

The DEAL reflection framework (Ash & Clayton, 2009) is designed to help students intentionally document and make sense of their learning so they can apply those insights in future contexts. In particular, it encourages students to carry lessons gained through community engagement into their ongoing roles as active and responsible members of their communities. The framework organizes reflection around four guiding prompts: 1. What did I learn? 2. How did I learn it? 3. Why does it matter? 4. What will I

do in light of it? The following table illustrates the development of reflection questions based on the DEAL framework recommendations.

DEAL Framework Reflection Questions	BLAE Reflection Questions
1. What did I learn?	Describe a specific moment or experience that stands out to you from your time at the school. What did you do, observe, or participate in that felt impactful, surprising, or challenging? *Prompt: "One moment that really stood out to me was when..."*
2. How did I learn it?	Think back on the experience you just described. What did you notice—about yourself, your students, the classroom environment, or the dynamics of dual language education? How did this make you feel, and what questions did it raise? *Prompt: "Looking back on that moment, I realized..."*
3. Why does it matter?	Now connect that experience to course concepts or readings. How did it help you better understand a theory, challenge an assumption, or deepen your understanding of bilingualism, dual language education, or educational equity? *Prompt: "This helped me make sense of..." or "This made me rethink..."*
4. What will I do in light of it?	Looking ahead, how might you apply what you've learned in a future educational, professional, or community-based context? What will you do differently next time you're in a bilingual or multicultural setting? *Prompt: "Moving forward, I plan to..."* What has BLAE taught you *about yourself* as a potential educator, researcher, advocate, or change agent?

Table 3. *DEAL Framework Informed Sample Reflection Questions*

As course designers, we also need to critically reflect on our instruction. Since this course is taught in the spring, we use the fall semester to debrief, gather feedback from our partners, and decide as a team which aspect of the course we could reenvision and redesign to continue improving not only the student experience, but also how we can better serve the school community's needs. Some changes recently implemented include streamlining data collection and analysis methods, assigning different roles to university students based on their strengths and interests, and offering leadership opportunities to students who have previously taken the course to come back the following year, enrolling in an independent study version of the course, to help lead research efforts.

What instructors can try: Design reflections as a recurring practice, not just a concluding assignment. Give students prompts that push beyond description. Reflection that generates more questions than answers is often doing exactly what it should.

Conclusion: Engagement That Lasts

Designing a community-engaged course requires genuine commitment and ongoing flexibility. It means allowing relationships to guide the work and returning semester after semester to the question of whether the partnership is serving the community as meaningfully as it is serving the university. That kind of sustained, self-critical engagement is demanding. It is also, we would argue, what the purpose of higher education demands.

In BLAE's case, the final project is a conference-style poster session held in the cafeteria at the partner school. School and district administration attend to see the students' research from the semester, and university faculty and administration are also invited. The partner principal allows teachers to attend on a rotating schedule, so they may see exactly what students have learned. The data and content from these projects is routinely incorporated into professional development for the DL teachers for the following August, before school starts. In this way, the reciprocity of the partnership comes full circle, in that all involved have benefited from the semester's work and partnership, and the research and data collected continue to impact the local school and its community.

What students learned in BLAE extended far beyond what we could have planned in a syllabus: academic confidence, cross-cultural empathy, professional clarity, and robust intellectual curiosity. These are not unimportant outcomes. They are the capacities that scholarship on civic learning, professional formation, and democratic education has consistently identified as essential to preparing graduates who can contribute meaningfully to an unequal and complicated world. The most striking feedback came from a student who wrote, *"I understood bilingualism before, but I never felt it until I saw it lived."* That is the heart of experiential learning, understanding that moves through hands, voices, and relationships, not only through text.

If institutions of higher education are to prepare students to think critically, work collaboratively, and make meaningful contributions to the communities and world they will shape, learning experiences must be provided that are grounded in authentic community contexts. Applied learning experiences grounded in community partnership are most effective when they are sustained through ongoing communication, collaborative needs assessment, and a mutual willingness to adapt over time. Through these reciprocal partnerships, both community organizations and university students can benefit from meaningful engagement, shared learning, and authentic, real-world experiences.

References

Ash, S. L., & Clayton, P. H. (2009). Generating, deepening, and documenting learning: The power of critical reflection in applied learning. *Journal of Applied Learning in Higher Education, 1*(Fall), 25–48.

AVID Center. (n.d.-a). *How AVID works*. http://www.avid.org/curriculum.ashx

AVID Center. (n.d.-b). *Research*. http://www.avid.org/research.ashx

Bennett, G., Henson, R. K., & Drane, D. (2003). Student experiences with service-learning in sport management. *Journal of Experiential Education, 26*(2), 61–69. https://doi.org/10.1177/105382590302600203

Bringle, R. G., & Hatcher, J. A. (1995). A service-learning curriculum for faculty. *Michigan Journal of Community Service Learning, 2*, 112–122.

Bringle, R. G., & Hatcher, J. A. (2000). Institutionalization of service learning in higher education. *The Journal of Higher Education, 71*(3), 273–290. https://doi.org/10.1080/00221546.2000.11780823

Bringle, R. G., & Hatcher, J. A. (2002). Campus–community partnerships: The terms of engagement. *Journal of Social Issues, 58*(3), 503–516. https://doi.org/10.1111/1540-4560.00273

Butin, D. W. (2007). Focusing our aim: Strengthening faculty commitment to community engagement. *Change: The Magazine of Higher Learning, 39*(6), 34–39. https://doi.org/10.3200/CHNG.39.6.34-39

Butin, D. W. (2010). *Service-learning in theory and practice: The future of community engagement in higher education*. Palgrave Macmillan.

Butin, D. (2015). Dreaming of justice: Critical service-learning and the need to wake up. *Theory Into Practice, 54*(1), 5–10. https://doi.org/10.1080/00405841.2015.977646

Clayton, P. H., Bringle, R. G., Senor, B., Huq, J., & Morrison, M. (2010). Differentiating and assessing relationships in service-learning and civic engagement: Exploitative, transactional, or transformational. *Michigan Journal of Community Service Learning, 16*(2), 5–21.

Cone, D., & Harris, S. (1996). Service-learning practice: Developing a theoretical framework. *Michigan Journal of Community Service Learning, 3*, 31–43.

Dewey, J. (1957). *Experience and education*. Macmillan.

Eyler, J., & Giles, D. (1999). *Where's the learning in service-learning?* Jossey-Bass.

Fenwick, T. (2014). Futures for community engagement: A sociomaterial perspective. In P. Gibbs & R. Barnett (Eds.), *Thinking about higher education* (pp. 109–122). Springer. https://doi.org/10.1007/978-3-319-03254-2_8

Guanlao, R., Pax, J., Wei, Y., & Zhang, W. (2025). A meta-analysis of community engaged learning and thriving in higher education. *Frontiers in Education, 10*, Article 1525176. https://doi.org/10.3389/feduc.2025.1525176

Jacoby, B. (2015). *Service-learning essentials: Questions, answers, and lessons learned*. Jossey-Bass.

Kolb, D. A. (1984). *Experiential learning.* Prentice Hall.

Kuh, G. D. (2008). High-impact educational practices. *Peer Review*, *10*(4), 30-31.

Morley, D. A., & Jamil, M. G. (2021). *Applied pedagogies for higher education: Real world learning and innovation across the curriculum*. Palgrave Macmillan.

Morton, M., Thomson, L., & Varghese, J. (2023). The value of critical community engaged teaching and learning is in the values: Advancing students' learning

outcomes. *International Journal of Research on Service-Learning and Community Engagement, 10*(1). https://doi.org/10.37333/001c.66273

Ricke, A. (2021). Applying students' perspectives on different teaching strategies: A holistic view of service-learning community engagement. *Michigan Journal of Community Service Learning*, 27(2), https://doi.org/10.3998/mjcsloa.3239521.0027.202.

Saltmarsh, J., & Hartley, M. (Eds.). (2011). *"To serve a larger purpose": Engagement for democracy and the transformation of higher education*. Temple University Press.

Stanton, T. K., Giles, D. E., Jr., & Cruz, N. I. (1999). *Service-learning: A movement's pioneers reflect on its origins, practice, and future*. Jossey-Bass.

Zimmerman, A. S. (2019). *Community-engaged research: Opportunities, challenges, and the necessity of institutional support*. In Scholarly publishing and research methods across disciplines (pp. 213–233). IGI Global. https://doi.org/10.4018/978-1-5225-7730-0.ch010

To Watch or to Read? Comparing Student Perceptions of Written and Video Feedback During Formative Assessment

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Abstract

Feedback is an essential component of formative assessment. Advances in technology have generated alternatives to traditional written “margin-comment” feedback that may benefit students in several ways. This study surveyed 59 college students about their perceptions of written and video-recorded feedback, comparing social belonging, perceived instructor care, perceived usefulness, perceived effectiveness, and general student preference across the two feedback modalities. Results indicated that students felt a greater sense of belonging when receiving video feedback and perceived that their professors cared more about their education. However, students did not show a clear overall preference for either form of feedback nor did they perceive either form to be more useful or effective for promoting learning. These results suggest that video feedback may be a useful instructional tool for supporting students’ social needs. However, conclusions are limited by the study’s small sample and reliance on student perceptions rather than objective measures of learning and performance.

Keywords: Formative Feedback, Video Feedback, Written Feedback, Student Belonging

To Watch or To Read? Comparing Student Perceptions of Written and Video Feedback During Formative Assessment

Feedback is an essential instructional tool. Ideally, professors offer feedback on student assignments, which students use to improve the trajectory of their comprehension and capacity. Feedback is a critical component of the formative assessment process, which is aimed at helping learners improve, rather than simply evaluating their performance (Spector, et al., 2016). Formative assessment is a best practice for education in general (Schildkamp et al., 2020), and it is *essential* in applied learning because applied education yields material impact by engaging students in a real-world context (Trolian & Jach, 2022). Real-world experience means real-world liabilities. As such, applied education necessitates ongoing, impactful feedback practices that correct errors and guide progress quickly (Waters, 2020).

However, students frequently report dissatisfaction with the feedback they receive, claiming that it is often vague and lacks clarity (Lowenthal, 2021; Nicol, 2010). For these reasons, many students report that they do not check or utilize instructor-provided feedback (Winstone et al., 2017). This defeats the purpose of providing formative assessment and can be quite costly in applied learning settings that involve real world consequences.

Simultaneously, instructors struggle to find time to offer meaningful feedback during significant increases in administrative burden in higher education (Woelert, 2023). Advances in video technology provide an alternative to traditional written “margin-comment” feedback which could help address some of the shortcomings of written

feedback. This study contributes to the research on video feedback in higher education by focusing specifically on student preferences for and the perceived usefulness of video and written feedback. This study also explores the social qualities of written and video feedback to determine if students feel a greater sense of belonging and instructor care when receiving one form of feedback over the other.

Student Preferences for Written and Video Feedback

Prior research examining student perspectives has found that both written and video feedback have distinct advantages (and disadvantages). For example, Borup and colleagues (2015) conducted a 14-week study where students completed a series of large assignments and were then given feedback after each assignment. Using a within-subjects experimental design, students received written feedback at one point in the semester and video feedback at another. Students were then asked to rate both forms of feedback on several different dimensions (e.g., usefulness, helpfulness, supportiveness, etc.). Overall, written feedback was perceived to be more convenient, specific, and efficient by both students and professors (See also Mahoney et al., 2019). Some reasons cited were the fact that videos could not easily be watched in public places and that recording and watching videos was associated with frequent technology failures.

However, Borup and colleagues (2015) found that students considered video feedback more personal and supportive (see also Mahoney et al., 2019). The importance of these affective/social benefits was considered especially noteworthy during the pandemic era (see Lowenthal, 2021 for a commentary) and continues to be important considering the high rates of loneliness and social isolation reported by students attending higher educational institutions in the United States (Fletcher et al., 2025).

Why the Social Component of Feedback Matters

As a fundamentally social species, humans are theorized to have a strong need to form meaningful social connections. A large body of social psychological literature suggests that this need is a potent motivational force in our daily lives and that many of our behaviors are directed toward satisfying this need (Baumeister & Leary, 1995). Along with this, extensive research and theorizing on self-determination theory (Ryan & Deci, 2000) suggests that the satisfaction of belonging needs increases intrinsic motivation and effort while simultaneously decreasing emotional burnout while pursuing goals (Gatt & Jiang, 2021).

Directly relevant to higher education, a recent meta-analysis conducted by Yang and colleagues (2026) synthesized evidence from 83 correlational studies that assessed the relationship between student belonging and academic performance. They found positive and reliable correlations between student belonging, academic performance, academic engagement, academic motivation, academic self-efficacy, intention to persist in school, and retention. Critically, the investigators found that *course belonging* (i.e., feeling a connection with the instructor and fellow students) was a better predictor of academic performance than *institutional belonging* (i.e., feeling a connection with one's broader college/university). This evidence suggests that it is critical to identify instructional

practices that increase student belonging and that course-specific approaches might be helpful in supporting student success.

Purpose of Present Study

While much of the previous research suggests that students value the efficiency of written feedback and the socio-affective vibe of video feedback, it does not tell us which of those qualities students want their professors to prioritize. Furthermore, much of the previous research was conducted pre-pandemic when video-based instruction was in its infancy and with now-outdated technologies. The process of recording and watching videos is now much more likely to go smoothly than in previous years, and students have managed to regularly overcome any prior barriers to viewing videos in public spaces. Furthermore, contemporary college students have a much richer history of receiving instruction through video than the participants in previous studies. Our rapidly evolving chronosystem makes it prudent to regularly update our beliefs about student perspectives if we want to understand what type of feedback our students want from us within our current social and technological milieu. Finally, the concept of belonging has gained visibility as an important predictor of student success (Gillen-O'Neel, 2021), but has not been specifically measured in prior studies on feedback preferences.

Method

59 students completed the study in exchange for partial course credit. Because we knew many of the participants in our sample, we chose not to collect demographic information to protect their privacy. Because demographic information was not collected from participants, the demographic composition of the study's sample is unknown. However, publicly available data indicates that the *population* from which we obtained our sample is predominantly Female (61%) vs. Male (39%). Approximately 64% of the population falls between 18-21 years of age. Ethnically, the population is predominantly White/Caucasian (67%), followed by African American (14%), Multiethnic (9%), Asian or Pacific Islander (2%), American Indian or Alaskan Native (1%), Hispanic/Latino (1%), then unknown/other (6%). We did not conduct an a priori power analysis to determine a sampling goal. Instead, our sampling goal was to simply recruit as many participants as possible within the timeframe we had for data collection.

We took steps to recruit students from courses where the instructors offered a mix of video and written feedback to ensure that students were familiar with both forms of feedback. The feedback students received was not standardized. We chose not to standardize the feedback to ensure that our study retained a high degree of ecological validity. Our concern was that standardized feedback might make the student/instructor interaction seem artificial and we wanted to evaluate authentic interactions so that our data would speak to everyday student/instructor interactions.

Students were invited to participate via announcements sent through their courses' learning management system (i.e., Canvas). Students who were interested in participating were able to do so by simply accessing a Google Form via a link in the announcement.

Upon accessing the Google Form, participants completed an informed consent procedure. If a student indicated they wanted to participate, they were then directed to respond to a short set of questions that were included to measure their perceptions of written and video feedback.

The first item was included to determine if students typically checked feedback on their assignments, *"I look at the feedback my professor gives on assignments in Canvas."* This item was scored on a True vs. False Response scale. All but one student indicated that they typically checked feedback on class assignments (98.3%).

Next, participants responded to the following items:

1. *Which type of feedback on assignments on Canvas helps you learn more?*
2. *Which type of feedback on assignments on Canvas gives you a greater sense of belonging?*
3. *Which type of feedback on assignments might make you think that your professor cares about your education?*
4. *Which type of feedback on assignments on Canvas is most useful?*
5. *Overall, which type of feedback do you prefer?*

Participants responded to all the above items on the following scale: -2 = Written feedback is much better; -1 Written feedback is moderately better; 0 = Both are about the same; 1 = Video feedback is moderately better; 2 = Video feedback is much better.

We also asked students which form of feedback they typically received in their classes, *"Overall, which type of feedback is used most frequently in your classes?"* After completing this short survey, participants were informed that the study was over and they were free to exit the survey.

Results

Analytic Strategy

We conducted a series of single-sample t-tests to determine how students perceived written vs video feedback. In these analyses, we calculated the average for each feedback dimension (e.g., "Which type of feedback gives you a greater sense of belonging?") then we compared this value against 0. We chose 0 since this was the midpoint of our response scale and would indicate a neutral response (i.e., the response favors neither video nor written feedback on any dimension). We set our threshold for statistical significance at $\alpha = .05$. Accordingly, any test statistic that produces a p-value less than 0.05 can be considered statistically significant. Given our response scale, an average that is significantly less than 0 indicates a preference for written feedback while an average that is significantly greater than 0 indicates a preference for video feedback. Descriptive statistics for our main measures are shown in Table 1.

Dimension	*M*	*SD*	% Supporting Written Feedback	% Neutral	% Supporting Video Feedback
Which type of feedback helps you learn more?	0.08	1.35	27.11	40.67	32.22
Which type of feedback gives you a greater sense of belonging?	0.75*	0.96	6.77	35.59	57.62
Which type of feedback makes you think your professor cares about your education?	1.02*	0.92	3.38	25.42	71.18
Which type of feedback is most useful?	0.03	1.33	32.2	30.5	37.28
Overall, which type of feedback do you prefer?	-0.02	1.33	35.59	27.11	37.28
Which type of feedback is used most frequently in your classes?	-1.2	1.28	79.66	6.77	13.55

Table 1. Descriptive Statistics
Note: *M* indicates the mean or average; SD indicates the standard deviation; *% Supporting Written Feedback* indicates the percentage of students that either strongly supported or moderately supported written feedback on a given dimension; *% Neutral* is the percent of students who indicated both written and video feedback were about the same; *%* Supporting Video Feedback is the percent of students who indicated moderate or strong support for video feedback on a given dimension. * is used to indicate statistical significance at α = .05.

Assessment of Student Perceptions of Video and Written Feedback

Our first analysis was conducted to determine if students felt that either video feedback or written feedback helped them learn more. We found that students' overall rating on this dimension was close to neutral, $M = 0.08$, $SD = 1.36$. The results from a single-sample t-test failed to reach the threshold for statistical significance, $t(58) = 0.48$, $p = 0.63$. Given these results, we cannot claim that students perceive either written or video feedback more effective for helping them learn. When assessing the percentage of students who felt that video vs. written feedback helped them learn more effectively, we found that approximately the same general proportion of students found video feedback (32.22%) more helpful than written feedback (27.11%).

We then assessed which form of feedback gave students a greater sense of belonging. Here we found that students generally felt that video feedback gave them a greater sense of belonging, $M = 0.75$, $SD = 0.96$. Critically, the results from a single-sample t-test found that students felt a significantly greater sense of belonging when receiving video feedback, $t(58) = 5.98$, $p < .001$. In terms of percentages, we found that 57.62% of students felt a greater sense of belonging when receiving video feedback versus written feedback (6.77%). This might suggest that students derive a greater sense of social belonging from video feedback compared to written feedback.

In a subsequent analysis we sought to determine which form of feedback made students believe their professor cared more about their education. Once again, we found strong evidence supporting video feedback, $M = 1.02$, $SD = .92$. The results from a single-sample t-test indicated that students felt their professors cared significantly more about their education when receiving video feedback, $t(58) = 8.5$, $p < .001$. Overall, 71.18% of students reported that they felt their professor cared more when they were given video feedback compared to written feedback (3.38%).
We conducted a similar analysis to determine which form of feedback students found most useful. Here we did not find sufficient evidence to conclude that students found one form of feedback more useful than another, $M = .03$, $SD = 1.34$, $t(58) = 0.20$, $p = .85$. The percentage of students who found video feedback to be most useful (37.28%) was close to the percentage who found written feedback most useful (35.59%).

Another single-sample t-test was performed to determine if students *generally* preferred written or video feedback. The results from this analysis did not provide strong enough evidence to suggest that students generally preferred video over written feedback, $M = -.02$, $SD = 1.33$, $t(58)$, $= .09$, $p = .92$. The percentage of students who preferred video feedback (35.59%) was close to the percentage who preferred written feedback (37.28%).

In a final analysis we assessed which form of feedback students typically received in their courses. We found that students generally received written feedback (79.66%), $M = -1.2$, $SD = 1.28$, $t(58) = -7.2$, $p < .001$.

Discussion

Instructor feedback plays a critically important role in formative assessment. Prior research on student perceptions of written and video feedback suggests that the two forms of feedback offer distinct advantages. Written feedback has been perceived as efficient, convenient, and specific. Video feedback has been viewed as more personal and supportive (Borup et al., 2015). This study sought to build on this research by examining students' perceptions of the usefulness and effectiveness of written and video feedback along with the potential social and relational consequences of receiving video and written feedback. Two noteworthy findings emerged. First, students reported a greater sense of belonging when receiving video feedback. Second, students felt that their professor cared more about their education when receiving video feedback. Importantly, these patterns did not extend to perceptions of effectiveness or usefulness, and overall, students did not show a clear preference for either video or written feedback. We believe these results suggest that the potential value of video feedback may lie less in its perceived instructional superiority than in its potential to enhance student perceptions of interpersonal connectedness with their instructors.

The Perceived Social and Relational Benefits of Video Feedback

Students reported a greater sense of belonging when they were provided with video feedback compared to written feedback. Students also felt that their instructors cared more about their education when given video feedback. These findings are generally consistent with Borup and colleagues (2015), who identified similar social benefits

associated with video feedback. When providing written feedback, instructors communicate through text, which, while useful for conveying information, may make it more difficult to communicate complex social cues such as tone of voice, facial expression, timing, and other characteristics of interpersonal communication. Anybody who communicates with students via email can appreciate this. Video feedback can convey many of the cues that are difficult to represent through text alone. As a result, video may provide instructors with additional means of communicating warmth and support to students.

The potential social benefits of video feedback may be particularly important in higher education because students have a fundamental need to experience meaningful social relationships and recent survey research finds that students often feel lonely (Fletcher et al., 2025). Baumeister and Leary (1995) argued that the need to belong is a fundamental human motive, while self-determination theory similarly identifies relatedness/belonging as a key psychological need (Ryan & Deci, 2000). From this perspective, teaching practices may influence students by communicating information and providing content-related feedback to support intellectual growth and by communicating that students are valued members of an academic community. Feedback may serve both an instructional *and* a relational function. Written and video feedback may be similarly capable of communicating information about students' academic performance, but video may have an advantage when the goal is to also communicate interpersonal information about the instructor/student relationship.

The present findings also suggest that video feedback may influence students' perceptions of instructor care. Students were much more likely to report that their instructors cared about their education when they received video feedback than when they received written feedback. This finding may reflect the additional social information conveyed through video, but it may also reflect students' perceptions of instructor investment. Recording and addressing feedback directly to a student may communicate that the instructor has devoted time and attention to that particular student's work. Thus, video feedback may function not only as a means of communicating information about an assignment, but also as a signal that the instructor is personally engaged in the student's educational development. This interpretation is consistent with previous research characterizing video feedback as more personal and supportive than written feedback (Borup et al., 2015; Mahoney et al., 2019).

Both the instructional and relational components of feedback are likely important, but our results suggest that the social and relational component may be underappreciated. The majority (79.66%) of the students in our sample indicated that they typically receive written feedback. This could be important given the growing evidence that belonging is associated with a variety of positive educational outcomes. As discussed earlier, a large meta-analysis found reliable positive correlations between student belonging and academic performance, engagement, motivation, intentions to persist, and retention (Yang et al., 2026). Importantly, Yang and colleagues found that course belonging, defined in part by students' feelings of connectedness to their instructors and fellow students, was a stronger predictor of these outcomes than broader forms of institutional

belonging. These findings suggest that students' immediate experiences within their courses may be particularly important to their broader educational experiences. Consequently, relatively small instructional practices that influence students' perceptions of connection and belonging may have implications that extend go their immediate perceptions to those practices.

However, our findings should not be interpreted as evidence that video feedback improves academic performance by increasing belonging. The relationships between belonging and the academic outcomes examined in prior research were not assessed here, and the present study did not examine whether video feedback actually resulted in better learning or academic performance. Moreover, because the present study did not use a true experimental design, causal conclusions cannot be drawn from the observed relationships. Nevertheless, the findings, when considered alongside prior research, warrant further investigation. If video feedback can reliably enhance students' sense of belonging and perceptions of instructor care, then video may represent one relatively simple instructional practice through which instructors can communicate social and relational support. Whether those perceptions subsequently translate into greater engagement, persistence, motivation, or academic performance remains an empirical question.

Influential models of education have already begun to emphasize the importance of these social and relational elements. For example, the Community of Inquiry model identifies *teaching presence* as an important component of effective teaching, particularly in online learning environments (Garrison et al., 2000). Teaching presence refers to the deliberate efforts instructors make to be visible, supportive, and engaged in the learning environment, and has been associated with student learning and engagement (Watson et al., 2023). Prior research has also found that video feedback can be an effective means of creating instructor presence in online courses and that students may develop stronger relationships with their instructors when receiving video feedback (Love & Marshal, 2022). Although instructor presence is often discussed in the context of online learning, the distinction between online and face-to-face instruction has become increasingly blurred. Even in traditional face-to-face courses, formative feedback is frequently delivered through online learning management systems. Thus, video feedback may provide instructors with another means of communicating presence and care when interacting with students through an online environment.

Interestingly, the social benefits associated with video feedback did not translate into a general preference for video. Students did not report that video feedback was more useful or more effective than written feedback, nor did they express an overall preference for one modality. This finding is consistent with the broader literature suggesting that written and video feedback offer different advantages rather than one modality being universally superior. Written feedback may remain particularly useful because it is efficient, convenient, and easy for students to revisit while completing future work (Borup et al., 2015). Video feedback, in contrast, may offer advantages that are less directly related to the content of the feedback itself. Students may not consider

video to be a better way to learn from feedback, while nevertheless experiencing it as a more personal form of interaction with their instructor.

Taken together, these findings suggest that the question of whether instructors should use written or video feedback may be less useful than considering what instructors hope to accomplish with their feedback. Written feedback may be well suited to communicate information about students' academic performance, whereas video feedback may provide opportunities to communicate interpersonal information about instructor support and care. Rather than viewing these modalities as competing alternatives, instructors may benefit from recognizing that they can serve complementary functions. Video feedback may be especially valuable when instructors want to use feedback to communicate that they are present and invested in the student's education. Written feedback might be useful for providing direct instruction to help students improve their performance or better understand course material.

Limitations and Future Directions

The current study has several limitations. First, our analyses were based on student perspectives rather than objective performance measures such as GPA or course grades. For this reason, these analyses do not reveal much about the effectiveness of either feedback modality. Future research should incorporate performance measures to provide a more objective index of feedback usefulness and effectiveness.

Additionally, the instructors who provided feedback did not follow a standardized approach. Instead, they were allowed to provide feedback as they normally would. We opted for this approach rather than a standardized approach because we wanted our study to maintain a high degree of ecological validity. Standardized feedback would have improved the internal validity of our study, but we worried that such standardization might limit our instructor's ability to interact with their students in a natural, organic manner. Future investigators should consider developing a standardized protocol for providing written and video feedback to guarantee that the quality and length of both written and video feedback are consistent between instructors.

The study also relied on a small sample, and we did not conduct an a priori power analysis to set a sampling goal. Our goal was simply to collect as many responses as possible during the window we had for data collection. While this is considered a defendable sampling goal (Simmons et al., 2011), our small sample size indirectly increases the risks for type 1 errors (i.e., falsely rejecting the null hypothesis) by potentially inflating estimated effects while simultaneously directly increasing the risks for type 2 errors (i.e., failing to reject a false null hypothesis). A small sample does not undermine the validity of these results, but it does raise concerns about their reliability. Thus, future investigations should involve larger samples, and our results need to be interpreted with proper skepticism.

Our study also suffers from low external validity. Our study was conducted at a single institution in the midwestern region of the United States. Because our sample came

from a specific geographical region, we cannot assume that our results apply to a more general population. Therefore, we encourage other researchers to conduct similar studies using other samples. Ultimately, we hope that the analyses reported in this manuscript will motivate subsequent investigators to continue probing the different advantages and disadvantages of video and written feedback.

Conclusion

Despite these limitations, our findings add to the growing literature on video feedback by drawing attention to a dimension of feedback that may be overlooked when effectiveness is evaluated solely in terms of learning and performance. Students did not perceive video feedback as clearly more useful or more effective than written feedback, nor did they express an overall preference for one modality. However, they consistently perceived video feedback as more conducive to belonging and as stronger evidence that their professors cared about their education.

We believe that our findings suggest that the question of whether instructors should use video or written feedback may be less useful than asking what instructors hope their feedback will accomplish. Written feedback may offer important advantages in efficiency and specificity. Video feedback may offer unique opportunities to communicate interpersonal connection and instructor investment. Given the importance of belonging in students' educational experiences, video feedback may represent a useful complement to written feedback, particularly when instructors want to communicate not only how students can improve but also that their instructor is personally invested in their development.

References

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117,* 497-529. https://doi.org/10.1037/0033-2909.117.3.497

Borup, J., West, R.E., & Thomas, R. (2015). The impact of text versus video communication on instructor feedback in blended courses. *Educational Technology Research and Development, 63*, 161-184. https://doi.org/10.1007/s11423-015-9367-8

Fletcher, C., Cornett, A., Plumb, M. H., & Ashton, B. (2025). *Student Financial Wellness Survey Report: Fall 2024.* Trellis Strategies.

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

Gatt, G., & Jiang, L. (2021). Can different types of non-territorial working satisfy employees' needs for autonomy and belongingness? Insights from self-determination theory. *Environment and Behavior, 53,* 953-986. https://doi.org/10.1177/0013916520942603

Gillen-O'Neel, C. (2021). Sense of belonging and student engagement: A daily study of first-and continuing-generation college students. *Research in Higher Education*, *62*(1), 45-71. https://doi.org/10.1007/s11162-019-09570-y

Love, S. & Marshall, D. (2022). Video feedback and instructor social presence in an asynchronous online course. *Journal of Effective Teaching in Higher Education, 5*(2), 43–58. https://doi.org/10.36021/jethe.v5i2.324

Lowenthal, P.R. (2021). Video feedback: Is it worth the effort? A response to Borup, et al. *Educational Technology Research and Development, 69*(1), 127-131. https://doi.org/10.1007/s11423-020-09872-4

Mahoney, P., Macfarlane, S., & Ajjawi, R. (2019). A qualitative synthesis of video feedback in higher education. *Teaching in Higher Education*, 24(2), 157-179. https://doi.org/10.1080/13562517.2018.1471457

Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass
higher education. *Assessment and Evaluation in Higher Education, 35*(5), 501-517. https://doi.org/10.1080/02602931003786559

Ryan, R. M. & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68-78. https://doi.org/10.1037/0003-066X.55.1.68

Schildkamp, K., Van Der Kleij, F. M., Heitink, M. C., Kippers, W. B., & Veldkamp, B. P. (2020). Formative assessment: A systematic review of critical teacher prerequisites for classroom practice. *International journal of educational research*, *103*, 101602. https://doi.org/10.1016/j.ijer.2020.101602

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological science*, *22*(11), 1359-1366. https://doi.org/10.1177/0956797611417632

Spector, J.M., Ifenthaler, D., Sampson, D., Yang, L., Mukama, E., Warusavitarana, A., Dona, K.L., Eichhorn, K., Fluck, A., Huang, R., Bridges, S., Lu, J., Ren, Y., Gui, X., Deneen, C.C., San Diego, J., & Gibson, D.C. (2016). Technology enhanced formative assessment for 21st century learning, *Educational Technology & Society 19*(3), 58-71. https://www.learntechlib.org/p/192710/.

Trolian, T. L., & Jach, E. A. (2022). Applied learning and students' well-being in higher education. *Applied Research in Quality of Life*, *17*(3), 1269-1286. https://doi.org/10.1007/s11482-021-09961-3

Waters, K.R. (2020). Slacking on: Lean practices in applied education. *Journal of Applied Learning and Teaching, 3*(2), 100-106. https://doi.org/10.37074/jalt.2020.3.2.19

Watson, S., Sullivan, D. P., & Watson, K. (2023). Teaching presence in asynchronous online classes: It's not just a façade. *Online Learning, 27*(2), 288–303. https://doi.org/10.24059/olj.v27i2.3231

Winstone, N. E., Nash, R. A., Rowntree, J., & Parker, M. (2017). 'It'd be useful, but I wouldn't use it': barriers to university students' feedback seeking and recipience. *Studies in Higher Education, 42*(11)*,* 2026–2041. https://doi.org/10.1080/03075079.2015.1130032

Woelert, P. (2023). Administrative burden in higher education institutions: A conceptualization and a research agenda. *Journal of Higher Education Policy and Management*, 45(4), 409-422. https://doi.org/10.1080/1360080X.2023.2190967

Yang, X., Zhang, D., Wang, X., & Samsudin, S. B. (2026). Sense of belonging and academic outcomes among postsecondary students: a meta-analysis. *Frontiers in Psychology*, *17*, 1841185. https://doi.org/10.3389/fpsyg.2026.1841185