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Embedding Generative AI as a digital capability into a year-long skills program

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Abstract

Generative Artificial Intelligence (GenAI) offers transformative possibilities for personalised learning while presenting challenges in academic integrity and assessment methods. This study explored the integration of GenAI as a digital competency within a year-long MSc programme, embedding its application into core skills modules over three semesters. Through a process-based assessment framework, students engaged with prompt engineering, ethical implications, and practical GenAI use. The findings indicated notable improvements in student confidence across key GenAI-related competencies, such as ethical usage and data protection. Thematic analysis of semi-structured interviews highlighted a cyclical relationship between GenAI utilisation, experience, and ethical awareness through adaptive learning. A clear tension between student trust in GenAI capabilities and unclear institutional expectations was also evident. Results emphasise the importance of incorporating GenAI literacy into curricula, supported by institutional frameworks, and rethinking assessments to prioritise the learning process over final outputs.

Practitioner Notes

1. Scaffolding and structuring GenAI integration across modules can incrementally boost students' confidence in prompt writing, ethical AI use, and data protection.
2. Curriculum design strategies such as experience mapping and "just-in-time" teaching are practical ways of providing GenAI support and guidance.
3. Adopting process-based assessments which focus on the creation process over the final output promotes ethical GenAI use.
4. GenAI can be used to promote digital equity by providing language and writing support for international and non-native English-speaking students.
5. Student concerns around academic misconduct, ethical use and data privacy can be addressed by embedding explicit guidance and reflection activities into GenAI teaching.

Keywords

Generative AI, Artificial Intelligence, Assessment, Process-Based Assessment, Curriculum Design

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Introduction

The emergence of Generative Artificial Intelligence (GenAI) as a class of Artificial Intelligence (AI) technologies that can generate content such as human-like text, images, and code based on input prompts has significantly changed global Higher Education. These technologies promise personalised support, greater efficiency in learning, and new ways of engaging with academic content. However, they also challenge long-standing educational norms, particularly around academic integrity, assessment authenticity, and critical engagement with knowledge. As universities worldwide grapple with the implications of GenAI, guidance has emerged encouraging institutions to redesign assessments and teaching practices (Moorhouse et al., 2023). Common themes in these recommendations include promoting critical thinking, reducing opportunities for misuse, and embedding GenAI literacy into curricula. Despite this guidance, much of the institutional response to GenAI in teaching remains academic, policy-focused or reactive, with few practical models demonstrating how GenAI can be responsibly integrated into day-to-day teaching while building student digital competencies.

Concerns about GenAI use are wide-ranging; tools like ChatGPT have been shown to produce assessment-quality outputs that are difficult to distinguish from student-authored work (Elkhatat et al., 2023; Newton & Xiromeriti, 2024), raising questions about authorship, learning, and trust. Detection technologies are often unreliable and biased, particularly against non-native English speakers (Liang et al., 2023), while over-reliance on GenAI may reduce opportunities for critical engagement and independent thinking (Bearman & Luckin, 2020; Bobula, 2024). In their editorial, Nguyen et al. (2024) set out the implications of GenAI in education and provide several insights on how to integrate AI into the curriculum by allowing the students to understand the basics of its use as an interactive technology and personalised learning tool, whilst also addressing ethical concerns (Bearman & Luckin, 2020; Hooda et al., 2022). Privacy and data protection add a further layer of complexity; many popular GenAI models are hosted on proprietary platforms that do not comply with regulations such as the UK's GDPR and retain user inputs for model training, with students being unaware of how their data is being used and who can access it (Nguyen et al., 2024).

Surveys of educators and students from across the globe reveal diverse attitudes towards GenAI in Higher Education (Chan & Colloton, 2024; Lacey & Smith, 2023; Palmer et al., 2023). There is a general recognition of GenAI's benefits in supplementing learning (Vo & Nguyen, 2024), assessment efficiency, language support (Pang et al., 2024) and feedback (Isiaku et al., 2024). However, students do also express concerns about the potential for superficial thinking (Isiaku et al., 2024), loss of creativity (Chan & Colloton, 2024) alongside the risk of undermining the authenticity of their work (Ali et al., 2024) and the potential for academic dishonesty and ethical implications (Lodge et al., 2024). Although students generally trust GenAI for tasks like grammar correction, they still prefer human educators for assessment feedback (Palmer et al., 2023; Smith & Francis, 2024). At the same time, there is growing evidence that students already use GenAI extensively. Surveys across multiple institutions show that students value GenAI for brainstorming, translation, feedback, and research assistance (Folmeg et al., 2024; Johnston et al., 2024; Zhou et al., 2024). While many students understand the risks of over-reliance or unethical use, they also recognise the increase in productivity and learning benefits these tools can provide. This presents a critical challenge for educators to move beyond prohibition or

suspicion of GenAI use within their teaching and instead create structured opportunities for students to learn how to use GenAI critically, ethically, and effectively (Smith & Francis, 2024).

The integration of GenAI into Higher Education requires more than access to the required technology; it demands deliberate, pedagogically grounded design. Competency-based learning assesses students' ability to apply these outputs to working-world applied scenarios rather than through traditional memory-based tasks (Huxley-Binns et al., 2023). In this framework, learning is seen as a constructive process resulting from acquiring knowledge or skills, and students are assessed based on observable outcomes or competencies. GenAI can facilitate competency-based learning by providing detailed feedback on performance and identifying areas for improvement, aiding learners in mastering specific competencies. To support this learning, assessment practices must evolve, with open-ended tasks, project-based learning, and authentic problem-solving better reflecting how students engage with GenAI in practice (Bobula, 2024; Chan & Colloton, 2024). Effective integration also includes critical reflection, requiring students to document and evaluate their GenAI use, enhancing both content mastery and GenAI literacy (Sok & Heng, 2024). Implementation must also account for students' concerns; while many students value GenAI for productivity and support, they remain cautious about fairness, bias, and ethical risks. Tailored, scaffolded curricula can help build confidence and competence, addressing specific worries and contexts of both students and academic staff (Folmeg et al., 2024; Johnston et al., 2024; Zhou et al., 2024).

This paper presents a practical model for embedding GenAI into a postgraduate curriculum with a large international cohort drawn from three continents, embedded in a structured skills programme. Our approach integrates GenAI across three semesters of core modules using experience mapping, just-in-time teaching, and process-based assessments. Rather than treating GenAI as a threat to academic integrity, we position it as a learning tool that, when scaffolded appropriately, can help students develop core digital competencies while fostering reflection, ethical awareness, and critical thinking. Here we address two research questions.

RQ1: How can GenAI be effectively embedded into a skills-based postgraduate curriculum to enhance digital competencies?

RQ2: What strategies can mitigate academic integrity and data privacy challenges?

Unlike earlier studies that largely concentrate on theoretical models or isolated applications, our research offers a comprehensive, practice-oriented framework that embeds GenAI across a range of skills-focused modules. Through process-based assessment design, explicit ethical training, and iterative feedback mechanisms, our approach addresses key gaps identified in the literature, most notably, the absence of integrated, sustainable models for ethical GenAI use within diverse international cohorts.

Method

Assessment design

In this study, experience mapping**,** a concept developed by Colin Beard as part of his broader framework on experiential learning (Beard, 2022), was used to embed GenAI into a series of three core research skills modules. The process involves designing, analysing, and refining learning experiences to maximise their impact on learners, delivering and building core skills and

competencies through structured delivery. Incorporating GenAI into module assessments in this study involved a shift towards emphasising the creation process rather than the product (Smith & Francis, 2024), especially with written articles (Rudolph et al., 2023).

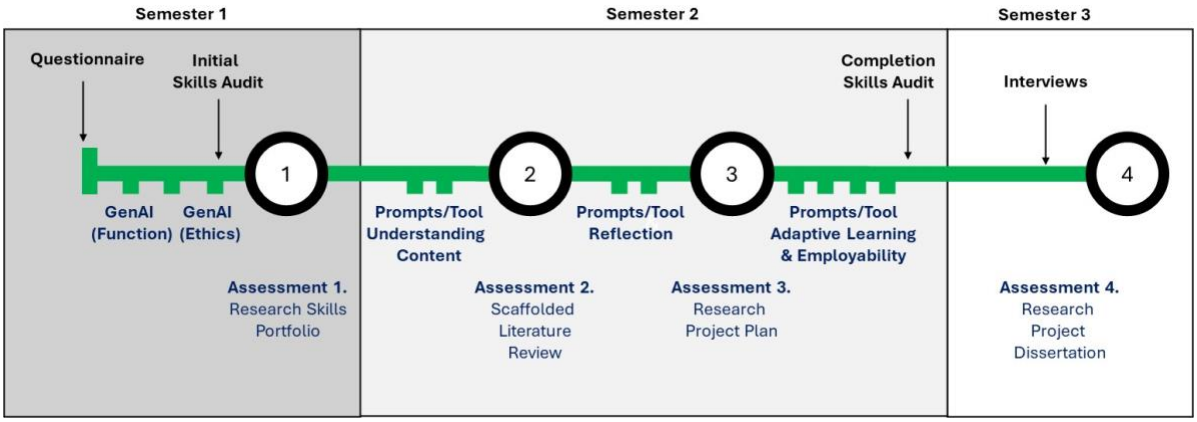
Assessments were structured to allow the incorporation of GenAI prompts alongside a rationale and critique of the generated outputs (Brew et al., 2023). Assessments were fully integrated into the taught context to help students develop these competencies around ethical and appropriate GenAI use and demonstrate learning outcomes. Seminars and tutorials were conducted to foster the development of competencies, including the ethical and proper use of GenAI, such as logging search strategies and keywords and critically appraising content validity (Crowther et al., 2010). GenAI was integrated into the assessment design by requiring students to document prompts and justify how the generated text contributed to their final article. Furthermore, templated guides were developed to structure and support this process, providing students with direction in documenting their progress towards the final product. A complete theoretical underpinning and assessment design strategy, alongside assessment rubrics, can be found in Smith and Francis (2024).

Curriculum delivery

The student experience mapping process utilised here involved designing, analysing, and refining learning experiences to maximise their impact on learners and was used to create a visual representation of the learning journey. Figure 1 presents a simplified experience map showing how GenAI content was embedded across the MSc curriculum. It highlights when key concepts were introduced, how these aligned with assessments, and where evaluation points occurred. During the first semester, learning points were identified as the need to understand GenAI's workings, the ethical and appropriate use of the tools (Perkins et al., 2024), data integrity considerations and the institutional policies around academic conduct. These key content points were crucial for students' understanding of how GenAI produces its responses and to allow reflection on the use of GenAI during their studies. During semester two, prompt design and example GenAI and GenAI-powered tools were covered, introduced, and explored that addressed specific student needs, such as aiding in understanding, scaffolding reflection, feeding forward on assessment tasks, or GenAI acting as a learning guide. Examples of prompts used are given in Appendix 1.

Figure 1

Learning experience map outlining the structure of the MSc skills delivered over three semesters: Open circles represent assessment points, while the green line traces the integration of GenAI-related teaching and development activities.



In semester one, students were introduced to the foundational principles of GenAI, including how large language models (LLMs) generate responses, alongside core concepts such as academic integrity, ethical use, and data privacy. In semester two, GenAI was positioned as a tool to support understanding of educational content, reflective practice, and employability planning.

To evaluate the teaching intervention, a mixed-methods approach was used. A questionnaire on GenAI understanding was administered at the beginning of semester one to inform curriculum development. A skills audit was conducted mid-semester one and repeated at the end of semester two to assess changes in students' self-reported capabilities. To gain deeper insights into the student experience, qualitative interviews were conducted in semester three.

Participants

The student participants were MSc cohorts on a five-year Biosciences and Chemistry Masters degree programmes: Analytical Chemistry and Pharmaceutical Analysis, Biotechnology and Pharmacology, Biomolecular Science, Molecular Microbiology, and Cancer Biology. The cohort is primarily international students, with representation from various nationalities from across the globe: Nigeria (~25%), India and Pakistan (~30%), the Middle East (~20 %), and Europe (~15%). Approximately 10% of students were home students from the United Kingdom, where the study was based. In all degree programmes, students participate in core skills modules that run for three semesters, with weekly tutorials and seminars as well as lectures and laboratory sessions. Seminar sessions are co-taught with the full cohort and are split into tutorial groups of 25–30 students. Laboratory sessions are a mandatory component of the degree programmes linked directly to assessment.

Ethics

Ethical approval was granted by the College of Health, Wellbeing, and Life Sciences Ethics Committee at Sheffield Hallam University (ER61054725), in accordance with the University's

Research Ethics Policy. As no identifiable or sensitive data were collected, approval was provided with minimal risk conditions. Participation was voluntary, and no demographic data (e.g. gender, age, education) were gathered or analysed.

For the in-class poll, students were informed via a brief statement that responses were anonymous, and participation was optional. A separate statement preceded the skills audit, explaining that responses would be tracked across semesters using SHU student emails, accessible only to the study organiser, with consent indicated by submitting a student number.

Interview participants were recruited via email and on-campus posters. Written consent was obtained following distribution of a study information sheet, and participants received a £10 gift card in recognition of their time.

Evaluation Instruments

Questionnaires:

Of the 180 students in the cohort, 156 opted into the study (87% participation rate). Questionnaire data (see Supplementary Information) were transcribed and indexed by an independent researcher into Excel. Student names were replaced with identifiers to ensure anonymity and minimise investigator bias.

Likert scale responses were numerically coded from 1 (strongly disagree) to 5 (strongly agree) for analysis. Given the ordinal nature of the data, nonparametric tests were used throughout. All observations were independent, with no individual appearing in more than one group. Group comparisons were conducted using Mann–Whitney U tests, with statistical significance reported at $P < 0.05$ and $P < 0.01$.

Skills Audit:

Skills audits were conducted early in semester one and at the end of semester two. Data were collected via an online questionnaire during a large group-taught session. Students were asked to evaluate the importance and confidence of a range of research skills, including GenAI, on a Likert scale of 1 = not important/confident, 2 = Limited importance/confident, 3 = somewhat important/confident, 4 = quite important/confident, and 5 = extremely important/confident. A copy of the responses was e-mailed automatically to the students for their own records. The ordinal data was analysed as above.

Interviews:

A qualitative research design was used to explore participants' experiences and perceptions of GenAI through semi-structured interviews (see Supplementary Information). Fifteen participants were recruited via email and provided informed consent prior to their individual interviews, confirming they had read the participation information sheet.

Interviews were transcribed using Microsoft Teams' automatic transcription feature and manually cleaned to remove filler words and verbal tics, following qualitative data management best practices (Gibbs, 2007), while preserving response integrity.

Data were analysed thematically using Braun and Clarke's (2019) six-phase framework. Researchers familiarised themselves with the transcripts, systematically coded key phrases, and grouped these into themes aligned with the research questions. Themes were reviewed, refined, and supported with participant quotes. Rigour was ensured through reflexive practice and adherence to Lincoln and Guba's (1985) criteria for trustworthiness.

Results

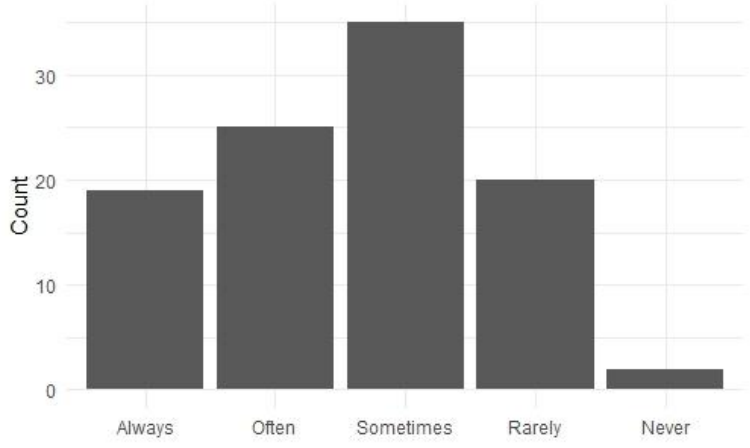
Evaluation of initial attitudes to GenAI use

To establish the students' base-level understanding and attitudes to GenAI, a questionnaire was undertaken during the initial GenAI seminar using a student response (clicker) system. The questionnaire followed taught content about how GenAI operates, including the concept of training models and content creation.

Students were asked, "How often do you use GenAI?" with 44% stating they use GenAI Always or Often (Figure 2). An open-text response was then used to capture which tools or models the students were using with ChatGPT identified as the primary GenAI tool used by this predominantly international student cohort.

Figure 2:

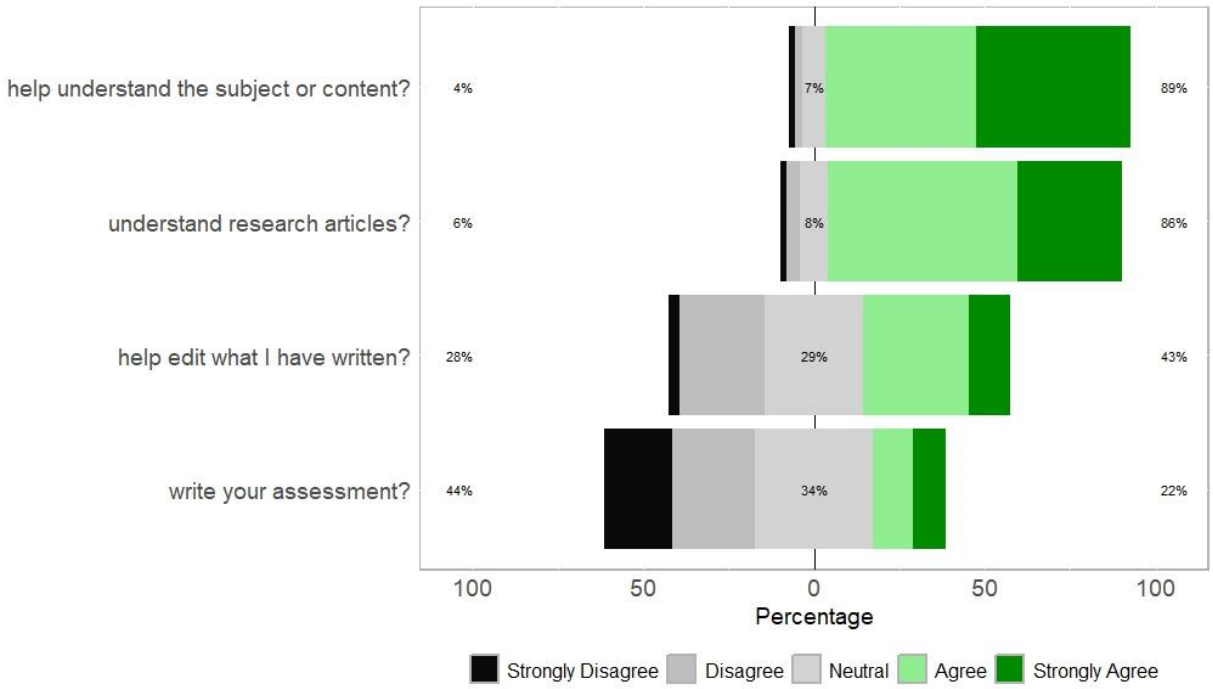
The number of students who use GenAI was determined by asking the question, "How often do you use GenAI?" n=101 responses.



A set of Likert scale questions was employed to gauge students' initial perceptions and attitudes towards using GenAI in their studies. Students were asked to indicate whether they believed the following scenarios were acceptable uses of GenAI. The survey assessed participants' views on GenAI's usefulness across various academic tasks, such as writing assessments, understanding content, editing written work, and locating research articles (Figure 3). Responses are categorised across five levels: Strongly Disagree to Strongly Agree (n=110).

Figure 3:

Percentage of respondents' views on the usefulness of GenAI in four academic tasks: writing assessments, understanding subject content, editing written work, and finding research articles.



Comprehension: Most respondents had a favourable view of GenAI's role in aiding content comprehension. 89% of participants agreed or strongly agreed that GenAI was helpful when understanding the subject or content, with only 4% strongly disagreeing and 7% disagreeing. This suggests a strong confidence in GenAI's ability to assist in understanding complex topics.

Research articles: GenAI was overwhelmingly viewed as beneficial for understanding research articles. A substantial 86% of respondents agreed or strongly agreed with this capability, with only a small minority, 6% strongly disagreeing and 8% disagreeing, expressing doubts. This highlights the perceived value of GenAI in streamlining the research process and improving access to scholarly materials. Overall, the data suggest that while there is strong confidence in GenAI's ability to assist with content comprehension and research, students understood the ethical concerns around using GenAI in generating and editing written assessments.

Editing written work: Opinions on GenAI's ability to help with editing written content were divided. While 43% of respondents agreed or strongly agreed that GenAI could assist in editing, 28% strongly disagreed, and 29% disagreed. This indicates that, although some users find GenAI useful for editing, a significant proportion remains unconvinced of its effectiveness.

Write assessments: When asked if it was acceptable that GenAI could effectively write their assessments, a significant portion of respondents replied negatively, with 44% strongly disagreeing and 34% disagreeing. Only 22% of respondents agreed or strongly agreed that GenAI could perform assessment tasks. This highlighted that most students understood concerns

around academic integrity and highlighted considerable doubt about GenAI's ability to generate accurate and complete assessments independently.

These findings present a layered understanding of how students perceive the role of GenAI in academic work. There is a clear distinction between GenAI's perceived value as a learning support tool and its appropriateness in the context of assessment and authorship. However, when the function of GenAI shifts from supporting learning to replacing student-generated output such as editing or writing assessments, confidence drops. The polarised views on editing and the widespread rejection of GenAI-authored assessment tasks point to a strong underlying awareness of academic integrity principles. Overall, the results suggest that students can make distinctions in how GenAI is used and that they are more comfortable with GenAI as a cognitive partner than as a content producer.

Assessment of perceived skills development

A pre- and post-module skills audit was conducted to evaluate students' self-perceived development in key GenAI-related competencies. This dual-stage audit provided a baseline of student confidence at the beginning of semester one and allowed for comparative analysis following structured GenAI instruction. Figure 4 presents the percentage distribution of student confidence across four domains: understanding how GenAI operates, writing effective prompts, ethical GenAI use, and data protection awareness.

Figure 4.

Change in Student Confidence in GenAI-Related Skills

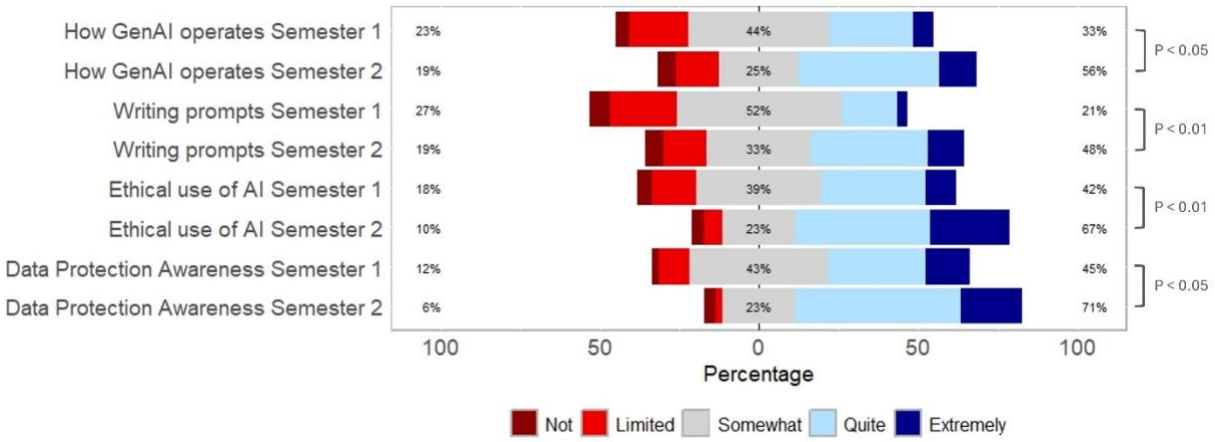


Figure 4 presents changes in postgraduate students' confidence across four GenAI-related skill areas: understanding how GenAI works, writing effective prompts, ethical use, and data protection. Confidence was measured at the start of semester one (n=92) and the end of semester two (n=53) using a five-point Likert scale, grouped as negative (Not, Limited), neutral (Somewhat), and positive (Quite, Extremely). Mann–Whitney U-tests were used to assess statistical significance.

At the start of the study, most students rated these skills as important to their academic development. Specifically, 77% identified understanding how GenAI operates as quite or

extremely important, 79% valued prompt writing, 88% recognised the importance of ethical use, and 90% prioritised data integrity. These perceptions remained consistent at the end of semester two, indicating that students' valuation of GenAI-related competencies was high from the outset and remained stable.

In contrast, students' confidence in applying these skills increased significantly over time. At the beginning of semester one, only 33% felt quite confident in their understanding of how GenAI operates, with 23% reporting no confidence. By semester's end, this rose to 56% reporting quite confident, and only 19% expressing no confidence. Confidence in prompt writing showed a similar improvement, with quite confident responses increasing from 21% to 48%, and limited confidence decreasing from 52% to 33%.

Students also showed marked gains in their confidence around the ethical use of GenAI. Initially, 42% reported being quite confident and 18% reported no confidence. By the end of the semester, confidence had risen to 67%, and those reporting no confidence dropped to 10%. Improvements were also observed in data protection awareness. At the start, 45% reported feeling quite confident and 43% indicated limited confidence. By semester's end, 71% felt quite confident, and limited confidence had declined to 23%.

These findings suggest that while students entered the program with a clear sense of the importance of GenAI-related skills, their practical confidence in applying them was initially uneven. Over the course of two semesters, the structured and scaffolded curriculum supported students in building not only their technical understanding but also their ethical awareness and critical engagement with GenAI. The significant growth in self-reported confidence across all four skill areas reflects the effectiveness of the learning design in addressing both knowledge and application.

Students' voice

During the third semester, fifteen one-on-one interviews were conducted to explore students' perceptions of the curriculum's impact on their GenAI-related digital competence. To minimise bias stemming from academic hierarchy, all interviews were conducted by student researchers. A structured question format was used, and transcripts were analysed thematically.

Three interrelated themes emerged from the data: (1) GenAI literacy and competence, (2) transferable skills and strategic application, and (3) ethical hesitation and uncertainty around appropriate use. These themes collectively reflect a holistic experience of engaging with GenAI in academic settings. Increased use fostered learning and adaptation but also raised new ethical concerns.

The relationship between these themes was also cyclical. As students gained experience, they refined their use of GenAI, adapted their learning strategies, and continually reassessed its ethical implications—shaping how they used the tool and what support they sought from it moving forward.

Theme 1 - GenAI literacy and competence:

Students shared how the structured educational modules have significantly contributed to their understanding of GenAI. The experience has not only increased their confidence in using GenAI

but has also improved their ability to use it effectively in a range of tasks. The explicit focus on guided use in semester one was seen as a key factor in developing not just technical competence but also a more critical and strategic approach to tool use and was reflected on by Student 14:

> "I've enhanced my skills in asking the right questions to AI and using tools like ChatGPT and others effectively after the [semester one] module."

This perspective was echoed by Student 3, who stated:

> "My confidence in using AI has increased significantly thanks to the modules."

Both responses highlight a key outcome of the curriculum design: students did not simply learn to use the tools but became more intentional and strategic in how they applied them. This increased confidence led to a broader and more purposeful use of GenAI. Students described applying it across a variety of academic and professional contexts, from summarising research papers and paraphrasing content to drafting CVs and unpacking complex ideas. The role of GenAI as a support tool was especially evident for students with additional language needs. As Student 4 shared:

> "It helps me with emails and checking my spelling because I am still learning English. It always translates for me or gives me synonyms, which makes it easier to write correctly."

Further, Student 14 extended this point to academic writing, stating:

> "Sometimes the slang in articles is difficult to understand, so this tool is helpful for us, especially for those improving their English. I use AI to paraphrase and rephrase my writing, which helps me improve the quality of my work. It also provides feedback on grammar, which is crucial as I am still learning English."

These reflections illustrate how GenAI fostered a sense of linguistic empowerment and supported independent learning. Collectively, these quotes show a trajectory from uncertainty to competence. In particular, non-native English speakers noted that it promoted inclusivity by offering the kind of linguistic support they might otherwise have struggled to access. This reinforces the idea that, when embedded through structured and integrated curriculum design, GenAI can act as a leveller, enhancing academic equity, boosting digital confidence, and encouraging independent learning. That said, as subsequent discussions will reveal, technical competence did not always equate to trust in institutional systems or a full grasp of ethical considerations.

Theme 2 - Transferable GenAI skills and strategic application:

As students progressed through the curriculum, they began to view GenAI not only as an academic support tool but also as a transferable skillset relevant to their futures. Student 8 summarised this transition:

> "The modules have taught me how to use AI in a positive manner, whether for academic purposes or other tasks."

Similarly, Student 2 reflected on the direct practical benefits of GenAI in diverse academic contexts:

> "The module taught me tricks like reading papers, creating outlines, and even preparing for job searches. Without AI, starting something like exam prep or coursework would have been more difficult."

Students described developing prompting strategies that enabled them to gain more meaningful, context-aware outputs, viewing GenAI as a valuable assistant that provides essential support. This includes language assistance for non-native speakers, simplifying complex tasks, guidance in learning new concepts, and feedback to improve their work. GenAI is seen as a tool that makes complex tasks more manageable by providing quick answers, summaries and guidance. As students learn more about GenAI, they report that they begin to use it more effectively as a supportive tool, refining their prompts and better understanding how to get the assistance they need. This strategic shift is further evidenced by Student 6, who commented:

> "The module helped me understand the potential of AI beyond basic applications, such as writing essays. It showed me that AI could be a valuable tool if used correctly."

Taken together, these quotes reveal a deepening understanding of GenAI as a productivity partner, one that can streamline complex tasks such as literature reviews, job preparation, and concept clarification. Crucially, the commentary from all students recognised that using GenAI effectively required an understanding of its limitations and an awareness of when human judgement was essential, an insight that aligns with literature on GenAI learning (Francis et al., 2025). This theme highlights the value of structured, skills-based GenAI education in preparing students for both lifelong learning and future employment. By equipping them with adaptable strategies, the programme developed not only confidence in using GenAI, but also the ability to navigate the shifting digital landscapes they are likely to encounter beyond university.

Theme 3 - Ethical hesitation and uncertainty about appropriate use:

Students addressed concerns regarding GenAI's reliability and ethical use. Despite growing technical confidence, students expressed varied levels of trust in GenAI, particularly around ethical boundaries. Student 7 raised concerns about reliability:

> "I use it sometimes but I'm not a big fan, you know. ChatGPT, for example. I don't really trust it because sometimes it gives wrong answers."

Students raised concerns about the ethical implications of using GenAI, especially regarding plagiarism and the originality of work. This negatively impacted their confidence in using GenAI for their studies. This scepticism was highlighted by Student 5, who underscored the ethical risks of overuse:

> "Using AI to produce essays or coursework is unethical. We should use it only for understanding or improving our own work."

Data privacy also emerged as a critical theme, particularly among students unfamiliar with how GenAI models handle personal information. For instance, Student 2 reported feeling less confident in their use of GenAI after learning about its risks during the taught module.

> "We cannot put any personal info into AI because it could be discovered by others. I didn’t know it takes personal info and feeds it into the system."

Similarly, Student 9 noted that learning about these risks changed their attitude:

> "I think I'm less confident in it after the [semester one] module because I didn't realise things like plagiarism and data privacy."

These reflections highlight an important nuance: increased literacy did not automatically equate to unqualified trust. In fact, some students reported a decrease in confidence as they became more aware of ethical and institutional complexities. This caution extended beyond academic use, as Student 13 noted:

> "Nowadays, some people use AI to generate data or images for research without doing the actual experiments, which could undermine scientific integrity."

Student reflections revealed a spectrum of trust in both GenAI and the institutional structures surrounding its use. These distinctions highlight how student trust or hesitation is shaped not only by perceptions of GenAI's reliability but also by the clarity, consistency, and transparency of educational practices. Students then fell into one of three broad categories: **(1)** Students who trust both GenAI and the academic process using the tools confidently and transparently, often integrating them into learning in reflective ways. **(2)** Students who trust GenAI but not institutional processes expressing concerns about unclear expectations or mixed messages from staff. **(3)** Students who distrust GenAI and/or the process either avoid the tools entirely or use them with significant hesitation. Understanding these profiles is key to designing inclusive, ethical, and pedagogically sound approaches to GenAI in Higher Education.

Taken together, these three themes offer valuable insight into how postgraduate students engage with GenAI when supported through structured, curriculum-integrated learning. Students not only developed greater competence and confidence in using GenAI (Theme 1) but also applied these skills across academic and professional domains (Theme 2) while navigating a complex landscape of trust, ethical considerations and institutional expectations (Theme 3). These findings link directly to both research questions: they demonstrate how GenAI can be embedded meaningfully within a skills-based postgraduate curriculum, and they identify the pedagogical and policy approaches needed to foster ethical, reflective use. Notably, the variation in student trust underscores the need to align GenAI integration not only with skills development but also with students' values, identities, and understandings of academic integrity.

Discussion

Integrating GenAI into the MSc skills development program demonstrates the benefits of embedding such technologies into Higher Education. The students here represent a diverse international cohort undertaking study at a UK-based institution. Our findings suggest that GenAI can significantly enhance personalised learning experiences and student engagement. In addition, GenAI use also necessitates careful consideration of ethical implications, particularly regarding academic integrity and the development of critical cognitive skills. This study provides educators with a framework for embedding GenAI literacy into the curriculum through structured, process-based assessments. For institutional leaders, the findings underscore the importance of clear policies and resources to support GenAI integration while safeguarding academic integrity and data privacy.

Enhancing Digital Competencies with GenAI

Students in this study and elsewhere (Isiaku et al., 2024; Ngo, 2023; Pang et al., 2024; Vo & Nguyen, 2024) have a favourable opinion of using GenAI in education, citing benefits such as time savings, personalised tutoring, and navigating complex academic tasks (Elkhodr et al., 2023; Kasneci et al., 2023). However, students also identify barriers such as the lack of ability to assess the quality and reliability of sources and the inability to cite sources accurately.

One of the primary advantages of our study was the role of GenAI in providing personalised feedback and support to students, particularly those from non-native English-speaking backgrounds. This finding has been echoed in other studies that noted students using GenAI for translation and language support (Folmeg et al., 2024; Pang et al., 2024). GenAI can enhance communicative practices for non-native English speakers and support students' language learning experiences both in and outside of the classroom (Wu & Yu, 2024). These tools also address issues such as lack of motivation, anxiety, limited authentic communication opportunities, and lack of personalised feedback (Bedford et al., 2024; Zadorozhnyy & Lai, 2024). Similar observations about the support that GenAI can give learners are also reported in further case studies (Bedford et al., 2024; Zadorozhnyy & Lai, 2024). Here, the students in question used GenAI as part of a personalised English language enhancement course, reporting that GenAI-assisted learning was an effective way to identify issues with their writing. Although GenAI can be beneficial for language learning, especially in speaking and vocabulary acquisition, limitations in supporting listening and writing practice have been noted (Wu & Yu, 2024). Strategies include utilising GenAI as a mentor for enhancing sentence structure, grammar, and spelling, providing personalised learning strategies and resources, recommending relevant language learning applications tailored to specific skills, and offering follow-up questions for comprehension checks (Bedford et al., 2024; Zadorozhnyy & Lai, 2024). GenAI's ability to give students instant and personalised feedback on their writing and research tasks is therefore a promising educational tool (Wu & Yu, 2024). Competency-based frameworks further ensure that students develop transferable skills, such as critical thinking and ethical GenAI usage, which are essential in the digital economy (Zhou & Schofield, 2024). Such approaches allow students to receive tailored support while learning, enhancing engagement and educational outcomes, aligning with individual learning trajectories (Bhutoria, 2022; Hooda et al., 2022).

Folmeg et al. (2024) emphasise the pivotal role of educators in shaping student perspectives on GenAI and promoting critical thinking about competencies in operation and ethical and responsible use. Students have also noted low confidence in the ability to use GenAI (Vo & Nguyen, 2024). Here, increased student confidence across various GenAI-related competencies, such as prompt writing and ethical GenAI use, further underscores the value of integrating these technologies into the curriculum. The structured approach of embedding GenAI into core modules through the tip of the week, with “just-in-time” learning principles (Novak, 2011), allowed students to gradually build their skills (Welch, Jun 20, 2010), leading to a notable improvement in their self-assessed abilities by the end of the program (Darling-Hammond & Snyder, 2000).

Balancing Academic Integrity and Ethical Challenges

Learning to use GenAI effectively involves both asking the right questions and interpreting responses—an area where students have reported needing support (Folmeg et al., 2024). This study highlights how, through a scaffolded approach, students' growing ethical awareness influenced how they engaged with GenAI. As their proficiency increased, so too did their ability to integrate these tools into their academic work while upholding principles of academic integrity. This theme underscores the learning process required to adapt to GenAI's evolving capabilities.

Students were required to log their GenAI interactions and critically evaluate AI-generated outputs as part of a literature review task. This exercise promoted ethical awareness and reflective use, encouraging critical engagement rather than passive reliance. However, concerns remained. Some students expressed scepticism about GenAI's reliability and voiced anxieties around plagiarism, data privacy, and ambiguous institutional expectations—concerns echoed in the wider literature (Isiaku et al., 2024). These divergent responses reflected varying degrees of trust, not only in GenAI itself but also in the frameworks governing its academic use.

Broadly, students fell into three groups: (1) those who trusted both the technology and the institution, (2) those who trusted GenAI but were uncertain about its academic legitimacy, and (3) those who distrusted both. Students in the second group often felt they were operating in a grey area, uncertain if their use of GenAI aligned with academic rules. This highlights the need for institutional clarity and consistent messaging. Those who lacked trust in both GenAI and institutional frameworks were more likely to disengage unless confidence was actively rebuilt through scaffolded exposure, peer collaboration, and explicit reinforcement of student agency. Even those with high trust in both areas still required structured guidance to ensure their engagement remained critical, ethical, and informed.

Aligning GenAI use with core learning objectives and integrating tasks that promote reflective analysis of AI outputs enabled students in this study to better understand GenAI's strengths and limitations. Yet, the impact of such integration depends heavily on the quality of curriculum design and delivery. The observed cyclical relationship, where increased use led to deeper reflection and evolving ethical considerations demonstrates the importance of ongoing adaptation in teaching strategies to meet the needs of a diverse student cohort.

Implications for Educators and Institutional Leaders

Clear guidelines for GenAI use in assessment have been shown to support academic integrity by clarifying expectations and boundaries (Perkins, 2023). In this study, such guidance was embedded through structured, process-driven assessments that required students to log their GenAI usage (Smith & Francis, 2024), and through dedicated seminar time to review institutional policies. This aligns with recommendations from Moorhouse et al. (2023), who highlight a broader shift towards redesigning assessments to incorporate GenAI in ways that promote critical thinking and creativity (Bobula, 2024; Chan, 2023).

Emerging assessment practices include open-ended, project-based tasks (Meir et al., 2024) and real-world problem-solving activities (Petrovska et al., 2024), which demand original thought and application of knowledge, thereby reducing opportunities for inappropriate GenAI use. While GenAI provides support for productivity and language development, its limitations in fostering higher-order thinking require careful pedagogical design (Putra et al., 2023; Richardson &

Clesham, 2021; Tenakwah et al., 2023). Because GenAI generates content through pattern recognition rather than understanding, its outputs may lack depth or creative insight. Over-reliance can discourage students from engaging in essential cognitive processes such as analysis, synthesis, and evaluation.

To mitigate this risk, assessments must go beyond reflection alone. Effective strategies include tasks where GenAI outputs serve as a starting point, with students required to verify, refine, or critique them through their own analysis. For example, scaffolded activities may ask students to improve, refute, or expand on GenAI-generated content. Collaborative methods such as peer review, structured debates, or group discussions around AI outputs can further prompt critical engagement. These approaches not only surface GenAI's limitations but actively develop students' higher-order thinking through collective dialogue. In addition, metacognitive prompts such as "What would you do differently than the AI?" or "Where might this response fall short?" encourage students to take intellectual ownership, fostering deeper learning and greater academic autonomy (Francis et al., 2025).

Practical recommendations

The integration of GenAI into Higher Education offers opportunities to enhance learning and teaching practices while presenting challenges that require practice-based solutions. Here we outline six actionable recommendations to enable the effective and ethical adoption of GenAI.

1. Embrace GenAI as a digital competency into the curricula through integration into core skills modules. These programs should provide a foundational understanding of how GenAI operates, its capabilities and limitations, alongside its ethical / data integrity implications. At the institutional level this requires prioritisation of GenAI literacy as part of institutional digital learning strategies and funding for staff development programmes.

2. Structure the learning experience to gradually introduce students to different aspects of GenAI, such as prompt engineering, tool usage, and ethical considerations in the context of the skills they are developing. Instructional design approaches, such as experience mapping, can be used to integrate GenAI into the curriculum. The framework of Perkins et al., (2024) can be used here, where introductory sessions focus on emphasising foundational knowledge and ethical considerations, while more advanced modules encourage students to engage more critically and creatively with GenAI, embedding it within the assessment itself.

3. Develop deep learning and critical thinking through process-based assessments. Shift the focus of assessments from evaluating the final product to emphasising the learning process through the documentation of their interactions with GenAI and then critically evaluating the outputs. This approach helps students develop a deeper understanding of the subject matter and minimises the potential for misuse and surface learning.

4. Provide ongoing GenAI support and guidance to the student cohort throughout their learning journey. Guidance can include access to prompt libraries, video tutorials, templated guides, and opportunities for feedback and discussion. Institutionally, universities can invest in GenAI-specific learning resources and infrastructure, ensuring equitable access for all students and staff.

5. Promote responsible GenAI use through clear guidelines within assessment briefs and institutional regulations. Course designers and policy developers must establish clear guidelines that ensure consistency across departments, outlining acceptable uses of GenAI in teaching, learning, and assessment.

6. Ensure data integrity and privacy compliance among students and academic staff. Students should not be asked to upload personal or assessment data into GenAI models unless privacy compliance is in place. Academics can offer workshops or resources to educate students about responsible data handling when using GenAI, highlighting risks like data retention by external platforms. Institutional leaders can set out university-wide policies around ethical use and data integrity.

Limitations and Implications for Future Research and Practice

This study offers valuable insights into the practical integration of GenAI in higher education and highlights opportunities for future research. While the findings demonstrate how structured GenAI use can support postgraduate skill development, they are based on a single UK case study and focus on self-reported confidence rather than direct measures of learning outcomes, limiting generalisability. Although the international composition of the cohort enhances relevance to global higher education, further research is needed to test the model across disciplines, undergraduate programs, and transnational contexts. The study's use of student voice, mixed-methods evaluation, and process-focused assessment contributes a novel perspective to the growing literature on GenAI in education. Future work should examine the long-term impact on learning, particularly in relation to higher-order thinking, and investigate how GenAI may differentially affect students from diverse demographic backgrounds, including those at risk of algorithmic bias.

Conclusion

As higher education continues to evolve in response to GenAI advancements, institutions must proactively address the opportunities and challenges presented. By fostering a culture of responsible GenAI use and aligning technological integration with pedagogical principles, Higher Education can empower students to become ethical, critical, and digitally competent professionals. The international significance of this study lies in its application beyond the immediate institutional setting. Our research drew on postgraduate cohorts comprising students from over 20 nationalities, reflecting the rich diversity found in many global and transnational education programmes. By implementing structured, process-driven assessment frameworks, paired with explicit ethical literacy and a scaffolded approach to GenAI integration (Smith & Francis, 2024) we tackle core challenges highlighted in recent literature (Folmeg et al., 2024; Pang et al., 2024): promoting digital equity, building institutional trust, and navigating ethical GenAI use across culturally and linguistically diverse student groups. In light of the rapid growth in international collaborations and partnerships, our approach offers a practical and adaptable model for institutions seeking to embed GenAI in ways that are inclusive, ethically grounded, and educationally robust.

While this study provides valuable insights into how structured GenAI integration can support postgraduate skill development, it is not without limitations. The data reflects a single institutional context and focus primarily on self-reported confidence and perceptions rather than direct

measures of learning or performance. Future research should explore longitudinal impacts, disciplinary differences, and how GenAI integration affects diverse student groups, including those with varying levels of digital access or prior AI experience. Nonetheless, this study offers a model for embedding GenAI into curriculum design that fosters not only digital competence but also ethical awareness, critical thinking, and academic integrity. As the role of GenAI in Higher Education continues to expand, institutions must respond not just with policy but with pedagogy, developing inclusive, adaptable strategies that prepare students to engage with GenAI responsibly and reflectively in both academic and professional contexts.

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References

Ali, O., Murray, P. A., Momin, M., Dwivedi, Y. K., & Malik, T. (2024). The effects of artificial intelligence applications in educational settings: Challenges and strategies. *Technological Forecasting and Social Change, 199*, 123076. https://doi.org/10.1016/j.techfore.2023.123076

Beard, C. (2022). *Experiential learning design* (1st ed.). Routledge. https://doi.org/10.4324/9781003030867

Bearman, M., & Luckin, R. (2020). Preparing university assessment for a world with AI: Tasks for human intelligence. In M. Bearman, P. Dawson, R. Ajjawi, J. Tai, & D. Boud (Eds.), *Re-imagining university assessment in a digital world* (pp. 49–63). Springer International Publishing. https://doi.org/10.1007/978-3-030-41956-1_5

Bedford, J., Kim, M., & Qin, J. C. (2024). Confidence enhancer, learning equalizer, and pedagogical ally. *Using generative AI effectively in higher education: Sustainable and ethical practices for learning, teaching and assessment* (pp. 33-41). Taylor & Francis. https://doi.org/10.4324/9781003482918-6

Bhutoria, A. (2022). Personalized education and artificial intelligence in the United States, China, and India: A systematic review using a human-in-the-loop model. *Computers and Education: Artificial Intelligence, 3*, 100068. https://doi.org/10.1016/j.caeai.2022.100068

Bobula, M. (2024). Generative artificial intelligence (AI) in higher education: A comprehensive review of challenges, opportunities, and implications. *Journal of Learning Development in Higher Education,* (30) https://doi.org/10.47408/jldhe.vi30.1137

Brew, M., Taylor, S., Lam, R., Havemann, L., & Nerantzi, C. (2023). Towards developing AI literacy: Three student provocations on AI in higher education. *Asian Journal of Distance Education, 18*(2), 1–11. https://doi.org/10.5281/zenodo.8032387

Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education, 20*(38) https://doi.org/10.1186/s41239-023-00408-3

Chan, C. K. Y., & Colloton, T. (2024). *Generative AI in higher education: The ChatGPT effect*. Taylor & Francis. https://doi.org/10.4324/9781003459026

Crawford, J., Cowling, M., Ashton-Hay, S., Kelder, J., Middleton, R., & Wilson, G. (2023). Artificial intelligence and authorship editor policy: ChatGPT, bard bing AI, and beyond. *Journal of University Teaching & Learning Practice, 20*(5), 1–11. https://doi.org/10.53761/1.20.5.01

Crowther, M., Lim, W., & Crowther, M. A. (2010). Systematic review and meta-analysis methodology. *Blood, 116*(17), 3140–3146. https://doi.org/10.1182/blood-2010-05-280883

Darling-Hammond, L., & Snyder, J. (2000). Authentic assessment of teaching in context. *Teaching and Teacher Education, 16*(5), 523–545. https://doi.org/10.1016/S0742-051X(00)00015-9

Elkhatat, A. M., Elsaid, K., & Almeer, S. (2023). Evaluating the efficacy of AI content detection tools in differentiating between human and AI-generated text. *International Journal for Educational Integrity, 19*(17). https://doi.org/10.1007/s40979-023-00140-5

Elkhodr, M., Gide, E., Wu, R., & Darwish, O. (2023). ICT students' perceptions towards ChatGPT: An experimental reflective lab analysis. *STEM Education, 3*(2), 70–88. https://doi.org/10.3934/steme.2023006

Folmeg, M., Fekete, I., & Koris, R. (2024). Towards identifying the components of students' AI literacy: An exploratory study based on hungarian higher education students' perceptions. *Journal of University Teaching & Learning Practice, 21*(6), 92–107. https://doi.org/10.53761/wzyrwj33

Francis, N. J., Jones, S., & Smith, D. P. (2025). Generative AI in higher education: Balancing innovation and integrity. *British Journal of Biomedical Science, 81*, 14048. https://doi.org/10.3389/bjbs.2024.14048

Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial intelligence for assessment and feedback to enhance student success in higher education. *Mathematical Problems in Engineering, 2022*, 1–19. https://doi.org/10.1155/2022/5215722

Huxley-Binns, R., Lawrence, J., & Scott, G. (2023). Competence-based HE: Future proofing curricula. *Integrative curricula: A multi-dimensional approach to pedagogy* (pp. 131–147). Emerald Publishing Limited. https://doi.org/10.1108/S2055-364120230000050008

Isiaku, L., Kwala, A. F., Sambo, K. U., & Isiaku, H. H. (2024). Academic evolution in the age of ChatGPT: An in-depth qualitative exploration of its influence on research, learning, and ethics in higher education. *Journal of University Teaching & Learning Practice, 21*(6), 67–91. https://doi.org/10.53761/7egat807

Johnston, H., Wells, R. F., Shanks, E. M., Boey, T., & Parsons, B. N. (2024). Student perspectives on the use of generative artificial intelligence technologies in higher education. *International Journal for Educational Integrity, 20*(1), 2–21. https://doi.org/10.1007/s40979-024-00149-4

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., . . . Kasneci, G. (2023). ChatGPT for good? on opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Lacey, M. M., & Smith, D. P. (2023). Teaching and assessment of the future today: Higher education and AI. *Microbiology Australia, 44*(3), 124–126. https://doi.org/10.1071/MA23036

Liang, W., Yuksekgonul, M., Mao, Y., Wu, E., & Zou, J. (2023). GPT detectors are biased against non-native english writers. *Patterns, 4*(7), 100779. https://doi.org/10.1016/j.patter.2023.100779

Lodge, J. M., De Barba, P., & Broadbent, J. (2024). Learning with generative artificial intelligence within a network of co-regulation. *Journal of University Teaching & Learning Practice, 20*(7) https://doi.org/10.53761/1.20.7.02

Meir, E., Pope, D., Abraham, J. K., Kim, K. J., Maruca, S., & Palacio, J. (2024). Designing activities to teach HigherOrder skills: How feedback and constraint affect learning of experimental design. *CBE-Life Sciences Education, 23*(1), 1. https://doi.org/10.1187/cbe.22-08-0158

Moorhouse, B. L., Yeo, M. A., & Wan, Y. (2023). Generative AI tools and assessment: Guidelines of the world's top-ranking universities. *Computers and Education Open, 5*, 100151. https://doi.org/10.1016/j.caeo.2023.100151

Newton, P., & Xiromeriti, M. (2024). ChatGPT performance on multiple choice question examinations in higher education. A pragmatic scoping review. *Assessment and Evaluation in Higher Education, 49*(6), 781–798. https://doi.org/10.1080/02602938.2023.2299059

Ngo, T. T. A. (2023). The perception by university students of the use of ChatGPT in education. *International Journal of Emerging Technologies in Learning, 18*(17), 4–19. https://doi.org/10.3991/ijet.v18i17.39019

Nguyen, A., Kremantzis, M., Essien, A., Petrounias, I., & Hosseini, S. (2024). Enhancing student engagement through artificial intelligence (AI): Understanding the basics, opportunities, and challenges. *Journal of University Teaching & Learning Practice, 21*(6), 1–13. https://doi.org/10.53761/caraaq92

Novak, G. M. (2011). Just-in-time teaching. *New Directions for Teaching and Learning, 2011*(128), 63–73. https://doi.org/10.1002/tl.469

Palmer, E., Lee, D., Arnold, M., Lekkas, D., Plastow, K., Ploeckl, F., Srivastav, A., & Strelan, P. (2023). Findings from a survey looking at attitudes towards AI and its use in teaching, learning and research. *ASCILITE Publications,* https://doi.org/10.14742/apubs.2023.537

Pang, T. Y., Kootsookos, A., & Cheng, C. (2024). Artificial intelligence use in feedback : A qualitative analysis. *Journal of University Teaching & Learning Practice, 21*(6) https://doi.org/10.53761/40wmcj98

Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: ChatGPT and beyond. *Journal of University Teaching & Learning Practice, 20*(2) https://doi.org/10.53761/1.20.02.07

Perkins, M., Furze, L., Roe, J., & MacVaugh, J. (2024). The artificial intelligence assessment scale (AIAS) : A framework for ethical integration of generative AI in educational assessment. *Journal of University Teaching & Learning Practice, 21*(6), 49–66. https://doi.org/10.53761/q3azde36

Petrovska, O., Clift, L., Moller, F., & Pearsall, R. (2024). Incorporating generative AI into software development education. Paper presented at the CEP '24: Proceedings of the 8th Conference on Computing Education Practice 37–40. https://doi.org/10.1145/3633053.3633057

Putra, F. W., Rangka, I. B., Aminah, S., & Aditama, M. H. R. (2023). ChatGPT in the higher education environment: Perspectives from the theory of high order thinking skills. *Journal of Public Health (Oxford, England), 45*(4), e840–e841. https://doi.org/10.1093/pubmed/fdad120

Richardson, M., & Clesham, R. (2021). Rise of the machines? the evolving role of AI technologies in high-stakes assessment. *London Review of Education, 19*(1) https://doi.org/10.14324/LRE.19.1.09

Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning & Teaching, 6*(1) https://doi.org/10.37074/jalt.2023.6.1.9

Smith, D., & Francis, N. (2024). Process not product in the written assessment. *Using generative AI effectively in higher education* (pp. 115–126). Routledge. https://doi.org/10.4324/9781003482918-17

Tenakwah, E. S., Boadu, G., Tenakwah, E. J., Parzakonis, M., Brady, M., Kansiime, P., Said, S., Ayilu, R., Radavoi, C., & Berman, A. (2023). Generative AI and higher education assessments: A competency-based analysis. *Res.Sq,* https://doi.org/10.21203/rs.3.rs-2968456/v2

Vo, T. K. A., & Nguyen, H. (2024). Generative artificial intelligence and ChatGPT in language learning: EFL students' perceptions of technology acceptance. *Journal of University Teaching & Learning Practice, 21*(6), 199–218. https://doi.org/10.53761/fr1rkj58

Welch, R. (2010). How just in time learning should become the norm. Paper presented at Atlanta: American Society for Engineering Education-ASEE. 15–649. https://www.proquest.com/docview/2318124897

Wu, T., & Yu, Z. (2024). Bibliometric and systematic analysis of artificial intelligence chatbots' use for language education. *Journal of University Teaching & Learning Practice, 21*(6), 174–198. https://doi.org/10.53761/6jmnst54

Zadorozhnyy, A., & Lai, W. Y. W. (2024). ChatGPT and L2 written communication: A game-changer or just another tool? *Languages (Basel), 9*(1), 5. https://doi.org/10.3390/languages9010005

Zhou, X., & Schofield, L. (2024). Using social learning theories to explore the role of generative artificial intelligence (AI) in collaborative learning. *Journal of Learning Development in Higher Education,* (30) https://doi.org/10.47408/jldhe.vi30.1031

Zhou, X., Zhang, J., & Chan, C. (2024). Unveiling students' experiences and perceptions of artificial intelligence usage in higher education. *Journal of University Teaching & Learning Practice, 21*(6), 126–145. https://doi.org/10.53761/xzjprb23

Appendix 1.

Prompt examples appropriate to the topic are used to support the development of GenAI competencies and appropriate use.

> **Prompt:** Break down [topic you'd like to understand] into smaller, easier-to-understand parts. Use analogies and real-life examples to simplify and make the concept more relatable.
>
> **Prompt:** How would you verify the information in this conversation?
>
> *Example prompt used to help understand more complex topics.

GenAI prompts were also presented to facilitate the reflection process by analysing learner inputs and providing automated yet personalised feedback.

> **Prompt:** As an MSc student enrolled on a Bioscience or Chemistry course in the UK, you require an action plan and tips to complete your next assignment. You have received feedback on your lab bookkeeping assessment which includes some example areas that need improvement. Please review the feedback and provide suggestions for enhancing the laboratory report assessment.
>
> *Example prompt used to gain feedforward advice following the initial assessment.

Real-time Adaptation of Learning Paths was also presented, enabling real-time adaptation based on ongoing learner performance. GenAI prompts tools were presented that modify the learning path instantaneously, offering more challenges or support as needed.

> **Prompt:** You are an [MSc Pharmaceutical Bioscience Student]. You are about to prepare a two-page CV to include with your application for a [PhD position]. Set out structure and ideas for content for an impactful CV."
>
> **Prompt:** In this conversation, you will take on the role of an interviewer. You are looking to hire an intern for one year. The pharmaceutical company is looking for a bench scientist. Ask questions that would be suitable for this role. You will ask the question, and I will then give you my answer. You will then give feedback.

GenAI prompts were also presented to help learners who struggled with a specific concept, particularly understanding research articles or choosing the correct statistical method for a given situation. Prompts were provided to generate additional examples, exercises, or explanations to reinforce understanding.

> **Prompt:** Your role in this conversation is to act as a guide helping a researcher to choose which statistical test to use when analysing their data. Your conversation will be based on working through a statistical decision tree. You will ask the researcher questions to guide them to the most appropriate statistical test. In your responses, give an explanation of the terms used below the main text. Use examples to help them understand. Your first question will be about the number of groups used in the study and ask for some background information. Are you ready?