Grasping and shaping the emergence of GenAI in education: Insights from a workshop series with practitioners

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Abstract

This practice paper reports on the iterative development, facilitation, and refinement of a workshop series with STEM educators centering on the role of Generative Artificial Intelligence (GenAI) in active and student-centered teaching and learning practices. A tentative deck of design lenses representing various types of GenAI interactions served as a point of departure for activating and inspiring dialogue and co-creation of teaching and learning designs that consider the role of GenAI-powered tools based on local contexts. We present key themes and ideas emerging from these dialogues and outline the iterative refinement of the design lens deck for future use in educational practice – in dialogue with both educators and students.

Keywords: Active learning, Problem-Based Learning, Generative artificial intelligence, STEM education

1 Introduction

In recent years, educational systems have undergone significant disruptions driven by technological advancements and global events. The sudden shift to emergency online instruction during the COVID-19 pandemic and the subsequent collective reflections it afforded regarding post-digital practices in a 'new normal' exemplify one such disruption (Otto et al., 2024). More recently, the arrival and public availability of sophisticated Generative Artificial Intelligence (GenAI) technologies have sparked polarized debates regarding their multifaceted dialogic affordances, ethical issues, and educational implications (Łodzikowski et al., 2024; Selwyn, 2024). Both events have prompted rapid adaptations in educational and pedagogical practices in arenas such as assessment practices and curriculum design. Very often, however, the responsibility of such adaptations has put educators as well as students at the forefront of navigating the complexity of an evolving educational landscape shaped by changing policies and emerging technologies (Driessens & Pischetola, 2024). In our prior research, we found that students experience several tensions related to navigating rules, norms, and social relations surrounding GenAI utilization in a group setting (Otto et al., 2025a). They missed dialogue with their peers and teachers when navigating these tensions. We believe that an important step toward addressing these uncertainties lies in equipping educators to initiate and sustain such conversations anchored in their local teaching and supervision practices. To this end, one meaningful approach builds on collective action, as noted by Mills et al. (2023):

> *In a moment of overwhelm, we can turn toward each other and toward students and share imperfect, incomplete insights and experiments.*

In this paper, we report on a workshop series designed to create a space for sharing and designing those insights and experiments among STEM education practitioners. Alongside the local insights contributed by

participants, we sought to activate initial and emerging insights reported in contemporary literature by materializing this knowledge into a deck of design lenses that served as catalysts for dialogue about the implications of GenAI in their local teaching environments as well as co-design new practices that consider those implications. Through this process, our aim was to support educators in becoming better equipped to support students in navigating the complexities of GenAI in education. In the following sections, we outline the workshop and lens design, including facilitation experiences that informed subsequent refinements alongside emerging insights from a parallel literature review (Otto et al., 2025b). We then highlight key themes that emerged from the discussions and outline the next steps.

2 Materials and methods

In the fall of 2024, we facilitated three workshops with STEM education practitioners and researchers across educational levels (Table 1). Workshops 1 (WS1) and 3 (WS3) followed a structured format revolving around the design lenses. Initially, participants were introduced to technical and ethical aspects of GenAI as well as frameworks for AI in Education (AIEd) (Molenaar, 2022; Mollick & Mollick, 2023; 2024). Subsequently, we used the lenses as both a structuring element as well as creative stimulation. The structure was adapted from Hansen's (2024) 'Creative collaboration' model as well as the think-pair-share model (Lyman, 1981) (Table 2).

Table 1: Workshops and participants

#	Participants	Arena	Duration
WS1	International engineering education researchers and educators (*N* = 38)	SEFI conference	60 minutes
WS2	Pre-university STEM teachers (*N* = 59)	LabSTEM-North conference	45 minutes
WS3	Scandinavian engineering education researchers and educators (*N* = 20)	ETALEE conference	60 minutes

Table 2: Workshop structure

Individual brainstorm	Participants draw a random design lens and reflect on its relevance to their current or past teaching practices
Same-lens exchange	Participants join others with the same lens to exchange ideas and discuss challenges grounded in their local contexts
Cross-lens exchange	Participants engage in discussions with participants who drew different lenses to share ideas, insights, and highlights from previous steps
Case work	In groups, participants apply multiple lenses to a shared case, co-designing approaches for integrating GenAI into teaching

Workshop 2 (WS2), designed for pre-university STEM teachers, was adapted to align with this audience's pedagogical needs and the session's shorter duration. Unlike the other two workshops, which were designed for a diverse audience of educators and educational researchers, WS2 was conducted exclusively for teachers attending the conference for competency development. Therefore, the introduction was expanded to include concrete, real-world examples of GenAI integration in STEM teaching as well as an overview of selected GenAI-powered tools and relevant characteristics (e.g., GDPR compliance). Additionally, the structured application of design lenses was replaced with a more flexible, discussion-based approach, where participants formed small groups and discussed one lens at a time. This ensured exposure to a broader variety of interaction types while allowing for in-depth discussion contextualized in similar local teaching practices.

2.1 Design lens development

Design is essentially a dialogue between ideas and the world, a dialogue that lies at the heart of inquiry (Rusmann & Ejsing-Duun, 2022). To nurture the dialogue on how to navigate tensions missed by students, the deck of design lenses served as a foundational element to provide a structure and language for dialogue as well as inspire new ideas. Originating from the field of gameful design, design lenses combine a clear statement of a design principle with a series of guiding questions to inspire perspective taking in design processes (Deterding, 2015). We adapted this concept to the context of active teaching and learning design in STEM education to provide educators and researchers with tangible and scoped representations of a multifaceted and unfamiliar topic (GenAI in education) and inspire thoughts on implications and ideas grounded in local practices. The content of these lenses was informed by an ongoing systematic literature review on interactions with GenAI-powered tools in the context of active and collaborative STEM learning environments (Otto et al., 2025b). From a synthesis of preliminary and evolving experiences reported in the literature, we identified a total of five overarching categories and 9 subcategories of human-GenAI interactions positioned to support student learning and higher-order thinking skills in both individual and collaborative learning spaces. Each category and subcategory were translated into a design lens encompassing a principle, guiding questions, and application examples.

The number and diversity of the lenses evolved in response to emerging insights from the ongoing review. Initially, based on 29 studies from 2023, the first five lenses were developed and tested in WS1. As the review expanded to 50 studies published between 2023 and July 2024, four additional lenses were developed, capturing a more nuanced variety of GenAI applications, which were tested in WS2 and WS3. This iterative process is depicted in Figure 1, while an overview of the latest iteration of design lenses designed for students can be seen in Figure 2.

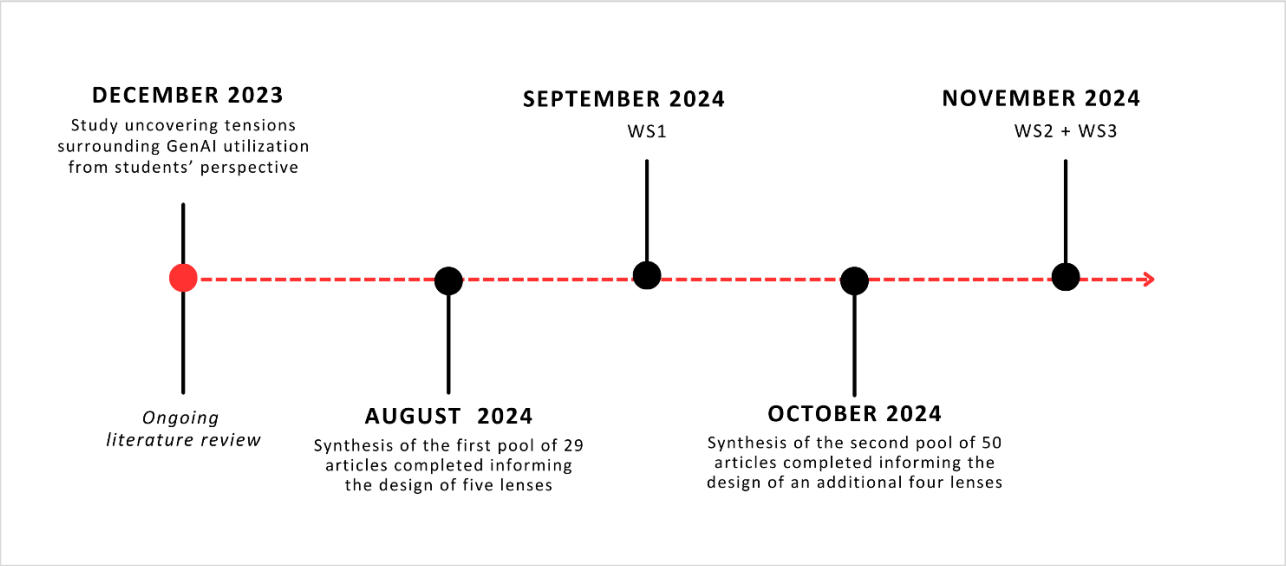

Figure 1: Process overview

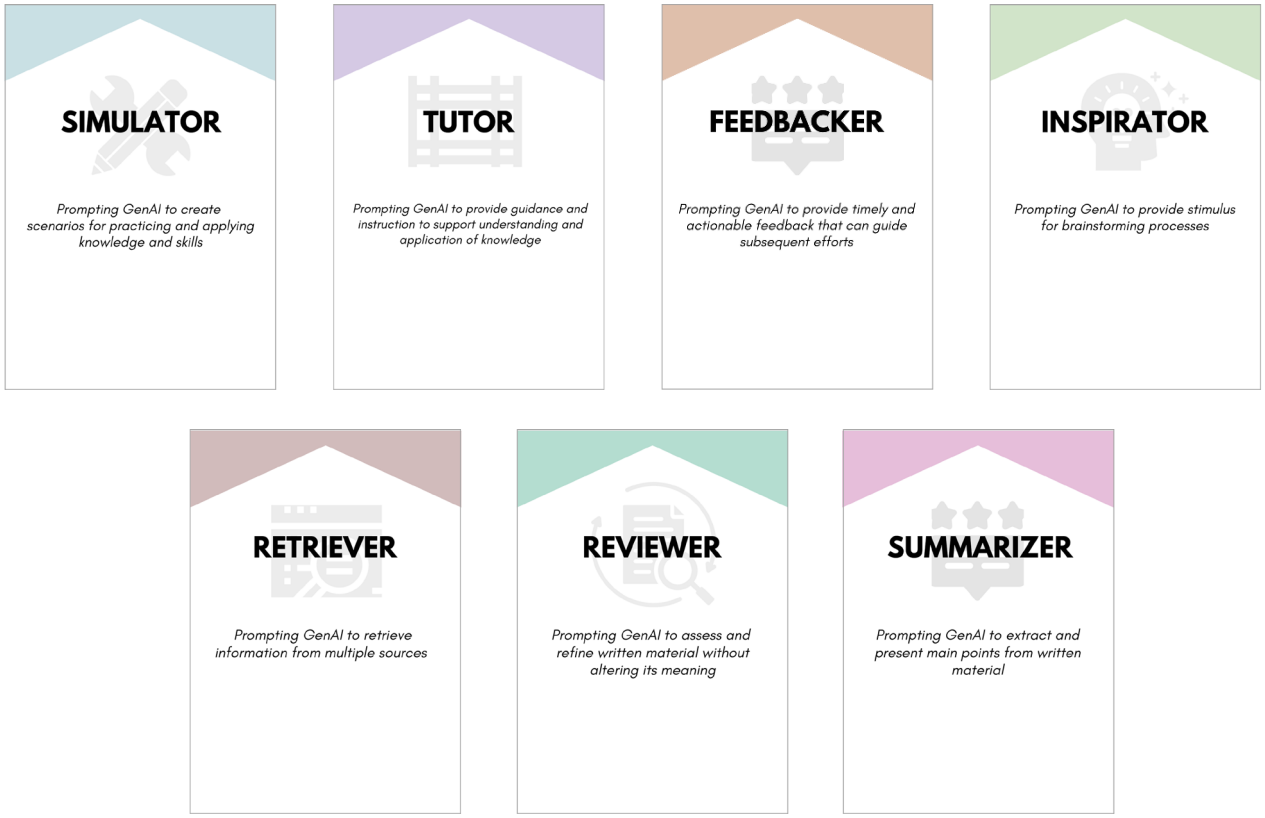

Figure 2: Design lens overview

2.2 Iterative test and refinement

Drawing on our experience facilitating and participating in the discussions at each workshop, subsequent reflections informed ongoing refinements to the workshop content and artifacts. Below, we share selected examples of these refinements implemented to enhance the operationalizability of the lenses for participants.

A key takeaway from the workshops was the value of using tangible cards to frame thinking and dialogue on a complex and unfamiliar topic. The lenses created a shared language that supported sense-making while enabling participants to engage hands-on with different application types. Combined with opportunities to externalize and refine ideas through peer discussion, this allowed participants to connect the lenses to their own practice and generate new insights. However, several barriers limited the full realization of these benefits. One major challenge concerned the complexity and cognitive load associated with interacting with the lenses. In the first iteration (Figure 3), the cards contained detailed background information grounded in research and theory. While this depth was intended to support and inform reflection, the effort required to process and apply the information to one's local practice within a limited timeframe created a high cognitive load. To address this, we revised the design of the cards. Lens descriptions were distilled into concise, single-sentence utilization principles. The guiding questions were refined, and multiple surface-level examples were replaced with a single, in-depth example (Figure 4). Additionally, we integrated a custom GenAI bot developed with schoolhub.ai. Participants could access the bot via a QR code, affording a more dynamic and interactive engagement with each lens.

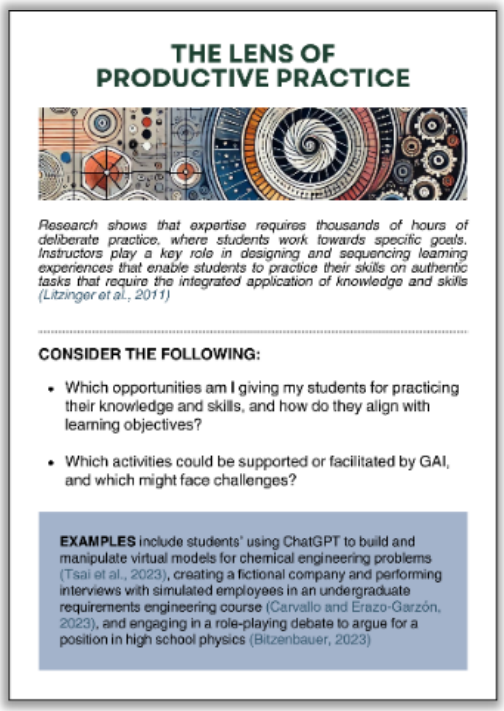

Figure 3: First iteration of design lens

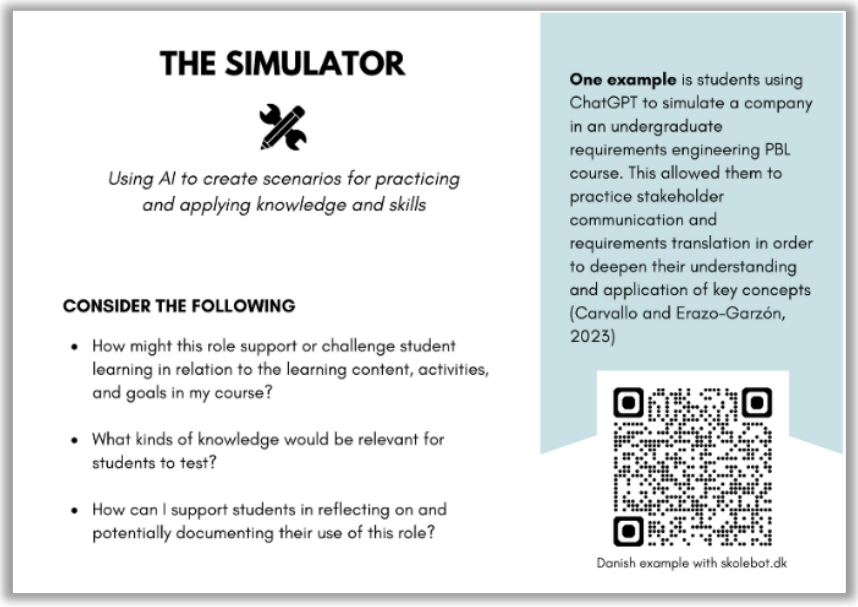

Figure 4: Second iteration of design lens

Another key revision emerged in response to challenges associated with the former *Offloader* lens. This interaction category, originally derived from the literature review and informed by Mollick and Mollick (2023), described scenarios in which tasks traditionally performed by students are delegated to GenAI. The underlying rationale is that offloading certain tasks can free cognitive resources for higher-order thinking (Lodge et al., 2023), provided it does not replace the thinking itself. However, during the workshops,

participants found the category too broad with limited practical value and post-workshop evaluations highlighted a need for greater disciplinary nuance. As one participant noted, the implications of offloading a coding task differ substantially from delegating the proof of a mathematical theorem or a reflective writing assignment. These distinctions highlight that the pedagogical consequences of offloading are highly context-dependent and shaped by both the task itself and the intended learning outcomes. At the same time, our ongoing analysis of an expanded pool of articles from the literature review revealed a more diverse range of GenAI roles than initially captured. This prompted a reorganization of the framework into main roles and sub-roles that afforded finer granularity. Consequently, the original *Offloader* lens was subdivided into several more specific sub-roles, informed by emerging literature and participant feedback.

3 Next steps

A recurring theme in WS1 and WS3 was the importance of incorporating student voices in shaping the role of GenAI in teaching and learning to ensure their perspectives are represented in decisions affecting their study practices and to better support them in navigating the complexities of an evolving landscape of GenAI in education. We try to nurture dialogue and thus facilitate change through two implementation strategies: 1) A sustainable implementation strategy engaging student and teacher voices in defining problems and practitioner involvement in testing the lenses and bringing them into their own contexts. 2) Workshops and lenses act as an expansive implementation strategy (Henriksen & Ejsing-Duun, 2022) allowing diffusion through these designs by dispersing the ideas of a broader use of GenAI reifying them into lenses and interactions among more teachers and students.

The call for student involvement manifested in several domains, including the development of use cases, course policies, and identification of inspiring practices. In WS1, for example, one group emphasized the need for exemplary use cases to guide students in using GenAI responsibly and purposefully. Rather than imposing predefined cases, participants advocated for a co-constructive approach in which students actively contribute to developing these cases to foster shared ownership (Otto et al., 2024). Similar concerns emerged in WS3, where participants discussed involving students in shaping formal course policies on GenAI utilization in PBL. Here, the emphasis was on aligning institutional guidelines with students' actual study practices to ensure that policies are both relevant and implementable.

Building on these discussions, particularly the emphasis on co-constructing use cases, policies, and practices, the next phase of our work involves developing a dedicated deck of lenses and an accompanying activity tailored for students. This resource will serve as the foundation for implementing a more reflective and purpose use of GenAI through a new workshop series aimed at supporting students in creating frameworks for responsible and purposeful GenAI use within both individual and collaborative study practices.

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