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Threading the GenAI needle: Unpacking the ups and downs of GenAI for higher education stakeholders

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Keywords

AI;
artificial intelligence;
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generative artificial intelligence;
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personalised learning.

Abstract

The incorporation of Generative Artificial Intelligence (GenAI) in higher education has transformed learning and teaching. When GenAI (e.g. ChatGPT) was released, it almost immediately began to feature heavily in learning and teaching practice. Many research studies are currently being undertaken to evaluate the potential perceived benefits and challenges of GenAI, especially in higher education. This paper leverages these studies to conduct an in-depth exploration of GenAI through a systematic literature survey to identify the common GenAI approaches implemented in the higher education (HE) sector, gather the perception of GenAI among stakeholders of higher education, and review cases of GenAI use in learning and teaching. The survey findings revealed that integrating GenAI into educational pedagogy enriches personalised and adaptive learning experiences facilitated by ChatGPT and virtual learning assistants. Furthermore, it is noted that the stakeholders have mixed perspectives on GenAI: education administrators are more concerned about the potential consequences of GenAI, such as excessive dependence and declining student proficiency, while teachers and students foresee opportunities for enhanced teaching and learning through GenAI.

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Introduction

The evolution of Information and Communication Technology (ICT) enables significant changes in our education, especially in learning and teaching processes (Maatuk et al., 2022). Most importantly, after the COVID-19 virus outbreak in 2020, institutions' and students' adoption of education technologies has skyrocketed (Qazi et al., 2024). The constant improvement and innovation in teaching and learning have been witnessed in the recent past as disruptive technologies such as Generative AI (e.g. ChatGPT) swiftly emerged (Rasul et al., 2023). Furthermore, higher education institutions are continually enhancing the learning experience for students by adopting various modes of learning, such as virtual learning, online learning, distance learning, and e-learning. These methods are supported by widely used learning management systems (LMS) like Moodle, Canvas and Blackboard, which are essential platforms for facilitating online education and teaching activities (Chugh et al., 2023). Moreover, the integration of advanced AI tools has revolutionised the educational landscape.

For example, a web-based chatbot introduced by OpenAI, widely known as ChatGPT, engages students in colloquial conversations, effectively responding to user-generated prompts, which have significantly influenced teaching and learning practices within the academic domain (Mhlanga, 2023). The headline "AI will revolutionise education worldwide", and many research reports claim that AI will transfer higher education by offering personalised teaching, collaborative learning, lifelong connections, interactive learning, and 24/7 support for instructors and students (Villarreal et al., 2023). It tailors learning activities to individual needs, provides feedback based on student strengths and weaknesses, and facilitates collaborative skill development in some difficult subjects such as language and mathematics. Generative AI, a subset of AI, further enriches teaching and learning by providing continuous support in various activities like automated essay grading and language translation. Tools such as ChatGPT contribute to improved student learning experiences, increased productivity, efficiency, and adaptive learning environments (Dhawan & Batra, 2020).

Given the exciting opportunities leveraged by generative AI (GenAI) in higher education learning and teaching, it is paramount that the implications of such tools in teaching and learning from various perspectives need to be analysed. In this paper, we aim to explore the common GenAI approaches implemented in higher education and their perception by stakeholders. We extensively examine diverse GenAI methodologies employed in higher education pedagogy and their effective integration of GenAI into teaching and learning. In addition, a comprehensive exploration of the practical use case of GenAI in teaching and learning contexts is provided, elucidating the potential challenge and future opportunities associated with integrating GenAI within an educational setting.

Continuing further, the section "Literature review" presents the existing work on GenAI and higher education. It further develops the research questions for this survey. Next, the research methodology employed for conducting this

survey is presented in the section "Methodology". Then, the results of the survey are reported in the section "Results". This is followed by the findings of the survey discussed in the "Discussion" section. Finally, the section "Conclusion" concludes the paper with limitations and future works.

Literature review

The use of technology in teaching and learning has been investigated for a long time. Higher education stakeholders have been constantly looking for innovative technologies that could enhance the learning experience for students. For example, virtual learning (Treve, 2021), online learning (Osobajo & Oke, 2022), distance learning, and e-learning (Mahfoodh & AlAtawi, 2020) are a few digital learning strategies that have been explored in the literature. For this, learning management systems (LMS) are the most popular backbone of educational institutions. Recently, the integration of AI into such learning platforms has been increasing and is truly revolutionising the learning paradigm (Jaboob et al., 2024). In particular, a GenAI-based chatbot, ChatGPT, has been used heavily in teaching and learning. It has brought several opportunities for enhanced learning, such as personalised learning, collaborative learning, and adaptive learning (Dhawan & Batra, 2020).

GenAI in higher education might enable students to receive personalised instruction and distinct assignments crafted to support their success and accomplish specific learning objectives, which ultimately boosts adaptive learning practice (Salinas-Navarro et al., 2024). Further, customisation and integration of GenAI in the learning management system will benefit in various ways. It enables individuals to progress through the learning material at a speed that suits their preferences and capabilities, thereby providing an inherent framework for the learning process. It empowers instructors to offer tailored assistance and support based on individual needs and enhances the involvement and participation of learners in the educational process (Michel-Villarreal et al., 2023). Finally, it has been claimed to enhance the student learning experience and increase productivity, efficiency, and adaptive learning (Elbanna & Armstrong, 2024).

Over the last few years, the literature review has explored the potential penetration of generative AI for effective and accessible personalised learning (Grájeda et al., 2024), collaborative learning (Tan et al., 2023), and the assessment of potential effects on academic integrity, critical thinking, and cognitive skills of learners (Chaudhry et al., 2023). However, it is essential to provide a timely review from the perspective of stakeholders' perception of integrating GenAI in higher education and its potential use case in teaching and learning. To fill the gap, this research is focused on seeking the answer to the following research questions.

- RQ1. What are the common GenAI approaches implemented in education and pedagogy?
- RQ2. How do education stakeholders perceive the implementation of Generative AI?

The RQ1 helps identify the most appropriate GenAI approach in higher education teaching and learning. RQ2 helps to know the stakeholders' perceptions of the application of GenAI in teaching and learning. Since the use of GenAI has recently boomed in academia, it has been used for various teaching-learning activities such as brainstorming for content creation, in-class activities support and evaluations. Therefore, RQ2 is supplemented with the pros and cons of using GenAI in these activities, which will help the stakeholders move forward.

Methodology

GenAI has sparked considerable debate in higher education ever since the public accessibility of ChatGPT in November 2020. Furthermore, the COVID-19 pandemic has left us with the habit of online learning, teaching, and working from home (WFH) culture. Education researchers and leaders have kept an eye on this development regularly and keenly. Researchers have taken it as an opportunity to evolve technology-enhanced teaching and learning and published their work for the digestibility of the scientific community (Akiba & Fraboni, 2023; Grájeda et al., 2024, Habibi et al., 2023; Nikolic et al., 2023; Rudolph et al., 2023b, 2023c). Hence, a systematic literature review would be a milestone in synthesising these discussions and publishing works on GenAI through the lens of higher education. To accomplish this, there have been some guidelines and protocols published in the literature (Ismail et al., 2023, 2024; Stracke et al., 2023). These protocols are fundamentally based on the widely used and trusted systematic review approach guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Page et al., 2021).

Like the review protocol proposed by Ismail et al. (2023), which is mainly targeted for analysing GenAI-related studies in higher education, we follow a similar approach to find the pertinent literature for this survey, as shown in Figure 1. Subsequently, we conducted the narrative analysis and synthesised the existing literature using narrative review approaches (Jahan et al., 2016). As a result, the research methodology utilised in this study integrates both systematic and narrative review approaches that can be framed as a hybrid narrative systematic review, providing an elucidative and nuanced examination of the related works.

To collate the research articles for a survey, we used the research questions to keep the search strategy focused and employed the inclusion and exclusion criteria to screen the literature thoroughly. Figure 1 illustrates the systematic approach used and the number of papers identified and synthesised at each step.

It is fundamental to have an effective strategy for searching and selecting the relevant literature for the review. Given the objective of presenting a comprehensive narrative review of the topic, we initially identified the key terms as "Generative AI" and "Higher education". For instance, as a preliminary step, the term "Generative AI" resulted in a list of 914,000 documents on Google Scholar. With such large numbers of search results, it was of utmost importance to narrow down the search string. It is challenging to find relevant studies

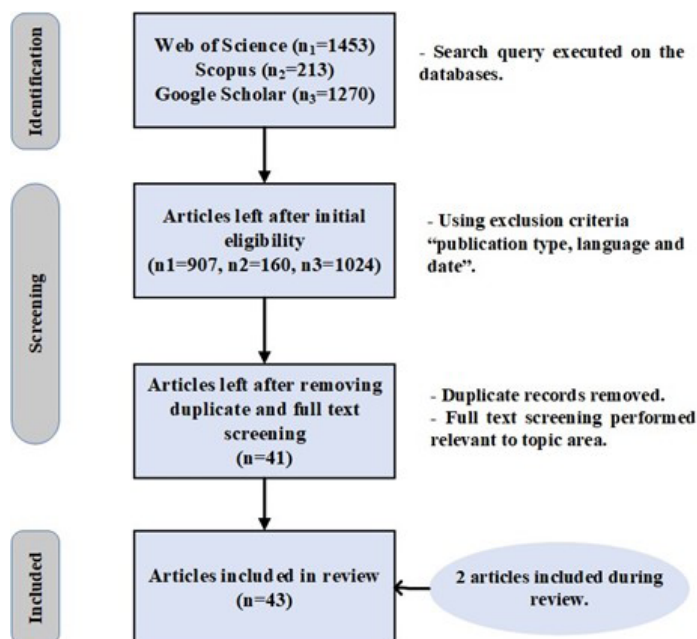


Figure 1: The systematic approach for article searches and selection (Page et al., 2021).

using such hit-and-trial methods. We thank Ismail et al. (2023) for identifying the key concept and search string that can be used to build the search string for this purpose. As demonstrated in their protocol paper, the key concepts such as "Artificial intelligence", "Higher education", and "pedagogical approach" are directly relevant to our review theme and perfectly matched with our research questions. Hence, following their guidelines, we formulated the search string using the keywords and logical operators as follows:

("generative AI" OR "chatGPT") AND ("higher education") AND ("education pedagogy").

The execution of the search string on Web of Science, Scopus and Google Scholar resulted in 1453, 213, and 1270 articles, respectively, while keeping the search within the title, abstract and keywords in each database (except Google Scholar, which does not allow such restriction). This will keep the search more focused, as Ismail et al. (2023) and Stracke et al. (2023) suggested. These results were further evaluated using the inclusion and exclusion criteria as listed in Table 1. After an initial screening of these documents using criteria such as language and peer-reviewed, we left with 160, 907, and 1024 articles from Scopus, Web of Science, and Google Scholar databases, respectively. Subsequently, we removed the duplicate records among these three databases and conducted thorough screening with title, abstract and full text, which resulted in a total of 43 articles for inclusion in the final review.

Table 1: Inclusion and exclusion criteria.

Criterion	Inclusion	Exclusion
Topics/areas	The studies focus on Gen AI tools in HE for teaching and learning.	The studies on GenAI do not focus on HE for teaching and learning.
Publication types	Peer-reviewed journal and conference papers	Book chapters, editorials, dissertations and grey literature
Language	English	Articles published in other than English language

Results from the literature review will be used to address the research questions for this study. RQ1 and RQ2 will be addressed directly based on the results, whereas the overall conclusion will be synthesised from the RQ1 and RQ2 data.

Results

In this section, we synthesise the survey results into two key themes. First, we provide an in-depth report on the existing work on AI and education pedagogy, aligning with RQ1. Second, we discuss stockholders' perceptions of GenAI and the pros and cons of GenAI in teaching and learning, aligning with RQ2.

AI and higher education pedagogy

Since its inception, GenAI has emerged as a promising tool for teaching and learning in higher education (Bozkurt et al., 2023). GenAI has been used for various learning activities, such as educational content generation, creating customised lesson plans and resources, evaluating students' performance, and providing feedback.

AI-generated tools and technologies offer various opportunities for personalised learning experiences by adopting content, resources, and assessments to meet individual student's needs and preferences, answering the research question "What are the common GenAI approaches implemented in education and pedagogy?". The summary of existing works on AI tools and applications that have been used in education pedagogy is reported in Table 2.

Looking at Table 2, it is evident that ChatGPT is the leading GenAI tool for teaching and learning. It helps students with real-time support and offers personalised feedback, recommendations, and resources tailored to individual student needs and personal preferences (Xu et al., 2024). Some other AI tools have also been used for personalised learning, such as adaptive learning platforms, intelligence tutoring systems (ITMS), learning analytics, virtual learning assistants, content personalisation, etc. (Hsu & Ching, 2023). However, ChatGPT is the most widely explored AI tool in the literature for various applications such as academic advising (Akiba & Fraboni, 2023), student behaviour and cognitive achievement (Jaboob et al., 2024), assessment integrity (Shanto et al., 2023), and collaborative learning (Tan et al., 2023).

Furthermore, GenAI can play a major role in collaborative learning, where multiple learners work together to achieve a shared goal. Here, learners share ideas, interact with each other, and come up with a robust solution to the assigned task. In this context, GenAI can be used by co-learners to brainstorm ideas and share them with others in a shared space (Tan et al., 2023). This will improve and enhance the interaction between learners, as humans can focus more on critical and creative thinking. Overall, features of AI tools demonstrated more effective and personalised learning for both students and teachers. Table 2 summarises the existing GenAI tools and applications used to enhance personalised learning in education pedagogy.

Table 2: Summary of existing AI tools and applications. Note "ChatGPT" represents both ChatGPT 3.5 and ChatGPT 4.

AI tools	Feature and highlights	Limitations and gaps	Reference
ChatGPT	OpenAI (ChatGPT) in the educational environment	- Limited to developing nations - Assesses the individual records, including newspapers, blogs, journals, and books	(Mhlanga, 2023)
ChatGPT	Impact of AI tools for students and educators: more effective and personalised learning in higher education	- Limit research on a single institution - Using AI in various dimensions of learning and teaching - Using Confirmatory Factor analysis	(Grájeda et al., 2024)
ChatGPT	AI-powered tools (ChatGPT) for academic advising more accessible, efficient or effective	Asked advising-related questions about current and respective student	(Akiba & Fraboni, 2023)
ChatGPT	Potential use and benefits of GenAI, such as personalised learning experience	Real-time access to the internet and search engines, Accuracy and up-to-date technology, data privacy issues	(Hsu & Ching, 2023)
GenAI	Integration of GenAI techniques and applications in student behaviour and cognitive achievement in Arab higher education	Ethical consideration, privacy concerns to related data collection and algorithms biases	(Jaboob et al., 2024)
AI tools	Feature and highlights	Limitations and gaps	Reference
ChatGPT	Mitigate the side effects of personal learning environments	- Interview only six professors and the ICT experts. - Semi-structured interview format with some biases and incurrences on their perceptions.	(Xu et al., 2024)
GAI /LLMs	GAI based on LLMs for collaborative learning – identify four aspects: AI readiness cognitive, knowledge, skills, vision and ethics	- Study based on the existing literature to identify the potential of GAI (LLMS). - Study needs more through rapid and continuous ideation, verification and refinement.	(Tan et al., 2023)
ChatGPT	Analysis of ChatGPT tool to investigate assessment integrity in engineering education	- Study focused on most of the undergraduate-level engineering subjects. - Ethical implication of integrating ChatGPT into a classroom.	(Nikolic et al., 2023)
GAI (ChatGPT)	Investigate PAIGE (Promoting Assignment Integrity using Generative AI in Education) for promoting assignment integrity in higher education. Two objectives prevent AI misuse, promote academic integrity, and explore innovative assignment criteria.	Resource constraints, ethical complexities, and user proficiency challenges.	(Shanto et al., 2023)

Stakeholders' perception of GenAI

Based on the literature survey, Table 3 on the stakeholder's perception of integrating AI technology in education teaching has positive implications for teachers, students, and educators (Chounta et al., 2022; Habibi et al., 2023), answering the research question, "How do education stakeholders perceive the implementation of Generative AI?"

In summary, teachers/educators appreciate the potential for AI to automate their routine tasks, easily prepare the content for teaching, and support administrative tasks (Zhang et al., 2023). Some educators are concerned about ethical implications and the need to balance AI technology and human interaction in the educational setting in the institutions (So et al., 2023), while teachers embrace GenAI (or ChatGPT) as a valuable tool for personalised learning, task automation and innovative teaching and learning.

On the other hand, students also have a similar perception of AI tools for personalised learning experiences and enhanced educational resources. All the stakeholders confirmed that integrating AI tools in higher education sparks a dynamic dialogue between stakeholders navigating the opportunities and effective incorporation of technology in the 21st-century AI era (Rudolph et al., 2023b). Table 3 summarises the existing work on the stakeholder perception of GenAI in Higher Education.

Table 3: Summary of stakeholder perceptions of GenAI.

Stakeholders	Perception of GenAI with stakeholders	References
Students	ChatGPT use in learning in higher education in Indonesian institutions	(Habibi et al., 2023)
Public, Students, and Educators	Public perception of the GenAI integration implementation was found to be positive and negative natural sentiments.	(So et al., 2023)
Students	The study focuses on five dimensions of the impact of GenAI in teaching and learning and found a significant and positive impact on student academic experience.	(Grájeda et al., 2024)
Students	AI applications can potentially revolutionise student learning, teacher teaching, and institution operation.	(Jaboob et al., 2024)
Student	AI tools like ChatGPT were found to be more effective and empowering students seeking academic advice.	(Akiba & Fraboni, 2023)
Teachers/Educators	Teachers frequently used GenAI, and the study found it to be a positive and helpful tool for their professional development.	(Kaplan-Rakowski et al., 2023)
Student and Teachers	Regarding the implications of AI integration in university teaching and learning, the study proposed an AI ecological education policy framework to address the implications of AI integration.	(Chan, 2023)
Teachers	AI tools support teachers in accessing, adapting and using multilingual content, supporting their administrative tasks, and adapting learning materials.	(Chounta et al., 2022)
Teachers	AI uses in education have been positively perceived as usefulness and ease of use, increasing the intention to use the technology.	(Zhang et al., 2023)
Students, Teachers and Educators	The use of AI tools like ChatGPT in academics has both positive and negative consequences, and hence, the stakeholders should establish clear user guidelines and policies.	(Hasanein & Sobaih, 2023)
Teacher and Students	Perceptions of PhD students and scholars on the use of ChatGPT and its implications were investigated.	(Firat, 2023)

Discussion

The use of AI and machine learning (ML) enhances the quality of pedagogical services in educational settings, as evident from the research report by Okagbue et al. (2023) with the systematic review of published work between 2000 and 2021. In educational pedagogy, personalised learning has attracted various researchers recently and has become one of the main applications of AI tools in education (Owan et al., 2023). Here, AI technology revolutionised individual learning experiences, creating students' individual basic needs, increasing student engagement, and improving overall learning outcomes (Pratama et al., 2023).

Furthermore, adaptive learning, also known as adaptive teaching, entails providing tailored learning experiences to cater to every individual's distinct educational or training requirements (Muñoz et al., 2022). Rather than employing a uniform approach, adaptive learning incorporates timely feedback, diverse learning paths, and specialised resources. ChatGPT can serve as a virtual tutor and provide personalised assistance to the students by fulfilling their learning needs, explaining their queries and offering guidance on specific topics (Limo et al., 2023; Javaid et al., 2023). While the idea of adaptive learning is not entirely novel, recent technological advancements, particularly in AI, such as GenAI, have contributed to its increased prevalence and sophistication.

Adaptive learning technology adopts a data-driven strategy, gathering information from individual learners and employing that data to modify eLearning content according to the learners' specific needs.

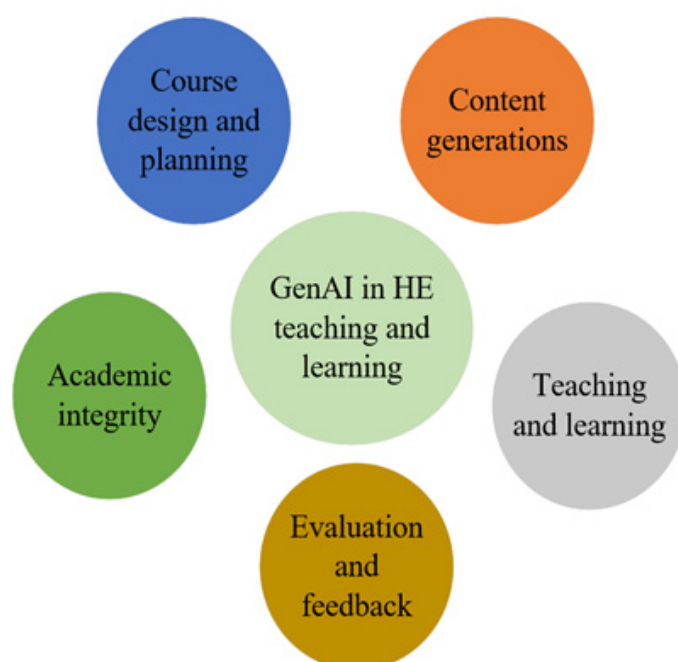


Figure 2: The various applications of GenAI in HE-learning and teaching. Note "HE" represents "Higher education".

In teaching and learning activities, the GenAI tools (e.g. ChatGPT 3.5 and 4) can be utilised as a supportive tool for various activities (Figure 2), such as brainstorming ideas for course design, content generation, lesson plans and evaluations (Liu et al., 2023). For example, while creating teaching resources, teachers may utilise AI tools for summarising a large volume of text and can make a concise presentation. Overall, GenAI tools like ChatGPT can work as personal assistants to educators by providing 24/7 support in their routine tasks (Rudolph et al., 2023a). However, maintaining academic integrity and avoiding the overreliance of students on such tools has become a challenging issue for educators and administrators (Rudolph et al., 2023c).

The perception of GenAI among stakeholders is a dynamic interplay of positiveness, scepticism, and curiosity (Figure 3). In higher education, academic administrators or education leaders play a critical role in shaping the strategic plan, implementing policy and procedures, and overseeing the successful integration of GenAI into various aspects of the educational environment in universities or institutions (Grájeda et al., 2024). Hasanein and Sobaih (2023) highlighted that education leaders have some concerns and negative consequences of using ChatGPT for academic purposes in education sectors, such as overreliance, loss of academic support, lack of quality and accuracy, potential bias, and deteriorated student skill sets.

However, from the student's point of view, positive perceptions were found, including time-saving, reduced anxiety, improved language skills, self-confidence, punctual submission, non-academic support, positive

experience, and synthesised content (Hasanein & Sobaih, 2023; Grájeda et al., 2024). According to Jaboob et al. (2024), research demonstrated that integrating emerging technology such as GenAI impacts students' behaviour and cognitive achievement with a highly satisfactory level of impact. In another study conducted in Poland and Egypt, results revealed that the effective integration of ChatGPT and formulating strategies in higher education should be promoted (Strzelecki & ElArabawy, 2024). Research conducted in Latin America about students' perceived impact of AI tools proves and advocates that the integration of GenAI has the potential to impact the academic experience for both students and educators (Grájeda et al., 2024).

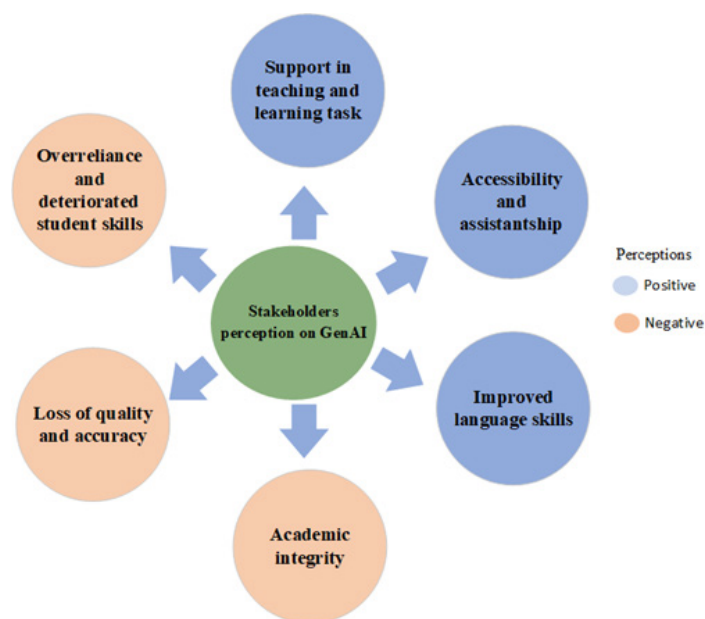


Figure 3: Examples of stakeholders' positive and negative perceptions of GenAI.

Recent literature shows that teacher perception of the integration of GenAI in HE has a more positive impact on teacher professional development and is a valuable tool for enhancing their learning experience, personalised education, providing tailored content and fulfilling the student needs (Kaplan-Rakowski et al., 2023). Research carried out on the perception of teachers' views on AI tools in Estonia and teachers have some limitations and little knowledge of AI, but research confirmed that AI tools integration supports learning and positive perception for further use in a classroom (Chounta et al., 2022).

Summary of findings

With two research questions (RQ1 and RQ2) formulated at the beginning of this survey, we summarise the findings as follows.

- The dominant GenAI approach implemented in education and pedagogy is the ChatGPT. It can be integrated into teaching and learning frameworks to enhance the students' learning experience, as suggested by Ilieva et al. (2023). The five-stage integrated framework suggests ChatGPT in course

offering activities such as diverse course planning options, lesson planning and preparations, lecture delivery, and evaluation.

- Overall, stakeholders recognise the benefits of AI tools, such as ChatGPT, in education for effective and accessible learning and educational task automation. However, the utmost care should be taken while using GenAI in an educational setting, including ethical issues and challenges such as academic integrity, privacy concerns, and fostering meaningful human-AI interactions. The use case of GenAI in HE is diverse and has not yet been fully explored. GenAI will bring unprecedented challenges and use cases in the future.

Conclusions

In this study, we conducted a systematic narrative survey of existing literature on GenAI by synthesising them into two perspectives: a) approaches of GenAI on educational pedagogy and b) perspectives of stakeholders on GenAI and its use cases in HE.

With the integration of GenAI and other ML technologies, students can be offered personalised and adaptive learning experiences. Several AI tools, such as ChatGPT, intelligent tutoring systems (ITS), virtual learning assistants, and content personalisation are widely used in educational settings that ultimately support adaptive learning. The customised learning experience maximises the learners' engagement and comprehension while addressing their learning needs effectively. So, if utilised properly, the GenAI tools can help make learning more adaptable and accessible, thereby improving the overall educational pedagogy.

While observing the stakeholders' perspective on GenAI, a mixture of positive and negative impacts was reported. The administrators of higher education institutions are more concerned about the adverse effects of outcomes associated with the utilisation of ChatGPT for educational purposes in academic settings, such as excessive dependence, diminished academic support, reduced quality and precision, and, more importantly, declining proficiency levels of students. On the other hand, the teachers see it as an opportunity to utilise it for enhanced learning by customising instruction, delivering content tailored to individual preferences, and meeting student requirements. Similarly, students share comparable insights on the utilisation of GenAI for personalised learning and enriched educational materials.

In conclusion, GenAI holds immense potential to revolutionise higher education learning and teaching by offering personalised and adaptive learning approaches. All stakeholders, such as students, teachers and educators, recognise its benefits in enhanced learning, content creation, and enriched experiences. However, careful consideration of some challenging issues, such as the excessive dependency of students on GenAI, as well as maintaining academic integrity and ethical implications, is necessary to ensure its successful implementation in higher education. With further research and collaboration between educators, technologists, and policymakers, generative AI can contribute significantly to

advancing learning and teaching in higher education sectors. This study acknowledges some limitations. First, it relies on the secondary data retrieved from the three databases (Scopus, Google Scholar and Web of Science), which may have introduced the database selection bias and missed the full landscape of relevant literature. Second, the field of GenAI is evolving rapidly, and new versions with different modes of accessibility (free and subscription) are popping up. Future research may consider including more research databases and these different GenAI tools for a more comprehensive assessment.

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