Approach Generative AI Tools Proactively or Risk Bypassing the Learning Process in Higher Education

DOROTTYA SALLAI (ID)

JONATHAN CARDOSO-SILVA (ID)

MARCOS BARRETO (ID)

FRANCESCA PANERO (ID)

GHITA BERRADA (ID)

SARA LUXMOORE (ID)

*Author affiliations can be found in the back matter of this article

ABSTRACT

The growing reliance of higher education (HE) students on Generative Artificial Intelligence (GenAI) tools for learning and assessment risks circumventing rather than enhancing the learning process without adequate support and direction. Reflecting on experiences within a UK university, we explored how students use GenAI tools in practice. We argue that students rely on GenAI differently for learning than for assessments and tend to focus more on the output or performance than on the learning journey itself. This raises questions on how GenAI can be successfully integrated into the curriculum without jeopardising learning. Based on observations that some students use GenAI platforms as a substitute for learning rather than as a tool to enhance learning, our policy recommendations focus on curriculum planning and assessment design.

CORRESPONDING AUTHORS:

Dorottya Sallai

LSE Department of Management, UK

d.sallai@lse.ac.uk

Jonathan Cardoso-Silva

LSE Data Science Institute, UK

j.cardoso-silva@lse.ac.uk

Marcos Barreto

LSE Department of Statistics, UK

m.e.barreto@lse.ac.uk

INTRODUCTION

The rise of Generative AI (GenAI) tools and their impact on teaching, learning, and assessment practices has become a significant topic of discussion in higher education (1, 2). Since November 2022, when OpenAI introduced ChatGPT, its online conversational AI chatbot, educators and students have been challenged by the capabilities of this new category of tools which includes similar systems from rival tech companies such as Google's Gemini, GitHub's Copilot, Microsoft's Copilot, and Anthropic's Claude.

For the first time, people could easily converse directly on almost any topic with an AI chatbot using natural language to discuss and 'look up' information instead of retrieving it from search engines, Wikipedia, academic databases, or primary sources (3). Some GenAI-powered tools also function as digital personal assistants, capable of auto-completing paragraphs or generating code without explicit conversation or instructions, while there are GenAI chatbots that can operate as personal tutors (4). Given the potential for these tools to automatically generate complete essays and other assignments used for assessment in higher education, to say nothing of the idiosyncratic approach GenAI-generated content often has towards factual accuracy, much of the discourse on GenAI in the academic sector has been centred on ethical considerations and concerns related to academic misconduct (5).

Here, we provide policy recommendations on assessment and curriculum design which reflect how higher education institutions and educators can adapt to these challenges and incorporate GenAI as an aid to learning These recommendations are inspired by initial insights from ❊ **GENIAL** (**Gen**erative **AI** Tools as a Catalyst for **L**earning)[1], a study conducted during the 2023/24 academic year to investigate how undergraduate and postgraduate students from quantitative and qualitative subjects at the London School of Economics and Political Science (LSE) interacted with Generative AI tools (ChatGPT and Gemini) in their courses.

We argue that the biggest pedagogical challenge of using GenAI tools in higher education is that students may use them to replace their learning process and critical skills. The changes brought by the advent of this technology demand that educators and higher education institutions rethink their curriculum and assessment design practices and approach this new era of AI-enabled learning with curiosity, self-reflection and a commitment to life-long learning. In contrast to the generally rather vague guidelines and policy documents currently available on AI in HE, our article provides some practical ideas and actionable recommendations that can quickly and efficiently make a difference for educators and HE institutions.

THE CONTEXT OF THE 2023–24 ACADEMIC YEAR

As GenAI tools grew in popularity an extensive scholarly debate arose on how to embrace and use GenAI in educational settings most effectively (6). While GenAI may create opportunities for increasing administrative efficiency and innovation in university education, for instance, by improving access to remote learning, asynchronous teaching delivery, online collaboration, gamification, and student engagement, it also presents significant challenges. These challenges are particularly evident in the areas of academic integrity, equity, and the future of traditional assessment methods like 'open book' exams, dissertations or essays (1).

Many scholars warned about the 'death' of the essay even before ChatGPT became freely available to all (7), calling our attention to the rise of academic cheating because of the increase in online take-home examinations after the Covid-19 pandemic and the almost parallel emergence of artificial intelligence (AI) (8). As Lindebaum and Ramirez (9) claim, freely available tools are already giving students the opportunity to rely entirely on GenAI when writing their assignments. These platforms not only design and write high-level essays but also paraphrase the text and check it against available plagiarism tools. Such platforms present a much more significant challenge than the previous threat of 'contract' cheating through 'essay mills' – professional websites that provide pre-written assignments to students (10). Now students can turn to a free language model supplier, such as ChatGPT, to generate academic work even more difficult to identify as fraudulent.

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1   Interested readers can find more information on the website: https://lse-dsi.github.io/genial

On the other hand, some have argued that the appropriate use of ChatGPT can be advantageous for learners, teachers, and researchers, especially non-native English speakers (11). From this perspective, AI can enhance students' linguistic abilities and serve as teaching assistants rather than as machines that replace human competence (12). Lecturers should be aware of the risk of students trusting GenAI tools too much, potentially distracting them from their learning goals. They may need to mentor and guide students more closely in navigating conflicting sources of information and validating outputs (1). Regardless of whether GenAI is a net harm or net benefit, higher education institutions face many unanswered questions about how their curricula and extracurricular offers will equip future graduates with the necessary skills to thrive in a future dominated by artificial intelligence (13). Educators face the challenge of identifying where their students require new skills and need to develop new competencies and what skills may become obsolete. It is not enough to think only about integrating AI into the current educational framework; universities also have to proactively create an environment to explore how AI enhances human intelligence (13).

POLICY REACTIONS FROM AROUND THE WORLD

In addition to academic discussions, policymakers have been working on providing guidance for dealing with GenAI. For instance, UNESCO's Guidance for Generative AI in Education and Research (14) emphasises that education and research practitioners need to use GenAI ethically in their practice. The report observes that GenAI could be useful in minimising the pressure of homework and exams. However, it also encourages education practitioners and learners alike to engage critically with GenAI's contents and outputs as they can be unreliable and conform to Global North cultural standards, underrepresenting voices from the Global South and Indigenous communities. The document also calls for GenAI's use to be prevented 'where it would deprive learners of opportunities to develop cognitive abilities and social skills through observations of the real world, empirical practices such as experiments, discussions with other humans, and independent logical reasoning'. As for assessments, the guidance suggests that GenAI's impact is not simply a matter of having concerns about learners cheating: the capabilities of GenAI tools should prompt a 'rethink [of] what exactly should be learned and to what ends, and how learning is to be assessed and validated'. Finally, it calls for education practitioners to have access to well-structured programmes on using GenAI in education (to date, only Singapore has such a programme (14, p.26)). The Council of Europe (15) identifies UNESCO's Guidance as a potential regulatory framework to build upon as it develops its own legally binding instrument that seeks to ensure a rights-based approach to using AI in education.

In the UK a Department for Education (DfE) policy paper (16) highlights the potential of GenAI tools to reduce workloads across the education sector and to free up teachers' time, 'allowing them to deliver excellent teaching'. However, like UNESCO, the DfE also points out the unreliability, inaccuracies, biases, and copyright and user privacy issues associated with these tools. The DfE's document states that while GenAI tools can make certain tasks quicker they do not replace the deep subject knowledge and judgment of a human expert and that it is 'more important than ever that [the] education system ensures pupils acquire knowledge, expertise and intellectual capability'. The document argues that one can only make the most of GenAI tools when they already possess a solid knowledge base. For example, being proficient in clear writing and having a good grasp of the subject being addressed are necessary for creating effective prompts. Additionally, one can only assess the accuracy of the tool's results if they have a framework for comparison. The DfE concludes that while the education sector should certainly make the most of the opportunities offered by the tools it should do so through safe and effective use of the tools to continue delivering an excellent education that prepares pupils to contribute to society and the workplace. The observations in our study align with the points raised in both documents: we agree that the impact of students using GenAI tools must be considered for more effective teaching instruction.

PRELIMINARY FINDINGS FROM THE GENIAL PROJECT

The objective of our research study – 🦥 **GENIAL** – was to explore how university students in full-time undergraduate and postgraduate courses use GenAI tools in their learning and assessment. The project launched as a smaller focus group initiative in June 2023 to evaluate the efficacy of code generation tools. Over the 2023–2024 academic year, as interest grew in the field, the

original initiative evolved into a multidisciplinary research project, investigating the learning behaviours of around 220 students in four undergraduate and three postgraduate courses, including quantitative and qualitative subjects. The courses ran in the autumn and spring terms of 2023–2024 in the LSE Departments of Statistics, Data Science, Management, and Public Policy. The study's preliminary findings are based on the analysis of student questionnaires, focus group sessions, observational experiments, and the analysis of chat logs that students created specifically for their course chats. Students who participated in the study were asked to create a specific chatlog for all their course-related GenAI conversations and share their chatlogs and brief reflections on their learning with the research team through weekly surveys.

Table 1 shows the list of courses participating in the study each term. We specifically aimed to explore differences in learning approaches and student perceptions in relation to the usefulness of GenAI tools in different subject areas as well as at undergraduate and postgraduate levels. In the autumn term 2023/24 (September to December 2023) the three participating undergraduate courses allocated in-class time for students to independently work on challenging tasks using ChatGPT as an aid while limiting free Web browsing and peer interactions. In spring term 2023/24 (January to March/2024) we expanded the number of participating courses to six to include a range of qualitative disciplines and to gather more data about how the students use GenAI tools, including their interactions outside the classroom and for assessments.

CASE STUDY	AUTUMN TERM (2023)	WINTER TERM (2024)
Undergraduate courses	DS105 – Data for Data Science	DS105 – Data for Data Science
	DS202 – Data Science for Social Scientists	DS202 – Data Science for Social Scientists
	ST207 – Databases	MG317 – Leading Organisational Change
Postgraduate courses		ST456 – Deep Learning
		PP422 – Data Science for Public Policy
		MG4B7 – Leading Organisational Change

Table 1 Participating courses in ❄ **GENIAL**.
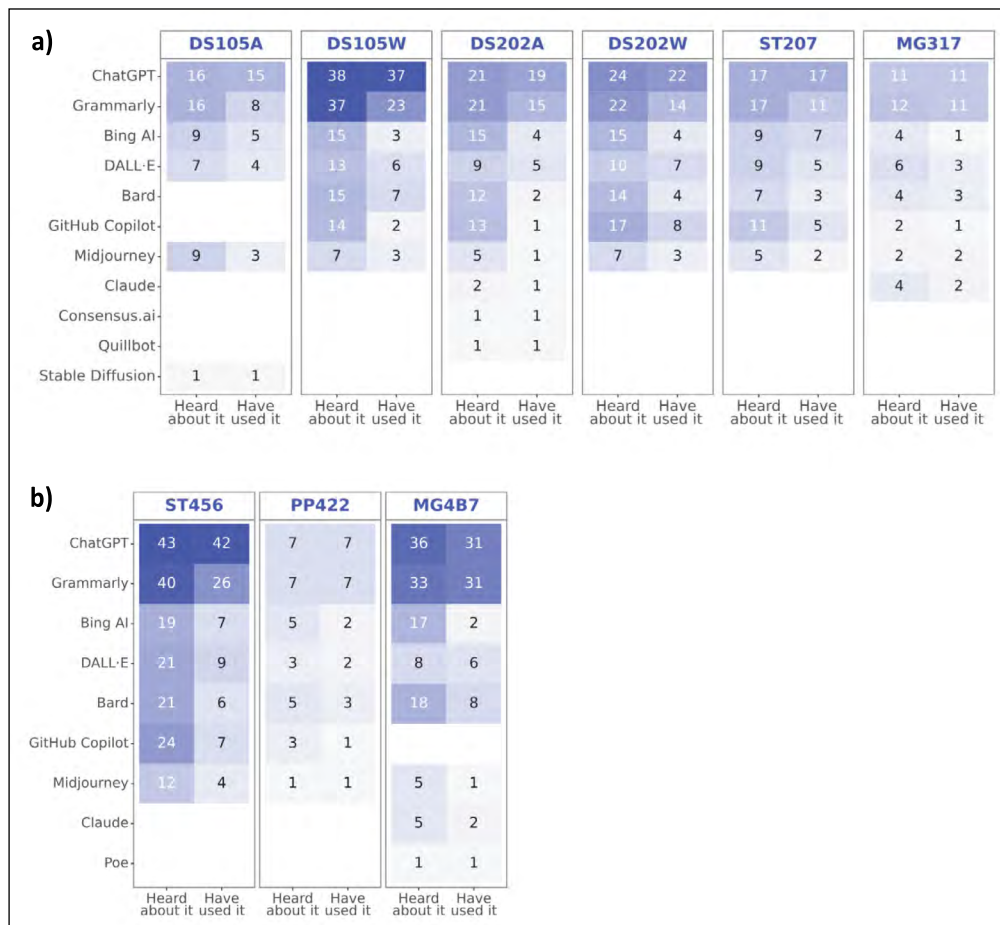

Figure 1 GenAI tools known to students in the GENIAL study from **a)** undergraduate and **b)** postgraduate courses.

We used various data collection methods to gather reliable and high-quality data. During the first term we ran a survey at the end of dedicated in-class activities where students were asked to work independently and to use the chatbots as an aid. In the second term we expanded our data collection efforts to include surveys and focus groups and every week we requested participants to share chat logs related to their learning and participation in the course, both in and out of the classroom. Furthermore, we obtained students' assignment submissions and chat logs. While a detailed report on our findings is forthcoming we here share some of the preliminary insights of this study that have significantly influenced our thinking and shaped our policy recommendations regarding the wider issue of the use of AI in Higher Education.

MIXED PERCEPTIONS OF THE USE OF GENERATIVE AI TOOLS BY STUDENTS

At the start of the term we asked students to list the GenAI tools they knew or had used. OpenAI's ChatGPT was recognised and used by almost all undergraduates (Figure 1a) and postgraduates (Figure 1b). Grammarly ranked second, followed by Microsoft's BingAI (now Microsoft Copilot) and OpenAI's image generator, DALL·E. A consistent proportion across all courses (~80%) reported using these tools for learning, with most of them stating that the GenAI tools made learning easier for them.

However, not all students found GenAI tools beneficial during the classes observed during the autumn term. Indeed, students had mixed perceptions of using GenAI for learning exercises. After each class with a 🔀 **GENIAL** activity participants were asked to rate the usefulness of the GenAI chatbot's assistance on their designated tasks. In Figure 2 we show that the responses of students from one of the participating courses – DS202 A (Data Science for Social Scientists) – produced two main rating modes: one around 3–4 and another around 6–7.
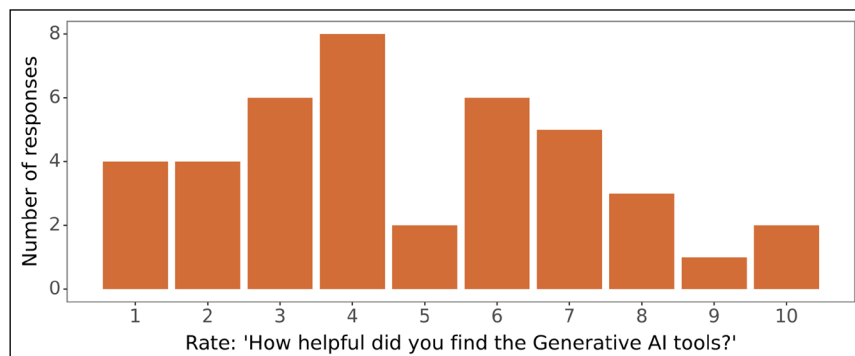
Figure 2 Distribution of all 80 responses from the 29 participating DS202 A students across eight weeks of the Autumn Term 2023/24 regarding their perceived helpfulness of GenAI tools.

This mixed perception of the usefulness of GenAI tools can be partly attributed to the limited time available for in-class activities. Typically, only the final 30 minutes of a 90-minute class were reserved for independent GenAI-assisted activity work, which limited the opportunity for deep thinking and experimentation. The design of the classes sometimes also required students to apply concepts and skills they had *just* been exposed to for the first time without the proper time for guided, supervised practice.

However, the mixed response can also be associated with the students' different levels of comprehension of the new material. Our preliminary analysis suggests that students benefit most from using GenAI tools when they clearly understand a task's purpose and have already grasped the basic underlying concepts needed to complete it. This view was also expressed by a DS105 A student in our end-of-term study: 'As long as you understand what ChatGPT is doing, then it is incredibly useful to use it as it does all the "meaningless" *work* for you. You get the code and then correct it, which is only possible if you understand the problem.'

During Winter 2023/24, when we also collected data about students' usage of GenAI tools outside of the classroom, we observed that most students used such tools for task completion and productivity gains**.** There were few instances of GenAI usage for exploring, or gaining deeper insight into, the subject matter itself. Rather, common uses included summarising required readings to save time and troubleshooting coding errors in programming-heavy courses. This usage appears to be a coping mechanism for the pressure of deadlines and because of limited time for assignments rather than a desire to learn more about a topic or skill. In one of the

focus groups a student explained that they would first use ChatGPT to create what seemed like a valid submission (in this case, programming code) and then worry about understanding what the code does later: 'It was like, I solved it first, I got the stress out of the way, and now I can take my time to learn and understand. Without worrying about, like, "Oh, I have to submit this assignment, and it's not working."'

In line with the above, we saw students asking GenAI tools to explain how a management framework applies to a business case study and then relying on the GenAI-produced summary when writing their reports, apparently without properly checking it against the course material. We also observed students submitting GenAI-generated code in their assessments where the code runs and produces something but where the output is unrelated to the task's objectives. The convincing tone of the GenAI chatbots' responses seems to give students the illusion that the output is always accurate and true. Ironically, we found that when students turned to chatbots and GenAI too much and too often they produced lower quality work. In the next section we discuss the failure of students to comprehend that doing well in assessments or getting good grades does not equal learning and how we may help students not to inadvertently bypass the core cognitive processes associated with learning.

DISCUSSION

MINDLESS USE OF GENERATIVE AI TOOLS FOR ASSIGNMENTS HINDERS THE LEARNING PROCESS

Assessment plays a central role in higher education and concerns more than just the students being graded, as several stakeholders, including governments, employers, funders, professional bodies, and parents are involved. This creates a high-pressure environment for students and teachers and significantly affects students' study priorities (17). It is unsurprising that this centrality sometimes forces students to prioritise creating a 'final product' that passes as a good demonstration of learning rather than to engage deeply with the desired course learning outcomes. Given GenAI tools' capacity to mimic sophisticated language, creating the illusion of expertise can worsen the gap between assessment and learning when used mindlessly and when detached from the learning process.

Students are aware of this conflict and the performative role that GenAI can play when used for assignments. During a 🧩 GEN**IAL** focus group session a student explained the reasoning for using ChatGPT and Gemini when working on an assignment as follows: 'There is like the "dual-purpose", so one of them is obviously to get high grades in the assignment, and the other one is to learn what's happening.'

Students' use of chatbots and GenAI autocomplete tools for assignments should not be reduced to cheating or laziness. Educators may find their students are genuinely interested in using them for learning. If we approach this new technology more constructively and in dialogue with our students, ensuring that assessments are constructively aligned with the learning activities in our courses, we can use it as a teaching opportunity. AI chatbots have the potential to boost students' interest and understanding and help them perceive more learning value from the activities and exercises they do as part of a course (18, 19).

It is true, however, that when turning to a GenAI tool for learning support, students may be persuaded by the chatbot's authoritative tone into believing or 'learning' things that are outright wrong (20, 21). This is a genuine concern, as these systems do not have reliable truth, knowledge or fact-checking mechanisms. When Google incorporated AI overviews into their Search product Internet users quickly found out that Google Search told its users to use 'non-toxic glue' when cooking pizza to make the cheese stickier and that it was okay – recommended even – for humans to eat rock once a day (22). While it is easy to recognise these responses as absurd, and it is improbable that they would taken as truth by students, less obviously absurd statements are also possible. Validating GenAI-generated content about a completely unknown subject is much more challenging. It is easier to be misled when we lack the minimal, foundational knowledge to validate what we are reading.

For the reasons mentioned above we argue that the biggest risk of the uncritical use of GenAI tools is that students inadvertently bypass learning rather than enhance it. Considering how AI chatbots

can significantly affect students' learning outcomes it is important for educators to critically reflect on and reevaluate their current curriculum and assessment design practices (23). These observations are in line with both the UK DfE's position that students need prior knowledge to use GenAI tools effectively and UNESCO's suggestion that learners and educators should critically engage with the tools and rethink what needs to be learned and how learning is assessed.

GENERATIVE AI EXACERBATES PRE-EXISTING CONSTRAINTS OF HIGHER EDUCATION

The mindless use of GenAI tools is also symptomatic of underlying, pre-existing issues within the learning ecosystem of higher education which are only exacerbated by the ease of use of such tools to create the content on which students are assessed. Abbas et al. 2024 (24) argue that time pressures and workload encourage students to use GenAI tools for assessments. They also show that excessive use of ChatGPT may negatively affect students' academic performance and memory, which corresponds with the findings in 🔆 GENIAL study when marking students' formative essays. Consequently, although students do not need prior practical and theoretical expertise to use GenAI tools they may still lack a complete understanding of the potential of such tools or the ability to use them to enhance their learning processes successfully (25). Although students held varied opinions regarding the advantages of GenAI during the Autumn Term, more than 80% of students across all classes in the spring term acknowledged the use of GenAI tools for learning.

Contrary to our prior assumptions, students in management courses found these tools somewhat less beneficial compared to those in quantitative and data science courses. This was somewhat unexpected, considering that GenAI tools are commonly seen as a possible threat to the future of essays (7), but not altogether unsurprising considering how essays produced by GenAI chatbots often tend to be generic and unoriginal (26, 27). Our research indicates that students are more inclined to use GenAI tools when they find the volume of readings or the complexity of the materials challenging. Conversely, they are less likely to depend on these tools when the pace of delivery and the subject matter are easier for them to follow. As one of the students stated in one of the weekly surveys: 'This week's content was pretty straightforward, and I haven't found myself using AI.'

Given that existing evaluation methods such as open-book exams, problem-solving questions, critical thinking assignments, case studies, and creative writing tasks are not 'adequate to confirm students' learning and performance in the absence of any tool capable of validating the authorship of the work' (28), and students are not necessarily able to judge accurately whether their use of GenAI tools will lead to their expected or hoped positive outcomes (29), educators need to rethink how they deliver and evaluate learning (27). This was also underlined by a participant in one of our focus groups, who stated: 'If your question cannot differentiate between a student who actually understands the content and an AI, that means your question is not good enough.'

This discussion highlights the importance of educating students on the impacts of GenAI use and the urgent need for higher education institutions to reform how they evaluate and measure learning through curriculum design and assessment.

POLICY RECOMMENDATIONS

This section proposes a few practical recommendations for higher education professionals, and regulators to constructively incorporate GenAI tools into their teaching, learning, and assessment practices. Based on our findings from the 🔆 GENIAL study these suggestions are intended to assist educators in maximising the benefits of GenAI tools while adjusting their teaching and assessment approaches to minimise any negative impact on their students' learning processes. Higher education leaders can also use them to understand how to best support faculty and staff in implementing these practices.

ASSESSMENT DESIGN

• **Separate the learning process from the assessed 'product'.** Design assessments with some continuous elements before submission, requiring documentation of

the development of the final output. Educators can require students to submit their assessments in parts or create in-term submission points in the form of short live pitches, presentations, or online video updates. These preliminary submissions do not need to be formally marked to be effective but feedback should be provided on the adherence to the learning path.

- **Map out the process the students follow as they work on their assignments.** Once a decision has been made about the form of the final (essay, exam, coding project, presentation) write down the steps a student who has engaged deeply with the course material and mastered the knowledge is expected to follow to produce the output.

  Take, for example, essay assignments. It is reasonable to expect that students can 1) identify the key literature from the course reading list, 2) use an appropriate search engine, using appropriate keywords, and 3) identify a related bibliography. From here, we expect the student to 4) read selected references, 5) judge their validity, 6) summarise the key arguments, and 7) establish connections across all readings. Explicitly writing those down will help devise strategies for effectively assessing the learning process, as described in the previous recommendation.

  Ideally, these processes should be mapped in a visual format to facilitate drawing the connections that normally arise (e.g., refining the keywords used for literature search after reading selected references). The map could be shared with students for maximal transparency but it is not necessary nor always wise.

- **Delay the adoption of GenAI tools when introducing a new topic or skill.** Employ practice activities targeting the understanding of key concepts immediately after they have been introduced. Then, add in practice formative assignments in which the explicit encouragement of GenAI tools grows as the level of complexity and the scope of the exercises incrementally increases.

  For example, in courses with a programming component, if students are told about the expected level of engagement with GenAI tools as they progress, it becomes more likely that the tools are used as an assistant to automate skills that have already been mastered earlier in simpler exercises. This mitigates the risk of bypassing the learning process. It is also important to ask for code explanations to identify the cognitive process used when working on the assessments.

  When advising students on the appropriate use of GenAI tools at different levels of difficulty it is important to explain the reasoning behind the recommendation. It is even better to discuss and come up with these recommendations together with the students.

- **Encourage students to track and share their use of GenAI tools to support their individual learning journey.** Techniques akin to those employed in language instruction, which assess students' knowledge and comprehension levels at the start of the semester, could be adapted in other fields to determine students' initial baseline understanding of the subject matter. From here, it would become possible to evaluate their overall progress by the end of the term, not only in relation to the marking criteria but also to their initial understanding. Integrate in-class comprehension tests at the beginning, middle, and end of the term to measure individual progress and use them at the end of the term to benchmark students' final grades to their learning journeys. The tracking could also be done through analytics feedback to help with student engagement (30).

CURRICULUM PLANNING

- **Teach criticism, complexity, and productive failures.** Teach students about the importance of locating primary sources of information and to be critical of GenAI-produced outputs. In coding, aim to teach high-level engineering concepts by critiquing the inconsistencies of functions output by a model or learning to re-prompt a system to produce cleaner and more consistent results. Similarly, while with GenAI students can achieve significant results, for instance in coding tasks requiring little skill, preparing them to move beyond simplistic GenAI-favoured solutions is critical. Finally, we should remind students that learning proceeds through engagement and productive failures while productivity goals that can be quickly but mindlessly achieved through some GenAI solutions can instead hamper the process.

- **Do not rely on temporary GenAI faults or incapacities.** Do not try to outwit the models or underestimate their problem-solving abilities by providing partial or confusing problem specifications. The models are constantly evolving and will be able to provide students with alternative ways of solving the problem. In coding-based courses invest in problems that can be solved in parts of increasing complexity and encourage students to engage with code analysis, debugging, and refactoring supported by GenAI tools.

- **Increase teachers' literacy of GenAI tools.** As students increase their engagement with such tools teachers need to develop the necessary literacy to guide them in their usage and understanding of AI. As highlighted in UNESCO's 'Draft for AI competency framework for teachers and for school students' (31), it is necessary to teach themes including AI foundations and applications as well as Ethics for AI, AI Pedagogy, AI for Professional Development and Human-centred Mindset. This is supported by the study by Cukurova et al. (32) which highlights how technical knowledge needs to be aligned with adequate technical support and plans to minimise workload, to address ethical issues, and to increase teachers' trust. The lack of these would otherwise undermine teachers' engagement.

CONCLUSIONS

Our findings from the ⚛ GEN**IA**L project validate certain observations about students' use of GenAI tools and which academics and policymakers have also highlighted. They establish that there is a risk to the mindless use of GenAI tools. While these systems can enhance the teaching and learning experience by unlocking new ways to exercise new skills and knowledge they pose a pedagogical risk. Because of the pressure to perform well on assessments and untimely submission deadlines students might rely on GenAI tools in ways that disregard the intended learning outcomes of structured teaching, inadvertently bypassing the intended learning process. This mindless use of AI distracts from the real purpose of the courses and further enlarges the gap between assessments and learning.

Educators must recognise that GenAI will impact their teaching practices even if they do not incorporate these tools in their courses, and decision-makers within academic departments and universities need to transition from complete bans on student use of AI to active engagement. Once we proactively guide students safely and adequately using GenAI tools as part of their learning process we counteract the potential pedagogical distraction these systems pose to the educational system. Furthermore, GenAI tools are something students will encounter in settings beyond the university, such as the workplace. By teaching them how to use these tools responsibly, critically, and safely we can prepare them to contribute positively to the workplace and to society.

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

Dorottya Sallai: Conceptualisation, Investigation, Writing – original draft, Writing – review and editing. **Jonathan Cardoso-Silva**: Conceptualisation, Data curation, Funding Acquisition, Investigation, Project administration, Writing – original draft, Writing – review and editing.

Marcos Barreto: Conceptualisation, Funding Acquisition, Investigation, Project administration, Writing – original draft, Writing – review and editing. **Francesca Panero**: Investigation, Writing – original draft, Writing – review and editing. **Ghita Berrada:** Writing – original draft, Writing – review and editing. **Sara Luxmoore**: Data Curation, Writing – original draft.

AUTHOR AFFILIATIONS

Dorottya Sallai ⓘ orcid.org/0000-0003-3411-4818
LSE Department of Management, UK

Jonathan Cardoso-Silva ⓘ orcid.org/0000-0002-9566-7400
LSE Data Science Institute, UK

Marcos Barreto ⓘ orcid.org/0000-0002-7818-1855
LSE Department of Statistics, UK

Francesca Panero ⓘ orcid.org/0000-0002-8287-163X
LSE Department of Statistics, UK

Ghita Berrada ⓘ orcid.org/0000-0001-8814-409X
LSE Data Science Institute, UK

Sara Luxmoore ⓘ orcid.org/0000-0002-9963-7487
LSE Data Science Institute, UK

REFERENCES

1. **Krammer SM.** Is there a glitch in the matrix? Artificial intelligence and management education. *Management Learning*. 2023 Dec 15. DOI: https://doi.org/10.1177/13505076231217667

2. **Maslej N, Fattorini L, Perrault R, Parli V, Reuel A, Brynjolfsson E,** et al. *The AI Index 2024 Annual Report* [Internet]. Stanford, CA: AI Index Steering Committee, Institute for Human-Centered AI, Stanford University; 2024 Apr [cited 2024 Jun 4] p. 1–502. Available from: https://aiindex.stanford.edu/report/

3. **Strzelecki A.** *Is ChatGPT-like technology going to replace commercial search engines? LHTN* [Internet]. 2024 Apr 4 [cited 2024 Jun 5]. Available from: https://www.emerald.com/insight/content/doi/10.1108/LHTN-02-2024-0026/full/html

4. **Koivisto M.** Tutoring Postgraduate Students with an AI-Based Chatbot. *Int J Adv Corp Learn*. 2023 Mar 13; 16(1):41–54. DOI: https://doi.org/10.3991/ijac.v16i1.35437

5. **Chan CKY.** A comprehensive AI policy education framework for university teaching and learning. *Int J Educ Technol High Educ*. 2023 Jul 7; 20(1):38. DOI: https://doi.org/10.1186/s41239-023-00408-3

6. **Barros A, Prasad A, Śliwa M.** Generative artificial intelligence and academia: Implication for research, teaching and service. *Management Learning*. 2023 Nov; 54(5):597–604. DOI: https://doi.org/10.1177/13505076231201445

7. **Marche S.** *The college essay is dead. Nobody is prepared for how AI will transform academia. The Atlantic* [Internet]. 2022 Dec 6 [cited 2024 Jun 4]. Available from: https://www.theatlantic.com/technology/archive/2022/12/chatgpt-ai-writing-college-student-essays/672371

8. **Gaumann N, Veale M.** *AI Providers as Criminal Essay Mills? Large Language Models meet Contract Cheating Law* [Internet]. 2023 [cited 2024 Jun 5]. Available from: https://osf.io/cpbfd. DOI: https://doi.org/10.31235/osf.io/cpbfd

9. **Lindebaum D, Ramirez MF.** "Negative" resource review: On the essay-writing algorithm Essay Genius at https://essaygenius.ai/. *AMLE*. 2023 Mar 20; amle.2022.0474.

10. **Medway D, Roper S, Gillooly L.** Contract cheating in UK higher education: A covert investigation of essay mills. *British Educational Res J*. 2018 Jun; 44(3):393–418. DOI: https://doi.org/10.1002/berj.3335

11. **Wang C.** *Exploring Students' Generative AI-Assisted Writing Processes: Perceptions and Experiences from Native and Nonnative English Speakers. Tech Know Learn* [Internet]. 2024 May 30 [cited 2024 Jun 5]. DOI: https://doi.org/10.1007/s10758-024-09744-3

12. **Mizumoto A, Eguchi M.** Exploring the potential of using an AI language model for automated essay scoring. *Research Methods in Applied Linguistics*. 2023 Aug; 2(2). DOI: https://doi.org/10.1016/j.rmal.2023.100050

13. **Gimpel H, Gutheil N, Mayer V, Bandtel M, Büttgen M, Decker S,** et al. *(Generative) AI Competencies for Future-Proof Graduates: Inspiration for Higher Education Institutions* [Internet]. University of Hohenheim; 2024 Feb [cited 2024 Jun 5]. Available from: https://zenodo.org/doi/10.5281/zenodo.10680210

14. *Guidance for generative AI in education and research* [Internet]. UNESCO; 2023 [cited 2024 May 13]. 48 p. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000386693?locale=en

15. *Regulating Artificial Intelligence In Education Council of Europe Standing Conference of Ministers of Education* [Internet]. Council of Europe Standing Conference of Ministers of Education; 2023 [cited

2024 Jun 9]. Available from: https://rm.coe.int/regulating-artificial-intelligence-in-education-26th-session-council-o/1680ac9b7c

16. **UK Department for Education.** *Generative artificial intelligence in education* [Internet]. UK Department for Education; 2023 [cited 2024 Apr 22]. Available from: https://www.gov.uk/government/publications/generative-artificial-intelligence-in-education

17. **McConlogue T.** *Assessment and Feedback in Higher Education: A Guide for Teachers* [Internet]. 1st ed. London, UK: UCL Press; 2020 [cited 2024 Apr 29]. 180 p. Available from: https://discovery.ucl.ac.uk/id/eprint/10096352/.

18. **Lee YF, Hwang GJ, Chen PY.** Impacts of an AI-based chabot on college students' after-class review, academic performance, self-efficacy, learning attitude, and motivation. *Education Tech Research Dev*. 2022 Oct; 70(5):1843–65. DOI: https://doi.org/10.1007/s11423-022-10142-8

19. **Fidan M, Gencel N.** Supporting the Instructional Videos With Chatbot and Peer Feedback Mechanisms in Online Learning: The Effects on Learning Performance and Intrinsic Motivation. *Journal of Educational Computing Research*. 2022 Dec; 60(7):1716–41. DOI: https://doi.org/10.1177/07356331221077901

20. **Zhou K, Jurafsky D, Hashimoto T.** *Navigating the Grey Area: How Expressions of Uncertainty and Overconfidence Affect Language Models* [Internet]. arXiv e-prints. 2023 [cited 2024 Jun 9]. Available from: https://ui.adsabs.harvard.edu/abs/2023arXiv230213439Z.

21. **Zhou K, Hwang JD, Ren X, Sap M.** *Relying on the Unreliable: The Impact of Language Models' Reluctance to Express Uncertainty* [Internet]. arXiv; 2024 [cited 2024 Jun 9]. Available from: http://arxiv.org/abs/2401.06730

22. **McMahon L, Kleinman Z.** *Glue pizza and eat rocks: Google AI search errors go viral* [Internet]. BBC News. 2024 May 24 [cited 2024 Jun 8]. Available from: https://www.bbc.co.uk/news/articles/cd11gzejgz4o

23. **Manolchev C, Nolan R, Hodgson E.** *Unlikely allies: ChatGPT and higher education assessment* [Internet]. JLDHE. 2024 Mar 27 [cited 2024 Jun 8]; 30. Available from: https://journal.aldinhe.ac.uk/index.php/jldhe/article/view/1136.

24. **Abbas M, Jam FA, Khan TI.** Is it harmful or helpful? Examining the causes and consequences of generative AI usage among university students. *Int J Educ Technol High Educ*. 2024 Feb 16; 21(1):10. DOI: https://doi.org/10.1186/s41239-024-00444-7

25. **Delcker J, Heil J, Ifenthaler D, Seufert S, Spirgi L.** First-year students AI-competence as a predictor for intended and de facto use of AI-tools for supporting learning processes in higher education. *Int J Educ Technol High Educ*. 2024 Mar 18; 21(1):18. DOI: https://doi.org/10.1186/s41239-024-00452-7

26. **Rudolph J, Tan S, Tan S.** *ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? JALT* [Internet]. 2023 Jan 25 [cited 2024 Jun 8]; 6(1). DOI: https://doi.org/10.37074/jalt.2023.6.1.9

27. **Klyshbekova M, Abbott P.** ChatGPT and Assessment in Higher Education: A Magic Wand or a Disruptor? *EJEL*. 2024 Feb 9. DOI: https://doi.org/10.34190/ejel.21.5.3114

28. **Chaudhry IS, Sarwary SAM, El Refae GA, Chabchoub H.** Time to Revisit Existing Student's Performance Evaluation Approach in Higher Education Sector in a New Era of ChatGPT — A Case Study. *Cogent Education*. 2023 Dec 31; 10(1):2210461. DOI: https://doi.org/10.1080/2331186X.2023.2210461

29. **Graham S.** Scott. Post-Process but Not Post-Writing: Large Language Models and a Future for Composition Pedagogy. *Composition Studies*. 2023; 51(1):162–8.

30. **Suraworachet W, Zhou Q, Cukurova M.** Impact of combining human and analytics feedback on students' engagement with, and performance in, reflective writing tasks. *Int J Educ Technol High Educ*. 2023 Jan 3; 20(1):1. DOI: https://doi.org/10.1186/s41239-022-00368-0

31. **UNESCO.** *Draft AI competency frameworks for teachers and for school students* [Internet]. UNESCO; 2023. Available from: https://www.unesco.org/sites/default/files/medias/fichiers/2023/11/UNESCO-Draft-AI-competency-frameworks-for-teachers-and-school-students.pdf.

32. **Cukurova M, Miao X, Brooker R.** *Adoption of Artificial Intelligence in Schools: Unveiling Factors Influencing Teachers Engagement*. DOI: https://doi.org/10.48550/arXiv.2304.00903

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