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Special Issue: Practical Ai

Designing in Uncertainty: GenAI and Creative Agency in a Graduate Seminar

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Generative AI (GenAI) has arrived in education faster than educators can make sense of it, and the dominant responses, prohibition or uncritical adoption, both miss a fundamental point: AI was not designed for educational purposes. Making it educational is a design act, one that demands comfort with uncertainty, iterative reasoning, and creative agency. This practitioner report examines a graduate-level course grounded in the Five Spaces of Design in Education framework, including Artifacts, Processes, Experiences, Systems, and Culture, and positions educators and learners as designers operating across multiple levels of an educational ecosystem. A distinctive feature of this course was its composition: high school students, graduate students, and university faculty worked as equals, disrupting traditional hierarchies and modeling the co-creation of knowledge. Throughout the course, GenAI served as a creative partner across a wide array of scaffolded assignments culminating in a public showcase for the university community. We argue that design-centered approaches cultivate the creative agency needed to act with purpose when the ground is shifting, precisely the disposition educators need in an era defined by technological uncertainty.

Generative Artificial Intelligence (GenAI) has arrived in education at a remarkable speed, prompting institutions to scramble to develop policies, frameworks, and guidelines. The dominant responses continue to move between prohibition and uncritical adoption, treating GenAI as either a threat to be contained or a solution to be deployed. Both responses miss a fundamental point: GenAI was not designed for educational purposes. It is a technology in search of a purpose, requiring educators to creatively repurpose it for pedagogical ends (Koehler et al., 2011). Making GenAI educational is, at its core, a design act. Design is the discipline that knows how to work productively within uncertainty, and the GenAI moment in education is defined by uncertainty: the technology shifts faster than any policy framework can track, its long-term effects on cognition and learning remain unknown, and the problems it surfaces resist stable definition. Indeed, education problems are "wicked problems," difficult not only to solve but to understand (Rittel & Webber, 1973). Yet education is a constructed field, a human design rather than a natural law that cannot be broken or a sacred, inevitable institution, which means its problems, however complex, are not intractable. Consequently, a fundamental educational problem is how to facilitate learning, especially as technologies evolve. Despite the decade-long recognition of technology's potential to facilitate learning (Devereux et al., 1933), designing effective learning experiences remains a complex and persistently challenging endeavor. New technologies alone cannot resolve these challenges. What is needed is a design mindset. While claims about its educational potential abound, GenAI cannot bypass the fundamental reality that educational problems are design problems. We argue that educators must be positioned as designers, and that responses to educational challenges should be understood not as products but as ways of thinking and collaborative processes that shape meaningful learning experiences. We present a practitioner report of a graduate-level course that describes the design, implementation, and lessons learned from a graduate-level course that positioned educators and students as educational designers, and explores how the *Five Spaces of Design in Education* (Mishra et al., 2018) were woven throughout its design and enactment. As such, the course attempted to explore how AI could be used openly and ethically and to provoke students to consider *what is* their current understanding of educational design problems, and *what could be,* in terms of innovative ways to address those problems. We acknowledge our positionality as educators, designers, and researchers, whose identities shape the construct of this study through the course structure, teaching and learning activities, and methodological approaches.

Literature Review

The proliferation of GenAI in educational settings has generated a growing body of scholarship, much of it focused on policy responses (Chan, 2023; McDonald et al., 2025), academic integrity concerns (Balalle & Pannilage,

2025), and the potential for GenAI to automate instructional tasks (Lee & Moore, 2024). Studies of GenAI integration in higher education show that pedagogical scaffolding improves student engagement, creativity, and learning outcomes (Qian, 2025; Xiaoyu et al., 2025). A design perspective offers a different framing. Design can be considered through the lens of transforming existing situations into preferred ones (Simon, 1996), a conceptualization that explains why integrating GenAI into education is fundamentally an act of educational design. Buchanan (1992) framed a designerly approach as particularly relevant for "wicked problems," which are ill-defined, entangled, and resistant to straightforward solutions (Rittel & Webber, 1973). In educational practice, such wicked problems involve engaging with the problem, receiving feedback on tentative solutions, and iteratively refining actions (Cross, 2023). More importantly, the design process is characterized as a one-shot endeavor (Buchanan, 1992; Rittel & Webber, 1973), constrained by the necessity to generate practical outcomes (Cross, 1982). Hence, every intervention carries implications, and missteps can propagate or surface further problems. Therefore, the indeterminate nature of educational design problems and the creative demand to generate practical yet consequential solutions necessitate supporting structures that facilitate iterative exploration. Deep-play provides such a structure, enabling learners to explore and experiment in contexts where rules themselves may be open to negotiation and reinvention (Koehler et al., 2011). Considering this demand for creativity, GenAI can be positioned as a collaborative partner in the design process, supporting creative inquiry and solution generation while expanding the space of design action in educational contexts (Creely & Blannin, 2025; Ivcevic & Grandinetti, 2024). Hwang and Wu (2025), in their survey study of 121 university design students, showed that the use of AI positively affected the creativity and design capabilities of the students.

Furthermore, the nature of design, from an epistemic and cognitive stance, is essential for addressing real-world problems rather than merely a problem-solving technique, and demands engagement across disciplinary boundaries (Cross, 1982). This is essential for GenAI in education, where challenges span technical, pedagogical, ethical, and cultural domains simultaneously. Graduate-level design-based pedagogy has been shown to cultivate designerly ways of knowing and solving problems (McLaughlin et al., 2022), raising questions about how GenAI might augment, or reshape, these forms of practices and outcomes in educational contexts.

Education, therefore, must adopt a transdisciplinary approach, integrating diverse epistemologies and ways of knowing to address complex challenges (O'Sullivan, 2025). As such, the *Five Spaces Framework*, conceptualized as fluid and permeable, highlights the idea that meaningful educational experiences emerge at the intersection of multiple perspectives. Such boundary-crossing requires "melioration" (Passig, 2007), the competence to borrow concepts from distant domains and adapt them to pressing challenges. In this course, melioration operated on two levels: students drew on expertise across age and disciplinary boundaries, and they creatively repurposed GenAI, a technology not designed for education, for pedagogical ends.

Conceptual Framework: Design Spaces and GenAI as Creative Partner

This course was grounded in the *Five Spaces of Design in Education*, which conceptualizes educational design as occurring across interrelated spaces of *Artifacts, Processes, Experiences, Systems, and Culture* (Mishra et al., 2018). This framework views education as a complex design problem, positioning educators and learners as designers operating at multiple levels of the education ecosystem and treating teaching and learning as iterative processes through which meanings are continuously shaped. The *Artifact* space attends to materials that mediate learning, such as assignments, tools, and platforms. The *Process* space focuses on pedagogical structures and instructional decisions, including sequencing, facilitation, and learner support. The *Experience* space describes how learners encounter and make meaning through participation in activities and interactions over time. Beyond the classroom, the *Systems* space examines institutional arrangements, policies, and infrastructures that enable or constrain design. The *Culture* space encompasses shared values, assumptions, and ways of being that shape how design, learning, and technology are understood.

Within this framework, GenAI is positioned not as a standalone tool but as a creative partner in the design process, characterized by intrinsic motivation and creative exploration without fear of failure. This frames the learning process as "training for the unexpected," a disposition essential for navigating emerging technologies (Spinka et al., 2001). As a designed artifact, GenAI also shapes and is shaped by *Processes, Experiences, Systems, and Culture*. This relational view aligns with scholarship that frames GenAI as supporting creative inquiry and expanding the space of design action, prompting us to ask how it participates in the iterative work of designing meaningful learning experiences across all *Five Spaces*.

Course Implementation

This practitioner report is grounded in practitioner inquiry, in which educators reflect and examine their own practice with the goal of generating insights transferable to others in similar contexts (Cochran-Smith & Lytle, 1993). In this graduate course, the instructors served simultaneously as instructors and scholarly practitioners engaged in the practice and study of teaching and learning. The student reflections described and referenced throughout this report were drawn from required end-of-semester reflection papers that asked students to synthesize their intellectual and creative journey across the course. These are presented not as research data but as practitioner evidence, illustrative of the kinds of thinking and growth the course was designed to cultivate. The artifacts and reflection quotes described in the course outcomes were selected to illustrate representative students' work across the *Five*

Spaces, prioritizing depth and specificity over frequency. We received full Institutional Review Board (IRB) approval, and all student materials were collected and used in accordance with approved ethical protocols.

Course Design

The course, *Education By Design*, was a 14-week in-person graduate-level offering, open to all majors, that treated design as a way of thinking and an approach to generating creative solutions to wicked problems of educational practice, specifically facilitating teaching and learning. By principle, it valued collaboration, context, openness, and diverse perspectives. Rooted in this philosophy, the course brought together a heterogeneous group of 25 students, including high school, master's, and doctoral students, as well as university faculty, who worked as equals within a shared, totally open, and public space on the school campus. Through this lens, the course explored how each of the *Five Spaces of Design in Education* may be transformed by the advent of GenAI. Focused on one key disruption, GenAI was not considered as a mere technical tool, but as a creative partner in the design of teaching and learning experiences. Importantly, there were no restrictions on the use of GenAI in the course, and the students were particularly encouraged to use it for all aspects of the class, provided it was used with full disclosure of its utility and proper citation. While this course encouraged the use of GenAI as creative and design partners, we lean on *Dewey's Four Impulses: inquiry* (the drive to find things out), *communication* (the drive to interact and exchange ideas), *construction* (the drive to make and build), and *expression* (the drive to represent ideas and feelings in personal ways), as a technology-agnostic framework for teaching and learning, allowing the course and its innovative approaches to be modeled and replicated regardless of the tools used (Dewey, 1956).

Course Structure

The course was held once a week, on Thursday, for about three hours over 14 weeks during the Fall 2025 semester. The course content and resources were hosted entirely on a dedicated website built by the instructor and freely available to anyone outside the school. The course outcomes, while predetermined by the researchers, were open-ended, creating opportunities for students to *inquire*, *communicate*, *construct*, and *express* self-determined outcomes aligned with the broader course outcomes. Each week was assigned a theme, for instance "Becoming a Designer", with corresponding learning activities such as small group discussions, design sessions, and readings, all with the goal of making students learn from one another and be challenged to take on hard problems. Assignment designs were intentional and ranged from collaborative group projects to independent written reflections.

During the first few weeks, students were encouraged to form small groups with peers they felt they could productively brainstorm design problems with. These self-selected groups were maintained throughout the course; however, for certain in-class activities, the instructors periodically created new and temporary groups through randomization. This afforded students the opportunity to brainstorm and learn from other students beyond their group.

Each week, the pedagogical moves followed a predictable order, allowing students to anticipate, prepare, and participate effectively. Each class period had a dedicated webpage that was updated weekly. The class started with a teaser introduction from the instructors about the day's topic, followed by student group presentations, discussions of the reading materials, accompanying activities, work time on class projects, and announcements.

Students engaged as designers through a sequence of assignments that included discussions, presentations, written research projects, and the creation of designed artifacts with educational implications, using GenAI as a creative partner throughout their design processes. The assignments were designed to span a wide range of media, scales, and approaches, from quick weekly reflections to substantial projects that engage public audiences. They were designed to push students to explore design concepts, experiment with GenAI tools, and translate insights into tangible artifacts. Just as importantly, these assignments were about sharing: making work visible to peers, to educators, and to the wider community, so that design becomes not only a personal act of creation but also a collaborative practice of communication and impact.

These assignments operated at three levels: *micro*, *meso*, and *macro*, reflecting increasing levels of complexity and scope. *Micro-level assignments* provided students with ongoing opportunities to reflect weekly on their learning and designerly reasoning, split into three sub-assignments. Specifically, these assignments included readings, videos, and podcasts, with students submitting their questions and curiosities drawn from the materials before each class, which in turn served as the basis for in-class discussion. Additionally, each week, a rotating group of students shared examples of *Good and Bad Designs* they encountered in everyday life. Students were required to capture and share only personally observed examples through a variety of means, such as taking photos rather than relying on online sources; ultimately, this sharpened their awareness of the designed world around them and built their abilities to analyze the designed world and design decisions critically. This also included analyzing AI-generated and AI-mediated experiences alongside physical designs, training students to see GenAI itself as a designed artifact with embedded assumptions. Another rotating group of students served as class documentarians for the *AfterClass Rapid Reflections*, capturing the spirit of the session, quickly transforming it into a creative artifact with the help of GenAI tools, and sharing it by the next class. These *AfterClass* pieces accumulated into a living archive of the classes' journey: rapid, creative snapshots that showed how GenAI can reframe learning in real time. Across all *micro-level* work, GenAI was not an optional supplement but the medium through which students documented, reflected on, and made sense of their learning.

Meso-level assignments consisted of medium-sized group projects spanning several weeks, enabling students to con-

nect theory with creative outcomes while addressing more complex, tangible, and practical design challenges. These assignments were also in three forms. One, *Artificial Sponsored Commercials*, where each group created a 45-second audio commercial for a fictitious AI company, product, or service. Students leaned on GenAI tools to generate audio or scripts, while focusing on being imaginative, whether that means comedic, dystopian, satirical, or utopian. The second form of the assignment, *Reel Design Thinkers*, involved each group selecting two design theorists from a provided list and working together to create several short reels that make their ideas accessible and engaging. The reels were expected to introduce the theorists, explain their key contributions, and situate those ideas in context, while also weaving in their group's perspective on why these ideas matter today. The challenge was to translate often complex theories into short, compelling narratives that spark curiosity and conversation. In each of these *meso-level* projects, GenAI served as both subject and instrument: students used GenAI tools to produce their artifacts while simultaneously interrogating the assumptions built into those tools. Finally, the students took up an educational design challenge from the Vice Provost to reimagine and expand learning for those who have been excluded from formal education. This lasted two weeks, culminating in a presentation to the Vice Provost during class.

Macro-level assignments involved semester-long, individual explorations of self-identified educational design problems, culminating in a public-facing final project and an accompanying reflective paper. The first sub-assignment involved *Vibe Coding for Learning*, where the students were expected to design a game, simulation, interactive experience, or set of artifacts that teaches or models something in a domain they choose, in a way that demonstrates both their creativity and their abilities to push GenAI tools as design partners beyond the obvious. This assignment unfolded as they sketched, prototyped, tested, and refined their ideas. Along the way, they documented their processes, reflecting on both the creative choices they made and what they learned about the possibilities (and limits) of GenAI in educational design. By the end of the semester, this work was expected to also feed directly into the final project, serving as both inspiration and raw material for the curriculum experience. The guiding question that sustained the assignment throughout was: How can I use GenAI as a design tool to create something that genuinely teaches, informs, or engages others? Furthermore, the course culminated in a student-designed capstone event, an "AI Carnival," where students presented their educational design solutions to a public audience that included high school students, teachers, faculty members, researchers, and community members beyond the university. Finally, students also wrote a final paper, reflecting on their learning and experience engaging with the ideas and activities embedded in the seminar. Across all levels of assignment, the emphasis was on deep-play: creative, exploratory engagement with GenAI that treated uncertainty not as an obstacle but as an invitation to experiment and iterate.

Course Outcomes

Through this practitioner report, we reflected on the *Education by Design* course, organized through the *Five Spaces of Design in Education* as a conceptual framework for making sense of what the course produced and how it unfolded. This framework guided our documentation of course experiences rather than serving as an analytical coding scheme, and we recognize that the *Five Spaces* are interconnected and mutually influencing; as such, boundaries between them are descriptive rather than definitive.

Artifacts

Students applied designerly reasoning to educationally motivated problems they identified, *constructing* digital artifacts across the three assignment scales: *micro*, *meso*, and *macro*. At the *micro-level*, students weekly read and submitted questions and reflections that seeded class discussions. In rotating small groups, they identified and presented examples of good and bad designs encountered in their everyday environments, capturing observations and photographs to sharpen their critical awareness of the designed world, an awareness intended to inform their subsequent design choices. Additionally, rotating groups produced eight creative session documentaries each week, in varied formats, including podcasts, poems, videos, websites, infographics, and interactive mind maps, using GenAI as a design partner.

At the *meso-level*, students completed three group projects, each using GenAI as a collaborative design partner. Students generated scripts and produced six short, fictitiously sponsored radio commercials for imagined companies, products, and services. These commercials were made in different creative flavors, including but not limited to satirical, comedic, and dystopian. One comedic example advertised a holographic computer as a solution to the burden of carrying physical devices. Students also produced 12 short video reels featuring design theorists, with the dual aim of making theoretical work accessible and deepening students' understanding of designerly ways of knowing. Finally, students responded to an authentic design challenge posed by the university's Vice Provost's Office, collaborating over two weeks to produce a 23-page proposal and a presentation for a disruptive distributed learning platform, one that reimagines access to higher education by addressing structural barriers for populations historically excluded from it.

At the *macro-level*, each student developed an individual semester-long project, iteratively prototyping several versions of an AI-assisted ("vibe-coded") solution to a self-identified educational design challenge within their domain of interest. By semester's end, students produced minimum viable functional artifacts, including simulations, websites, and applications, addressing topics ranging from historical technology museums and carbon footprint calculators to music production, calorie tracking, interstellar exploration, and web-building tools. Indeed, minimum viable functional artifacts are typical of design work, as there is never a final true solution; as one student reflected, "I

realized: design is not finished when the artifact is complete. design is completed when users interact with it. The community reveals blind spots, possibilities, and interpretations we did not anticipate". These artifacts were presented at the AI Carnival, an event co-organized by the students and university staff. Students also submitted a reflective paper synthesizing their intellectual journey across the semester, from their initial conceptions of design to their evolved understanding by the course's end.

Process

The sequencing of the assignments was an intentional instructional design decision: *micro-level* tasks built awareness and design literacy; *meso-level* group projects introduced authentic, external-facing design challenges requiring negotiation and collaboration; and *macro-level* projects demanded sustained, iterative inquiry across the full semester, cumulatively influenced by their evolving experience. GenAI was deliberately integrated at each level, not as a fixed tool but as a flexible creative partner, shaping how students approached problem framing, ideation, and artifact production. Collaborative groupings were intentionally rotated, creating conditions in which students' design processes were not static but evolved through repeated cycles of *inquiry*, *construction*, feedback, and iteration.

Experiences

The students' meaning-making and experiences were particularly reflected in their final reflection paper. Their reflection papers revealed their *expression* of the course, not as passive recipients of content, but as sustained, embodied participants in design activity. One student described:

> One of the most profound realizations I had through DCI was how different this course was from traditional academic classes. This was not a book-driven, theory-heavy curriculum. We didn't sit in rows taking notes from slides. Instead, we learned through experiences, interactions, reflections, and embodiment. Rather than memorizing definitions of design thinking, we practiced design thinking. Rather than discussing creativity abstractly, we activated creativity through play, observation, and collaboration. Rather than reading about human-centered design, we lived it by examining our own reactions, assumptions, and emotions.

The *micro-level* design assignment, which involved identifying good and bad designs in the students' everyday life, functioned as a recurring perceptual training, with multiple students reporting that the course altered how they moved through the world:

> The 'Examples of Good and Bad Design' activity completely shifted my awareness. Suddenly, every door handle, street sign, and piece of classroom furniture became worthy of analysis. I remember standing in a grocery store, frustrated by a confusing aisle layout, and thinking, 'This is bad design.' Then I noticed the automatic doors that accommodated people with mobility challenges and thought, 'This is good design.' The activity trained me to notice how design shapes human behavior and experience in ways both visible and invisible.

The collaborative group structure deepened students' experience; students described their groups as spaces where trust, creative risk-taking, and intellectual vulnerability developed organically over time, an *expression of deep-play*:

> What surprised me most this semester was how often moments of confusion or hesitation turned into moments of learning. There were times when assignments felt open-ended to the point of uncertainty, but that openness ended up being valuable. Instead of waiting for instructions or 'the right answer,' I learned to trust myself more, explore ideas, and just start creating. That's something I want to carry with me into my UI/UX career: the courage to try things without knowing exactly how they'll turn out.

For the *meso-level* projects, engagement with authentic, high-stakes challenges, particularly the Vice Provost's distributed learning challenge, pushed students to confront nuances of design decisions, with one student reflecting:

> Of all the activities this semester, the Distributed Learning Ecosystems challenge from [the Vice Provost] was the turning point. The moment where the course moved from insightful to transformative. The prompt was intimidating in its scale... This wasn't a question about efficiencies or optimizations. It wasn't about designing a better website or improving a course flow. It was asking us to strip higher education down to the studs and rebuild it for the 'non-consumers' for people who have never had a seat at the table.

At the *macro-level*, the semester-long vibe coding projects generated by the students were reported to be an opportunity for new ideas with one student describing that "[their] semester-long Vibe Coding project, developing a music-therapy self-regulation game tool, became the vehicle through which these ideas came into focus," with another student attributing AI-assistance as a tool to debug their work:

> For example, I experienced this co-evolve of problem and solution in my Vibe Coding project on JianPu notation. At the beginning, I only had a vague brief idea of 'design an interactive tool to introduce Jianpu.' As someone who does not see myself as a 'coding person,' I felt overwhelmed and unsure where to start...Later, when the JianPu notation in my early prototypes turned out to be incorrect and I had to negotiate with Claude to fix it.

Systems

The *Systems* space surfaced most prominently through two course experiences: the Vice Provost's distributed learning challenge and the AI Carnival. Students were pushed beyond artifact-level design to grapple with institutional structures, access barriers, and policy constraints at scale. One student reflected that the challenge forced a confrontation with "the reality that not everyone starts at

the same baseline. We often design for the people already in the system but not for those who have been historically excluded from it." Another student described how the exercise exposed unexamined assumptions embedded in educational infrastructures "that mirrored traditional systems: linear progressions, hierarchical expertise, standardized pathways. But as we iterated, we kept challenging these assumptions." The AI Carnival extended this systems thinking into practice, requiring students to navigate real institutional logistics, coordinate across teams, manage timelines, and *communicate* with audiences, which one student described as "systems design in real time."

Culture

The *Culture* space was perhaps the most distinctive feature of this course, shaped largely by its heterogeneous composition. Students themselves named this directly: "We have a diverse group this semester, including high school students, PhD Students, master's students from different majors and departments," while another noted how the flattening of traditional academic hierarchy supported their learning in unexpected ways:

> A big part of that comfort came from the diversity in the room. There was no age limit, no strict divide between backgrounds, no sense of hierarchy. We had people with different careers, different life stories, different ages, and yet it never felt uncomfortable or intimidating. If anything, that diversity made discussions richer and made me learn more from my classmates than I expected. I learned from their perspectives, their experiences, and their creativity. Watching how other people approached assignments made me rethink my own ideas and become more flexible as a designer. Sometimes the smallest comments from a teammate made me see a project in a new way.

Conclusion

This practitioner report contributes to educational scholarship by demonstrating how design-centered pedagogy can prepare educators and educational technologists to navigate the inherently wicked nature of educational problems through design-based approaches that genuinely engage with GenAI. The diverse composition of students, faculty, and campus community members in collaborative design work challenges traditional classroom hierarchies and exemplifies a distributed learning ecosystem where knowledge is genuinely co-created across roles and perspectives, disrupting conventional notions of expertise and authority in educational settings. Furthermore, by applying the *Five Spaces of Design in Education* framework (Mishra et al., 2018), this work extends design theory by demonstrating how designerly ways of knowing can be enacted across multiple scales and dimensions of educational practice. This approach recognizes the distinction between information and knowledge: while GenAI can generate information, the design process and creative struggle transform that information into knowledge. For educators, instructional designers, and educational technologists, the course provides a replicable technology-agnostic model for addressing complex, ill-defined educational challenges and for redesigning graduate seminars, grounded in iteration, collaboration, and creative agency rather than fixed outcomes.

Ultimately, this course demonstrated that design offers educators what no policy document or technology roadmap can: a way of acting with purpose in conditions of radical uncertainty. The educational challenges posed by GenAI will not resolve into stable problems with definitive solutions. They will continue to shift, surprise, and resist. A design disposition does not promise to eliminate that uncertainty. It treats uncertainty as the condition of the work, not an obstacle to it. The students in this course did not emerge with settled answers about GenAI in education. They emerged with something more durable: the capacity to inquire, construct, communicate, and express in the face of the unknown, the creative agency to engage in design, namely, devise "courses of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111).

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