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LAIK your classroom: A practical framework to integrate generative AI in higher education classrooms

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Abstract

The proliferation of generative artificial intelligence (GenAI) tools in the last two years and their ongoing development make their integration in education an inevitable reality. Recent studies into the integration of GenAI tools in academia have focused on opportunities for education and challenges to consider. In this context, few frameworks and models have been proposed, but none have addressed the need for a comprehensive and practical framework to facilitate teachers' efforts to integrate GenAI into their classrooms. This study, therefore, addresses this research gap by developing a framework for the integration of GenAI in classrooms, the LAIK framework. The framework is designed to identify the necessary elements that should be considered before, during, and after integrating GenAI tools in higher education classrooms. To build the framework, data were collected from teachers, students, and classroom observations. Results from the study highlighted the need for four practical stages in this framework, namely (1) laying the foundation, (2) assembling GenAI-friendly classes, (3) investigating and monitoring, and (4) keeping the teacher informed. The framework also offers a variety of options to consider for practical ways to integrate GenAI technology to support learning in the classroom.

Introduction

It has been just over a year, and generative artificial intelligence (GenAI) is increasingly becoming imbedded in many major service providers (Bower et al., 2024; Singla et al., 2024). While the technology was not built for educational purposes, it surely has disrupted education enough to cause a wave of concern and calls for necessary restructuring or even reconceptualization of assessment practices in academia (Bower et al., 2024; Cotton et al., 2023; de Winter, 2023; Mao et al., 2024; Rudolph et al., 2023; Sullivan et al., 2023). Despite the unique challenges and opportunities presented by GenAI, the education landscape has a proven track record of adaptability in the face of previous technological innovations. Google, the search engine, is one simple example. Although the technology of search engines now seems an indispensable part of our lives and of our education system, education and humankind happily lived before it was first released in 1998 (Hall & Hosch, 2024). While Google's search engine did not generate an instant shockwave like GenAI, it eventually redefined information access, compelling the education system to adapt. Both search engines and educators managed to coexist and support each other. Educators adjusted their teaching and assessment methods that utilize accessing and retrieving information, which led to broader changes in educational practices.

As the education ecosystem responds to a new reality shaped by GenAI, stakeholders—including researchers and practitioners—share the responsibility of investigating effective ways to integrate GenAI while maintaining quality and serving learners' best interests. One of these ways, as Hwang and Chen (2023) advocate, is by developing frameworks that guide teachers' efforts to "implement [GenAI]-based learning strategies, teaching plans or research designs" (p. 15). In fact, several researchers have emphasized the need for well-researched methods to integrate GenAI into teaching and learning (Crawford et al., 2023; Sidorkin, 2024; Tlili et al., 2023). This paper aims to address this need.

Existing frameworks to guide GenAI integration in classrooms

In their discussion of GenAI integration in a UNESCO guidance, Miao and Holmes (2023) stress the need to prioritize "human capacity and collective action, and not technology" (p. 7) to facilitate effective learning environments. This highlights the critical role teachers play in facilitating an effective and responsible approach to integrating GenAI into education. Similarly, Jeon and Lee (2023) demonstrate in their discussion of teachers' relationship with AI in the classroom that successful AI implementation in a learning context hinges on "teachers' pedagogical expertise that was strengthened by the AI-generated data" (p. 4). They also report that despite the growing body of research on the educational use of AI, much of this work has narrowly focused on specific applications and roles, failing to capture the full spectrum of possibilities associated with integrating AI technologies into educational environments. Sidorkin (2024) echoes their findings as he emphasizes the need for theory and frameworks to ensure "shaping the future of education in the age of artificial intelligence" in meaningful ways (p. 1).

A few GenAI frameworks have been proposed in the literature discussing different levels of GenAI integration at different depths. For instance, the IDEE framework proposed by Su and Yang (2023) encourages teachers to consider four aspects: (a) "identify[ing] the desired outcomes", (b) "determin[ing] the appropriate level of automation", (c) "ensur[ing] ethical considerations", and (d) "evaluat[ing] the effectiveness" of the tool (pp. 5-6). The framework can be generally seen as a guide at the abstract planning level of GenAI integration; however, there is little attention given to the practical and more hands-on level of classroom integration. The framework does not offer the needed detail and structure when it comes to levels of automation, and it does not give details about classroom application as part of the process.

Another framework proposed by Rowland (2023) focuses on academic writing and is built on the idea that utilizing AI for academic writing should not be seen as binary (used or not used). Rather, there is a continuum of nine levels ranging from "entirely human-generated" to "entirely AI-generated" (p. 36). He offers a detailed account of the different GenAI-guided activities to facilitate academic writing from a student perspective. Similarly, Pigg (2024) proposes a descriptive framework focusing on the practice of writing. The framework outlines "descriptive codes that name and describe practices early adopters enact when integrating these technologies into research writing" (p. 2). Both frameworks focus on using GenAI to support academic writing only, and they do not address the process from a teaching perspective.

Finally, Kolade et al. (2024) offer a framework based on their research into GenAI for learning and assessment. Their framework proposes that teachers can utilize GenAI tools at three different levels of assessment whether summative or formative. These levels are knowledge, competence, and performance. Along the same lines, Perkins et al. (2024) propose a framework that focuses on assessment. Their framework encourages teachers to "support students in engaging with GenAI tools in an appropriate and ethical manner" (p. 5) at different levels suggesting that GenAI use is not binary, as Rowland (2023) suggests. While both frameworks offer practical ways for teachers to account for GenAI, they primarily focus on assessment. Assessment is an important part of the learning process, but only one part of what happens in the classroom.

Research gap and study objectives

As discussed in the previous section, the frameworks proposed in the literature to discuss GenAI in education do not focus on the aspects of classroom integration aspect and/or the teacher's perspective. That is, there is little focus on the various roles GenAI can play *inside the classroom*, as part of the lesson while still prioritizing learning as the main drive. This limitation has led to a significant gap in the literature addressing the effective application of GenAI. To the best of our knowledge, there is currently no practical

framework that comprehensively guides teachers in integrating GenAI into classrooms. Nor is there a framework that considers the various ways GenAI can support learning in the classroom, along with the associated planning and follow-up work. In fact, in their critical analysis of the GenAI landscape in education, Wang et al. (2024) recommend that research efforts should focus on finding ways in which GenAI can "be integrated into current curricula to enhance students' learning" (p. 12). Echoing a similar emphasis, the UNESCO Director for the Future of Learning and Innovation cautions:

> Without institutional guidance of any sort, these technologies are likely to get welded into education systems in unplanned ways with uncertain implications and possible unintended consequences…. Educational institutions need an agile and iterative approach, or they will forever be trying to catch up with the relentless pace of technological innovation (UNESCO, 2023, para. 8).

This study seeks to address this clear need for a practical framework to guide the efforts of educators and researchers as they utilize (or investigate) GenAI tools in the classroom meaningfully and responsibly, across various higher education (HE) courses. Therefore, the study seeks to answer the following research question: *How can teachers integrate GenAI technology into their classroom in effective and meaningful ways?* To answer this question, we propose the LAIK (pronounced like the word *like*) framework for teachers based on insights and feedback collected from teachers in various workshops on GenAI for over a year. The framework is designed to identify the necessary elements that should be considered before, during, and after integrating GenAI tools in HE classrooms. It also offers a variety of options to consider for practical ways to integrate GenAI to support learning in the classroom.

Methodology

Study design

To develop a practical and comprehensive framework to integrate GenAI in HE classrooms, we sought to collect data from both teachers and students, the primary participants in a classroom environment. This approach ensures a comprehensive and inclusive design by considering both teacher and student perspectives. During the data analysis process, several elements for effective GenAI integration emerged. The process of identifying and combining these elements to build the framework was iterative and cumulative; with each round of data collection and analysis, the different elements in the framework were further enriched and/or validated.

Data collection

Data were collected from the two main layers of participants (i.e., teachers and students) in different ways. Data were collected from over 600 educators through different workshops and training engagements since February 2023. The workshops focused on GenAI technology and its educational implications, and they primarily discussed ChatGPT because, in the early stages of this GenAI era (and when these workshops started), users were mostly interested in and familiar with ChatGPT compared to other tools and other forms of GenAI.

Overall, the workshops focused on (a) introducing ChatGPT as a tool, (b) highlighting strategies for using GenAI to support teaching and learning, and (c) discussing the impact of GenAI tools on higher education. These workshops allowed active engagement with education stakeholders at different stages of building the framework. Their engagement throughout these instances offered great insight into their experience as teachers with GenAI in their practice. Different tools were used to gather data from teachers throughout these engagements, but for the purposes of this study, we will use data collected from the five-week course to report insights from teachers. The course was offered in March 2023 and again in May 2023. In this course, 36 participants filled out two surveys, engaged in three focus groups, submitted eight written tasks, and designed one lesson or activity that utilizes ChatGPT for teaching and learning. Data from this stage identified the main elements of the framework and helped draw a clearer picture of effective GenAI integration *for teachers*.

Data from students were collected after the first version of the framework was established. That is, after engaging with educators through multiple training engagements, Version 1 was considered rich enough and ideal to be used in the classroom. The course was dedicated to teaching academic research writing skills. Students (n = 186) were from different degrees, with different language proficiency levels, and at different levels of technological literacy. They also had different exposure levels to GenAI; some have been using ChatGPT extensively, and some, surprisingly, never heard about it. Data were collected at this stage through two surveys, two written assignments, and eight classroom observations. Data from this stage highlighted opportunities for development to refine and expand the framework, making it more engaging and supportive of GenAI-assisted learning *for students*.

Data analysis

Data collected from teachers throughout the process were sorted into Excel sheets and qualitatively analyzed in terms of classroom application. Upon educators' completion of the training course, analysis of the data identified three main areas to consider for the framework: setting the scene, developing an AI-friendly environment, and evaluating and monitoring. This led to Version 1 of the framework, which was comprehensive enough to be implemented in class with students. Using it with students offered insight into how students with different abilities and proficiency levels interact with the technology and the learning activities developed as part of the framework. This helped to enrich the framework (V1) further and led to the development of the final framework (V2), which will be discussed in detail in this paper. Figure 1 summarizes the process of building the framework.

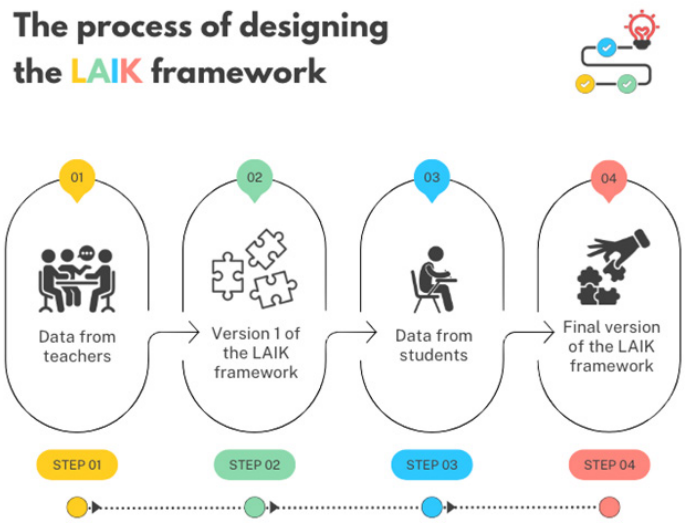

Figure 1. The process of designing the LAIK framework.

Results

Insights from teachers

Data from teachers throughout the process of developing the framework highlighted teachers' keen interest in learning more about "user-friendly styles and methods of maximized ChatGPT use for the general improvement of my teaching methods and productivity" (Teacher 29) and "how it could be beneficial for faculty in different streams… [and] how various levels of students can benefit from AI tools" (Teacher 19). Throughout teachers' engagement with the workshops, several elements of effective GenAI integration emerged and were stressed: the need for training and setting GenAI-use boundaries clearly for students, the need for clear, practical and responsible methods to integrate GenAI in class, and the need for staying up to date with the latest updates and changes to these tools.

When the framework was discussed with participants, they found different kinds of activities outlined in the framework (Stage 2) useful:

> I learned that there are many positive ways that teachers and students can use the technology for teaching and learning. This PD was really a great 'learning-by-doing' experience and I learned a lot from all the ideas shared. I came away with more confidence and optimism in using AI-powered programs. (Teacher 6)

> I've also learnt many ways it can be used in teaching, such as lesson planning, lesson activities and materials. I've also come to find out more about introducing it to students and making them use it to generate ideas for their writing. (Teacher 27)

Insights from students

Data from classroom observations and students' assignments demonstrated the effectiveness of the framework in providing students with the necessary information to utilize GenAI effectively during class and to develop a more critical understanding of GenAI and its role in learning. Data gathered from classroom observations and students' engagement with the framework stressed four important elements to include in the framework: the need for training, the need for clear examples of misuse *in relation to the course*, the need to provide sample prompts at the beginning of GenAI-assisted classes, and the need to monitor students' engagement with GenAI throughout the course.

In the pre-survey, a small group of students (17%) had never heard about ChatGPT, but the majority reported using the tool to help answer questions and write (or complete writing) their assignments. Only one student from all 186 participants had something to say about the need to check the information she gets from ChatGPT: "sometime[s] I use it for assignments and then I double check the information from [the] internet because sometime[s] chat gpt is not correct" (Student 147). Others seemed to trust its output to a great degree as they used phrases, such as "trusted information" (Student 122) and "information with high standard" (Student 57) to describe how and why they use GenAI in their studies.

Towards the end of the course and after implementing the framework with them in class, students filled out a survey with open-ended questions about their experience. It was interesting to see that their attitude towards the tool (and GenAI in general) shifted. When asked: "What should teachers tell their students about ChatGPT?", the majority stressed the need for teachers to "explain how to use it correctly" (Student 13) and to inform students "that it is helpful but does not always give true and realistic information" (Student 6). Another student highlighted the need to inform students "how they can use it in a legal way in the course and teach the student how to find accurate information, and also teach them that CGPT [is] not always correct" (Student 45). After being introduced to GenAI in class through the LAIK framework, students' overall experience demonstrated an appreciation for the learning assistance it provides, as well as a critical awareness of its limitations and how they can address them. One of the students explained:

> I think what we learned about ChatGPT in this course was really helpful, I got to know how to properly use it in a good and helpful way. So this topic should at least be mentioned briefly to other students so they know what to avoid doing with chatgpt. (Student 7)

The framework

Upon analyzing and collating data and insights during the course of this study, we found that an effective framework for the classroom integration of GenAI cannot just focus on the classroom experience. The nature of GenAI tools requires the addition of three other critical areas that shape the classroom experience when integrating GenAI. Accordingly, the findings of this study suggest that to effectively integrate GenAI technology into higher education classrooms, there needs to be four essential stages (see Figure 2). Each stage is discussed in detail in the next section.

Additionally, observations from our study highlighted the need to draw upon a few defining beliefs about the role of technology in education to build the framework. The first

fundamental belief is that technology should not be the central focus in any educational setting; rather, it should facilitate learning. The highest priority should always be the learning experience and learners' needs. The second critical belief is centered around the human aspect of learning. Over-reliance on GenAI in place of classroom engagement with teachers and peers is both ineffective and potentially unsafe due to GenAI limitations. Finally, the framework is built on the core understanding that teaching in the classroom is a dynamic experience that dictates a certain degree of flexibility to allow for an organic learning experience. As Rudolph et al. (2024) aptly explain: "Teaching well encompasses adapting our teaching strategies to align with the unique contexts we encounter" (p. 15).

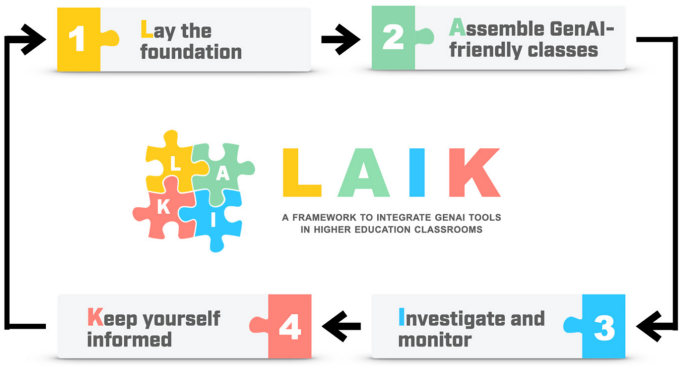

Figure 2. The LAIK framework.

The LAIK framework

To address the growing need for a practical framework for teachers to integrate GenAI technologies in their classrooms, the LAIK framework was systematically developed and iteratively refined to include four stages. It is designed to be comprehensive and to systematically—yet flexibly—allow educators to introduce, utilize, and maximize the benefits of GenAI technologies in the classroom. As outlined in Figure 2, the LAIK framework is built around four stages.

The first stage, *Laying the foundation*, focuses on building the basics of GenAI use for learning, making sure learners are fully aware of the target tool(s), guidelines, and strategies that ensure optimal use of GenAI. The second stage is *Assemble GenAI-friendly classes*. This stage details GenAI-friendly learning activities that teachers can integrate into their classrooms to implement GenAI tools as part of students' learning in ways that are both responsible and meaningful. The third stage, *Investigate and monitor*, emphasizes quality assurance of GenAI integration efforts. Finally, *Keep yourself informed* is the final stage, and the stage that emphasizes the importance of staying up to date with the latest developments in GenAI and the latest discussions and research surrounding its educational use and implications.

Before discussing the stages, however, it is important to acknowledge that the framework operates under the assumption that the teacher has already chosen the most appropriate GenAI tool(s) for their classroom. This choice should align with (a) the course's learning outcomes, (b) students' learning needs and background, and (c) the institution's guidelines and policy. While choosing an appropriate GenAI tool is indeed an important step, it is beyond the focus of our framework because of the continually evolving and expanding landscape of available GenAI tools. The defining characteristics and boundaries of GenAI tools are rapidly changing and advancing in ways that cannot be fully anticipated or accounted for at any given time. Additionally, while the framework is meant to be used by teachers in the classroom, the boundaries that define some of its components will depend on the institution's overall policy and regulations. However, the absence of such regulations or lack of clarity should not deter teachers from utilizing the framework or GenAI in their classrooms.

Stage 1: Laying the foundation

The first stage is critical to the success of teachers' efforts to integrate GenAI into their classroom. This stage must be introduced in class because it ensures that students are critically aware of the affordances offered by GenAI and the limitations that surround its use. Even though GenAI tools do not require advanced technical skills, students need direct and clear training on how to use GenAI tools effectively and how to use them *for learning*. Several issues and skills need to be covered at this stage. They are the building blocks of the meaningful and responsible use of GenAI in the classroom.

Introduce the tool

The first issue to cover at this stage concerns (1.1) the GenAI tool(s) that the teacher of the course intends to use in the course. The teacher needs to clearly and directly (a) explain the capabilities of the target GenAI tool, and, if possible, the mechanics of it in ways that make sense to the students. This is important because it can dispel the unrealistic excitement that often accompanies new tools. Students need to understand that although GenAI tools seem to respond meaningfully, they do not understand language, think, or use logic and common sense like humans do. Rather, GenAI tools utilize the training data that they have been exposed to predict the most probable next sequence in any given context (Bubeck et al., 2023; Wu et al., 2023; Yang et al., 2023). In other words, the GenAI responses are based on some algorithmic and probability calculations, not on human-like understanding and reasoning of prompts or language.

The teacher should also (b) highlight the tool's limitations with examples that make these limitations clear and relevant to students. The students must understand that GenAI tools can only go as far as their training data goes and that the training data is known to be limited in different ways and contains biases and inaccuracies. Students should also understand that GenAI does not generate outcomes the way we do: think, plan, and then write. Rather, as Wolfram (2023) explains:

> when ChatGPT does something like write an essay what it's essentially doing is just asking over and over again "given the text so far, what should the next word be?"— and each time adding a word. (More

> precisely, … it's adding a "token", which could be just a part of a word, which is why it can sometimes "make up new words".) (para., 4)

Therefore, it is even more paramount to discuss these tools' ability to fabricate data or present inaccurate output that is seemingly correct. The teacher should show students examples of these limitations in ways that are relevant to students and their course.

After discussing the capabilities and limitations, the educator should (c) outline the tool's privacy and data protection terms. Students need to understand the implications of sharing their data with GenAI tools and how this can impact their digital footprint and online privacy. This is important to ensure that students do not overshare information or risk their privacy when using the GenAI tool(s) used in class. One example of this happened years ago when Target, a famous retailer in the States, used machine learning to identify patterns in users' purchases to make predictions based on patterns of purchase, allowing the company to offer targeted discounts and offers. In one instance, as reported by Hill (2012), Target started sending "coupons for baby clothes and cribs" to a teenager. Her father went to the store to complain: "Are you trying to encourage her to get pregnant?" The store manager had apologized before the father called again a few days later: "I had a talk with my daughter. It turns out there's been some activities in my house I haven't been completely aware of. She's due in August. I owe you an apology" (para. 10). Because of the daughter's purchases (i.e., her digital footprint), Target predicted her pregnancy (and acted upon it) before the daughter or her father knew about it.

Discuss the ethics of the tool

The teacher needs to highlight (1.2) the ethics of using GenAI tools, whether generally or in relation to specific tools being used in class. In this discussion, the educator needs to (a) outline the general guidelines for responsible and ethical use of AI and GenAI—what are the boundaries that define acceptable and ethical use of GenAI? Many institutions have already set GenAI guidelines that the teacher can utilize in this discussion, but if not, the teacher can draw upon UNESCO's latest guidance on GenAI use in education (Miao & Holmes, 2023).

The guidelines for proper GenAI use must be followed by (b) addressing potential misuses of the tool with clear examples that relate to the course. It would also be useful if these misuses are tied to the student handbook or academic integrity guidelines set at the institution.

Finally, the teacher should (c) emphasize the importance of these ethical guidelines and the broader implications of not adhering to them, not just in terms of affecting students' academic standing at the institution, but also in terms of learning gains, job readiness, and their personal and professional integrity. In a market where GenAI is easily available to everyone, those who will stand out are the ones who know how to *responsibly and meaningfully* use GenAI to leverage *their own* skills and talents instead of simply replacing them.

Showcase effective ways to use the tool

While teachers are laying the foundations for GenAI use in class, they should (1.3) showcase effective ways to use the tool for learning. This showcase should (a) start with effective prompting skills that efficiently lead to better results. The way one crafts their prompt greatly guides and restricts GenAI tools. This is due to the "garbage in, garbage out" principle that shapes the GenAI technology. That is, the quality of the input defines the quality of the output. This principle applies to the kinds of data used to train GenAI; the machine will multiply the same patterns (good or bad) identified in the data used to train the machine. That is, GenAI tools do not operate to find the best answer to a user's request, but rather to find what the training data says in relation to it. The "garbage in, garbage out" principle also applies to prompting and makes the user experience highly dependent on a user's ability to appropriately write and structure the prompts (White et al., 2023). The way one writes their prompts will—to a great extent—shape the output GenAI generates. This is why it would be helpful if teachers compiled or prepared a prompt bank designed for their course, with a few prompt templates that target the different aspects of the course and its assessments. This would make it easier for students to apply effective prompting skills as they engage with the course materials and assessments. This prompt bank would be especially helpful for students whose command of English is not strong enough and will therefore struggle with writing effective prompts. This prompt bank can also be shared as Open Educational Resources (OER), where other teachers within a given institute or online can reuse and enrich accordingly. Regardless of the way a teacher chooses to teach these prompting skills, students must understand the trial-and-error nature of effective GenAI prompting and its multi-step process. More often than not, an effective prompting experience requires iteratively refining prompts to obtain the best results.

In addition to prompting skills, the teacher should also (b) illustrate ways to use the tool for personalized learning as this has been one of the most cited uses for GenAI in education (Chan & Colloton, 2024; Chan & Hu, 2023; Cotton et al., 2023; Crawford et al., 2023; Crompton & Burke, 2024; Kasneci et al., 2023; Wang et al., 2024; Xu, 2024; Zhai, 2023). We believe that using GenAI for personalized learning might not be easily done unless students are explicitly shown how to take advantage of this aspect. For example, Figure 3 shares two examples of prompts shared with students to use GenAI as a tutor for different experiences; although they were limited and only in text form, students were able to realize the potential of GenAI as a personalized tutor and utilized these examples to create their own prompts for other purposes, such as using GenAI to prepare for a project's oral defense and to study for a quiz.

When showcasing effective use of the target GenAI tool, the teacher should (c) highlight critical skills needed to use the tool and (d) share practical ways to evaluate output generated by the tool. One of the major drawbacks of GenAI tools is their ability to fabricate data and make it seem real

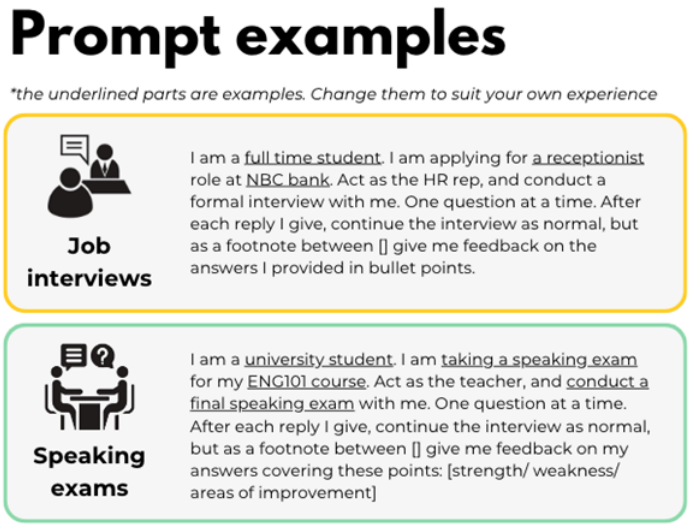

Figure 3. Examples of personalized learning prompts shared with students.

and authentic. Merely informing students of this drawback is not enough; they need to be equipped with the necessary critical skills and practical strategies to help them evaluate and assess (1) when they can(not) use GenAI to assist in their learning and (2) how to use the output generated by GenAI properly. One way to address this is to provide students with a checklist for critically evaluating GenAI output, including questions about checking facts, examining logic and coherence, identifying potential bias, and looking into opposite views other than the ones discussed in the piece generated by GenAI. Finally, teachers should also encourage their students to (e) utilize the tool to foster creativity, illustrating how the tool can facilitate innovative thinking but *not replace their own creativity*.

Establish a clear GenAI policy for the course

The last issue to highlight while setting the stage for GenAI use in class is to (1.4) establish a clear GenAI policy for the course. This is best done by involving learners in the process. In collaboration with learners, educators should (a) define what constitutes acceptable use of GenAI for the course and (b) outline prohibited uses of GenAI for that course, aligning it with the institution's general academic honesty and integrity policies.

Additionally, the teacher should clearly (c) detail how GenAI use should be disclosed by learners. The teacher could simply choose not to require any disclosure, but we believe at the early stages of using GenAI in class, it can be helpful to keep a record of GenAI use. This could be general or detailed, including a record of their prompts and chats with the tool, and explanations of how they used, evaluated, and/ or modified the GenAI output each use. This record allows teachers to hold students accountable and give feedback, and it helps students review and reflect upon their GenAI interactions.

Stage 2: Assemble GenAI-friendly classes

In addition to laying the foundation in Stage 1, an effective integration of GenAI tools in the classroom hinges on creating a learning environment that facilitates the responsible and meaningful use of GenAI. This is the primary objective of *Stage 2: Assemble GenAI-friendly classes* which highlights different ways to build a GenAI-friendly learning environment.

Start an activity with GenAI

The first way to integrate GenAI into learning activities is to use the tool(s) to (2.1) start an activity, focusing on the initial engagement with the activity. GenAI tools can help students with the background knowledge needed to engage in the activity, where the teacher is always available to provide more support or further assistance. For example, learners can use the tool to (a) clarify any prerequisite knowledge needed for the activity. Learners can also use GenAI tools to (b) outline and explain the steps needed to complete the activity. This can help learners who normally feel daunted by activities requiring multiple steps. For example, learners can ask GenAI to outline the steps needed to solve a differentiation problem in math.

GenAI tools can also help learners (c) brainstorm and develop ideas. One of the advantages of using GenAI for brainstorming is that it can offer a wide range of ideas instantly. Students should be encouraged to continually revise and modify their prompts for better and more fitting ideas, and they should be encouraged to leverage GenAI-generated ideas as a springboard for developing their own ideas, tailored to their local context and better suited to their skills and strengths. This should allow them to take ownership of their ideas and learn how to use GenAI to amplify their own creativity instead of replacing it.

Gain more clarity with GenAI

The second way to make learning GenAI-friendly in class is to encourage students to use GenAI to (2.2) gain more clarity for their activities, facilitating a deeper understanding *during* an activity. Learners can use the tools to (a) simplify critical concepts/theories/etc. encountered during the activity. For example, learners can prompt GenAI: "Explain concept x in terms that a 10-year-old would find easy to understand. Give examples". If the explanation was not clear enough, learners should prompt it again: "try a different way" or "simplify further", as many times as needed.

Learners can use GenAI to (b) translate instructions, expressions, etc. into their native language to help them overcome any language barriers that might affect their progress. It should be noted, though, that the performance of many GenAI tools is not at the same level with all languages due to the fact that the training data for these tools lacks linguistic diversity (Petrov et al., 2024; Ruder, 2020; Weidinger et al., 2022).

Another way for GenAI tools to help students gain more clarity is to use these tools to (c) simulate or model the outcomes of the activity to help set an example for the kind of results they would get or should aim for. For example, when working on a science experiment, students can use GenAI to simulate the effects of mixing certain elements, allowing students to learn about the impact of their choices before actual implementation, or students can take it a step further and use their experiment results to verify the accuracy of results generated by GenAI.

Receive feedback from GenAI

Teachers can also encourage students to use GenAI in class to (2.3) get feedback from the tool. For example, students can ask the tool to (a) give feedback on *their progress*. The more specific the request for feedback is the better the results. For example, a student can share their incomplete code with GenAI to give feedback on the logic and efficiency of the code.

Students can ask GenAI to (b) proofread learners' output. The more specific the request for feedback is in the prompt, the better the results. For instance, after drafting an essay or report, students can use the tool to identify grammatical errors, awkward phrasing, or inconsistencies in verb tense. Students can take it a step further and ask GenAI to explain the changes it made.

GenAI can also be used to (c) suggest ways to improve learners' work. To get the most out of a GenAI tool, the prompt should be clear and specific. Instead of prompting GenAI to "give me feedback to improve this", it would be more effective to ask the tool to provide its feedback in bullet-point form and to specify the target areas where feedback is needed, such as clarity, coherence, or efficiency.

Finally, GenAI tools can be prompted to (d) grade students' work based on a rubric. In some cases, it might help to break down longer texts into smaller chunks to get better and more accurate feedback. This is because GenAI tools have a limit on the number of tokens they can process at one time, although this limit is progressively increasing (Gartenberg, 2024; Chandler, 2023; OpenAI, 2023; Zhang et al., 2024).

Amplify the output with GenAI

GenAI-supported activities in the classroom can also (2.4) amplify traditional activities. Students can leverage GenAI tools to (a) generate artwork for the activity allowing them to visually complement their work in ways that could not have been possible without GenAI tools. The kinds of art they can generate are endless, with different tools offering different options and ways to customize the prompt. However, it should be noted here that there are concerns about how GenAI tools produce artwork in ways or styles that mimic real-life artists without their consent or permission (Robins-Early, 2024).

Learners can also (b) simulate real-world scenarios to complement their learning activity using GenAI tools. For example, GenAI tools can be asked to predict outcomes of policy decisions in simulated government settings or create fictional business scenarios based on certain factors the activity defines. The advantage of using GenAI tools to create these scenarios is the endless and customized varieties they can generate.

To a certain extent, GenAI tools can also be used to (c) design virtual tours related to an activity, for storytelling, interior design, real estate, or any other courses. Learners can design different aspects of the tour with the help of text-to-text GenAI tools to generate specific details and prompts, and then they can plug in these prompts into text-to-image, text-to-video, and text-to-sound tools to generate the visual and auditory elements needed for the work.

Study with GenAI

Students should also be encouraged and taught how to (2.5) study with GenAI. One of these ways is to use GenAI to (a) summarize or identify main ideas and key concepts from study materials. Many GenAI tools allow for uploading PDFs to analyze and summarize them in a matter of minutes; most go a further step and suggest some key questions to ask about the uploaded document. This could be helpful for students revising for a test or when they have ample amounts of materials to go through and study.

Students can also use GenAI tools to (b) generate practice quizzes. These tools can generate general quizzes on specific concepts. More effectively, learners can provide a 5-question sample and ask the tool to create more questions on a given list of concepts and key points. Alternatively, learners can plug the entire practice quiz into the tool and ask it to generate similar quizzes at the same level, covering the same topics and using the same style.

Students can also use GenAI to (c) give feedback on their understanding of a concept as they study it. Finally, GenAI tools can be used to (d) showcase structured approaches to solving different problems with endless examples. There is no doubt that these approaches would already be covered by their teacher in better and more contextually-rich ways; however, not every student is physically (or mentally) present during class, and others simply forget. When using GenAI tools to facilitate this kind of learning, students can ask the tool to further explain certain steps they are struggling with or give more specific examples that target these difficult areas. Having access to this kind of personalized learning around the clock without the fear of looking incompetent is a perk our generation would have loved to have growing up. Nevertheless, this perk can easily turn into a double-edged sword. While such access is desirable, knowing the limitations of GenAI tools and the kind of flawed yet seemingly-accurate output they can generate, there is the risk that students may not utilize the necessary critical thinking and information literacy skills required to use these tools effectively. In a recent investigation, Barnum (2024) tested a GenAI tool designed to offer math tutoring (Khanmigo) and found: "Khanmigo frequently made basic arithmetic errors,

miscalculating subtraction problems such as 343 minus 17. It also didn't consistently know how to round answers or calculate square roots. Khanmigo typically didn't correct mistakes when asked to double-check solutions" (Barnum, 2024, para. 5). This highlights the urgent need to implement clear measures that encourage and ensure the development of students' critical thinking and fact-checking skills before, or at least as, they use GenAI for learning purposes.

Roleplay with GenAI

GenAI-infused learning activities in class can also utilize (2.6) roleplaying with these tools. One of the main features that GenAI tools uniquely have is their ability to engage in a human-like conversation with their users. This capability makes GenAI tools well-suited for roleplay. Learners can use GenAI to (a) conduct interviews in which GenAI can be prompted to assume the role of any person/side. For example, when practicing for a job interview, GenAI can act as the interviewee demonstrating optimal answers or as the interviewer asking questions. It can also be prompted to give feedback on the student's responses and engagement while maintaining the roleplay.

Another way for learners to roleplay with GenAI for learning is to prompt the tool to (b) act as a counterpart in simulated scenarios such as sales negotiations and medical patient situations, allowing learners to customize the roles. Although less demanding than real life, these simulations provide valuable training. At the time of revising this draft, OpenAI announced the release of ChatGPT-4o, which is meant to be freely available to all users. It can engage in a conversation with users via video, with very little if any delay (OpenAI, 2024a). For an early demo of these roleplay capabilities, watch Khan (2024) and OpenAI (2024b). These new capabilities can be extremely helpful for roleplay in simulated scenarios.

GenAI tools can be used to (c) practice oral exams. If students have access to sample questions, GenAI can conduct exams and grade students' performance. It can also create similar questions or use generic ones if no samples are available.

Correct GenAI

Finally, one of the important ways to integrate GenAI tools in the classroom is (2.7) correcting GenAI. This use of GenAI is critical because it changes the narrative from GenAI being the undefeated know-it-all wizard to being a powerful tool that has many limitations. This use also helps learners become more critical of GenAI output and, hopefully, any other content they come across online. The first way to implement this approach is to ask learners to (a) verify *facts* provided by the tool against credible sources. For the first few times, it would be optimal if the educator provided students with relevant and credible sources to use. Additionally, it is helpful to know that because of how GenAI tools operate, the more local and unpopular the topic is for this activity (i.e., not enough reliable content has normally been available about it online and hence in the training data), the more likely GenAI will produce output that is inaccurate, irrelevant, outdated, or even biased.

A GenAI-infused classroom should also regularly ask learners to (b) assess the tool's output for including *diverse viewpoints*. GenAI output has been shown to favor one side of the spectrum —any spectrum— while still claiming to be neutral and objective (Rozado, 2023). Learners must understand that GenAI is not fully reliable for comprehensive information, and they must be trained to evaluate the inclusiveness of different viewpoints in its results. They should also be trained and taught to investigate and look beyond GenAI output as they formulate their understanding and views of different social and cultural issues.

Similarly, learners should be tasked with trying to (c) identify and understand possible *biases* embedded in the tool's output. These biases can be clear and straightforward, but they can also be embedded and hidden. In 2018, Amazon used AI to hire the most qualified candidates from a pool of resumes (Iriondo, 2018; Lavanchy, 2018). The tool was trained using the data of CVs submitted to the company for ten years. It was soon abandoned because researchers found that the tool discriminated against female applicants. Upon further analysis, they found: "Given the low proportion of women working in the company, as in most technology companies, the algorithm quickly spotted male dominance and thought it was a factor in success" (Lavanchy, 2018, para. 3).

Another way to incorporate activities that teach learners how to correct GenAI is to design activities that require learners to (d) critically evaluate the tool's output for quality and relevance to *current events and specific/local contexts*. They should also be tasked with (e) developing and expanding on the tool's output to provide more relevant and reliable information about local issues and communities. A lot of the details and stories about non-Western cities and communities are not given enough, comprehensive, or even fair coverage online, and are therefore not covered enough in training data used with GenAI tools. This could also be true about Western cities and communities that are not mainstream. In any case, learners should be trained to spot these gaps and inaccuracies, and they should be encouraged to be advocates for their own communities and issues. In a recent study, Zheng and Stewart (2024) investigated ChatGPT's production of *moral dilemmatic stories* aimed at improving language learners' cultural awareness. They found "WEIRD (western, educated, industrial, rich and democratic) cultural values are embedded in moral dilemmatic stories generated by ChatGPT" (p. 11). They suggest that teachers should first train students to be more critically and culturally aware of their own local contexts before they can apply appropriate critical appraisal skills to WEIRD-built narratives generated by GenAI.

Stage 3: Investigate and monitor

After actively engaging students with GenAI tools in class, *Stage 3: Investigate and monitor* focuses on the importance of observation, feedback, and continuous improvement to ensure that GenAI's integration into education remains effective and responsible. This will include three main tasks,

each designed to foster a cycle of quality assurance and enhancement from the teacher's perspective.

Track learners' engagement

The first and most important task is (3.1) tracking learners' engagement with GenAI tools for learning. This involves (a) observing learners' prompting efficiency and ability to interact *with the tool* effectively. This is critical because the way tools are prompted greatly shapes the experience and output of GenAI tools. From our class experience, students who struggle to engage with GenAI tools due to ineffective prompting often become frustrated and either give up or use the tool's output poorly.

Another important way to track learners' engagement is to (b) monitor and evaluate learners' engagement and interaction *with the output* of GenAI, mainly from critical and ethical standpoints. How effectively are learners able to critically evaluate and critically utilize GenAI output? How effectively are students able to practice sound ethical judgement on (un)suitable utilization of GenAI output?

Along similar lines, educators should also (c) review learners' GenAI-assisted output. The main question to investigate here is to see what role GenAI plays in learners' output. How reliant are learners on GenAI as they complete assigned work?—Are they fully reliant on GenAI to get the task done for them? Or do they use GenAI to improve *their own* work? And, how effective is their use of GenAI in helping them produce better outcomes instead of simply distracting them from learning?

Finally, and most importantly, teachers should (d) assess learners' GenAI-infused learning progress and assessment readiness. The focus is never the tool, but the learning process and the learners. Teachers should monitor the impact of integrating GenAI tools on students' learning outcomes, readiness for assessments, interaction with the material and with peers, and ability to sustain effective learning habits. Educators should also monitor how learners' experience with GenAI in the classroom is shaping their overall digital competency.

Gather learners' insights

In addition to monitoring students' use and progress, teachers should also seek to (3.2) gather learners' insights and feedback on the use of GenAI for their learning. Teachers should actively (a) gauge students' comfort and proficiency levels with these technologies and (b) identify any challenges they may encounter. This involves not only addressing technical difficulties but also understanding emotional and cognitive barriers to effective use. As GenAI tools become more advanced and allow for auditory and visual interactions, some students might be uncomfortable interacting with GenAI in non-textual forms. Additionally, there will be students with different digital abilities that might affect their interaction with GenAI. Recognizing and accommodating these students is essential for ensuring that all students can benefit from the technology, safely and meaningfully. Finally, (c) asking students for suggestions for improvement can be a powerful tool to enhance the integration of GenAI in the classroom. Students' feedback may help identify areas for improvement, or they may suggest other creative and useful ways to use these tools to support their learning.

Refine and enhance

Finally, teachers should use data collected from tracking students' engagement and feedback to (3.3) refine and enhance the GenAI-infused learning experience. That is, teachers should (a) incorporate learners' feedback and consider their learning outcomes and progress. By actively integrating students' feedback, teachers will ensure their GenAI-supported classrooms are engaging and addressing students' needs. Accounting for students' performance and learning outcomes is also critical because classes can be fun and engaging but add very little to students' learning. Pickering (2017) cautions: "engagement is a poor proxy for learning and students need to do more than just appear to be physically interacting and enjoying their teaching sessions" (p. 4). Finally, the last two tasks to do when refining the integration efforts are the output of the final stage (Stage 4). More will be shared on the how in the next section, but to ensure the ongoing improvement of GenAI integration, the teacher should always (b) account for any developments or updates that happen to the GenAI tools they are using and (c) consider new ideas and approaches suggested by colleagues and other educators. More on this is shared in the last stage, Stage 4.

Stage 4: Keep yourself informed

Although *Stage 4: Keep yourself informed* is the last stage of the framework, it is an ongoing process that teachers ought to engage in throughout the other stages. There are three main tasks involved in this stage.

Engage in comprehensive and relevant AI training

The first task is to (4.1) engage in comprehensive and relevant AI training. GenAI is not built for education but can be used for education; GenAI integration in the classroom is not a given, but an acquired skill that needs training and continuous development. Therefore, an effective and meaningful integration of GenAI in the classroom relies on the educator's up-to-date knowledge and understanding of the technology and its educational implications. While it is ultimately the institution's responsibility to provide relevant and comprehensive training for teachers, individual teachers can (a) seek the growing learning opportunities available online covering the basics of GenAI. There are several opportunities available free of cost at the time of writing this paper (AI4T, 2024; Google Cloud, 2024; Microsoft, 2024). Educators will also benefit greatly from (b) attending and participating in webinars, conferences, and events that discuss the use of AI / GenAI in education. Many of these events are offered online by well-known institutions. They are valuable because they are offered by those who

are aware of the academic and social dynamics that shape GenAI in education.

Stay up to date with GenAI tools' developments

To stay informed, teachers should also (4.2) stay up to date with GenAI updates. GenAI tools are on a rapidly evolving trajectory with frequent updates and releases. Educators must stay informed about these changes, as they significantly impact how students can use these tools for learning. For example, in May 2024, OpenAI released an updated model of ChatGPT that "can respond to audio inputs in as little as 232 milliseconds, with an average of 320 milliseconds, which is similar to human response time(opens in a new window) in a conversation" (para. 1, OpenAI, 2024a). This update paves the way for many learning possibilities and, at the same time, flags other issues that teachers need to account for in their GenAI-infused classrooms.

The best way to stay informed about such changes is to (a) follow social media accounts, either of the official accounts of these tools or of established educational technology experts who actively share about the use of technology in education. Teachers can also (b) subscribe to websites that are dedicated to covering GenAI or technology updates (e.g., Gizmodo, n.d.; TechCrunch, n.d.; The Verge, n.d.). Finally, teachers will find a lot of value in (c) engaging with communities and other educators who discuss these tools. There are many forums and spaces where educators and specialists share their own experiences with GenAI for teaching and learning. An educator can use hashtags like #edchat and #AIED (short for AI in education) on all forms of social media to find some of these accounts.

Stay informed about GenAI policies and research

Finally, teachers should (4.3) stay informed about GenAI policies and research reports. While policies and regulations concerning GenAI are not evolving as rapidly as the development of GenAI tools, these policies are still continuously advancing and redefining the landscape and boundaries of GenAI application. Although teachers are bound by their institutions' regulations and policies, (a) staying informed about general guidelines and policies surrounding GenAI application around the world is necessary to maintain responsible and effective GenAI use in their classrooms. Many of these policies help direct educators' attention to issues that might be overlooked otherwise, such as issues of privacy and copyright. It is also useful to (b) follow the publications of organizations like UNESCO; they have been active with their AI-dedicated publications that offer great value and relevant insights and application considerations for educators (e.g., Jaakkola, 2023; Miao & Holmes, 2023; Miao et al., 2021; Miao & Shiohira, 2022; Sabzalieva & Valentini, 2023). Finally, (c) reviewing expert reports and publications on the general and educational use of GenAI provides educators with useful insights into recent trends and industry outlooks.

Discussion and implications

This paper aimed to present the LAIK framework which is designed to guide educators' efforts as they integrate GenAI tools in their classrooms (see Figure 4). The LAIK framework is built on four stages where educators: (1) lay the foundation for GenAI in their classrooms, (2) assemble GenAI-friendly classes, (3) investigate and monitor the use of GenAI, and (4) keep themselves informed. Each stage of the framework accounts for a different set of needs concluded from teachers and students who engaged with GenAI during the course of this project. The first stage of the framework addresses the critical need for training and familiarizing students with the technology of GenAI and the tools they are going to use in the classroom (Jeon & Lee, 2023; Miao et al., 2021; Waring, 2024; Zhai, 2023). This foundation sets the stage for an informed, responsible, and meaningful learning journey with GenAI technologies. This stage can be efficiently covered in one or two lessons for a brief overview or expanded over a week for a more in-depth exploration. Various factors should be considered when deciding how long or how extensive this stage should be, including class size, students' prior exposure to GenAI, and the complexity of the tools being introduced. However, regardless of how long it takes, this stage ensures that students can engage with the technology in effective ways that facilitate learning with GenAI in Stage 2. The second stage covers the different learning activities we believe GenAI can effectively aid without affecting the learning experience. The stage is built in ways that encourage students to capitalize on the assistance GenAI provides while still prioritizing their own work and ideas. The third stage focuses on teachers' efforts to ensure the quality and sustainability of GenAI integration efforts through monitoring students and asking for their feedback. Discussing quality assurance in higher education, Leckey and Neill (2001) identify student feedback as one of the main elements contributing to "quality assurance for university teaching" (p. 24). By actively integrating students' feedback, teachers will ensure their GenAI-infused classrooms are engaging students and addressing their needs. Finally, the last stage addresses the rapidly evolving landscape of GenAI tools and their role in education. As stressed by Lee et al. (2024):

> AI has had, in recent months, and will continue to have, a dramatic impact on [higher education]. It is imperative that educators, and management, stay abreast of developments and continue to commit to ongoing research and discourse regarding responses to AI, keeping in mind the university's obligation to serve the students in preparing them for industry (p. 9).

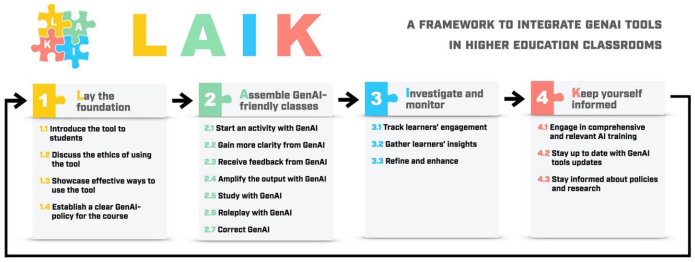

Figure 4. The LAIK framework and its components.

There are a few implications and recommendations to consider when engaging with the framework and its different stages. The first issue to consider when using the framework is the need to constantly remind learners of (a) the limitations of GenAI, (b) the constant need to verify output generated by GenAI tools, and (c) how GenAI can be effectively utilized —meaningfully and responsibly—for learning. It is necessary to constantly remind them that GenAI tools are, after all, *machines* that do not think, reason, use logic, or understand language the way we do as humans. Similarly, as stressed throughout the framework, there is a constant need for *critical* engagement with GenAI tools and the output they generate. In a recent conceptual paper, Bearman and colleagues (2024) call this kind of engagement *evaluative judgement* and highlight the emerging need to sharpen these skills "in recognition of this new reality" (p. 1). They explain that students need to be trained on how to discern high-quality output and how to critically engage with the output generated by GenAI, which can very much look authentic even if it is not. They explain that this ability is dependent on students "apprais[ing] many different examples" with the "iterative" use of GenAI in the process (p. 7).

Additionally, students' mixed GenAI-readiness levels are another important consideration. Students' exposure to and experience with GenAI will vary in terms of technical, critical, and language skills. This is why the first stage of the framework is critical. One of the main issues we observed with students was their varying proficiency levels with prompting skills which affected their willingness to utilize these tools and/or their ability to utilize and evaluate GenAI output properly. In every course, there will be students with varied prompting abilities, no matter how much their teacher discusses these strategies and skills in class. To avoid disadvantaging the weaker ones, the teacher can structure the learning activities to be group-based to ensure each group contains at least one student with strong prompting abilities. It could also be helpful to compile a prompt bank designed for the course. This would be used as a reference guide for students to refer to as needed or as instructed throughout the course.

Another consideration to keep in mind is the possibility of some students over-relying on GenAI tools in ways that go beyond the acceptable guidelines. Over-reliance on GenAI tools has been noted by researchers as a valid concern that can affect the quality and outcomes of learning (Habib et al., 2024; Moorhouse, 2024; Sidorkin, 2024; Wang et al., 2024; Wu et al., 2024; Yu, 2024). As Sharples (2022) puts it: "Students employ AI to write assignments. Teachers use AI to assess and review them. Nobody learns, nobody gains" (p. 1122). One way to address this concern is to focus on the process of learning instead of just the outcome (Cotton et al., 2023; Rudolph et al., 2023; Swiecki et al., 2023). In other words, rather than designing the activity to be done all at once, the teacher can break it down into distinct steps or stages, making sure that the outcome of each stage is fed into the next one. This would make it very difficult to let GenAI do all the work by itself.

Another issue to consider when building GenAI-friendly learning environments is the assertion that all these uses do not and should not eliminate the need to prioritize the human aspect of education and learning in the classroom (Miao & Holmes, 2023; Sidorkin, 2024; Tlili et al., 2023). The framework is built on the idea that GenAI tools should not replace the human element of learning; instead, GenAI should be integrated as a learning aid that facilitates learning responsibly and meaningfully. Crawford et al. (2023) advocate that "the interaction with the teacher comes first, and that the AI comes second, relegating AI to a support role as the second educator in the room, rather than the primary" (p. 6). Miao and Holmes (2023), in their UNESCO guidance on GenAI, assert a similar emphasis. They highlight the need to adopt: "a human-centred approach that promotes human agency, inclusion, equity, gender equality, and cultural and linguistic diversity, as well as plural opinions and expressions" (p. 7). In other words, the use of GenAI in the classroom is not a tool to replace teachers' presence or to eliminate the need for interactions with students and peers.

Finally, for the framework to work successfully, teachers of all backgrounds (technical and non-technical) need to be familiar with how GenAI tools work and how they can be best utilized. The need for teacher training has been emphasized by many researchers as one of the critical requirements for the effective integration of GenAI in teaching and learning (Celik, 2023; Glaser, 2023; Kizilcec, 2024; Kohnke et al., 2023; Lodge et al., 2023; Tlili et al., 2023). For example, realizing the data-hungry nature of GenAI will make teachers more aware of its privacy implications and will, therefore, help teachers make informed decisions when choosing GenAI tools for their classes. Institutions must invest in empowering their educators with customized training on GenAI for education. This training does not need to be technical, but it must cover a few critical elements. It should (a) explain the mechanics of GenAI, in non-technical terms, (b) discuss the ethical boundaries and latest regulations that define the GenAI landscape, (c) outline the capabilities and limitations of GenAI tools, and (d) explore the role GenAI can play in their practice, preferably using the LAIK framework. Educators need this understanding to be more adept at effectively integrating GenAI tools into their classrooms. This knowledge will also empower educators to navigate many issues they or their students might face while using GenAI tools in class.

Conclusions, limitations and future research

There is a growing need to proactively integrate GenAI tools in classrooms in responsible and meaningful ways. This study proposes and discusses a practical framework that guides educators from all disciplines as they integrate GenAI tools in their classrooms. The LAIK framework is built on four stages where educators: (1) lay the foundation for GenAI in their classrooms, (2) assemble GenAI-friendly classes, (3) investigate and monitor the use of GenAI, and (4) keep themselves informed. The stages are iterative and build on and feed each other, allowing for an integration that accounts for the constantly evolving and developing GenAI landscape.

The framework is designed for and has been tested in HE learning environments. More research can be done in different and unique learning contexts to identify elements of the framework that might need to be reconsidered or added to the framework to make it more robust and inclusive of different environments and learning needs. Similarly, researchers and educators specializing in K-12 education may find the framework applicable, but further research is necessary to ensure its relevance and effectiveness for K-12 learning environments.

Additionally, while the LAIK framework lists a good number of activities to consider when utilizing GenAI tools for learning, it is important to bear in mind that there are possibly more ways to utilize GenAI tools as the technology becomes more advanced and more features are added. We invite educators and researchers to expand the framework and add more possibilities and ways to actively and critically engage students with GenAI in the classroom.

Finally, the framework does not include the important step of choosing the right or most suitable GenAI tool; as previously discussed, this was considered not possible at the time of writing the paper given the elaborate and unpredictable development trajectory for GenAI tools. More research can be conducted to account for the developing GenAI landscape and to identify a systemic approach to choosing the right tool(s) based on students' learning needs, the course's learning outcomes, the type of assessments involved, the institutions' guidelines, and the teacher's teaching style.

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