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Generative Artificial Intelligence (AI) in higher education: a comprehensive review of challenges, opportunities, and implications

Michal Bobula
University of the West of England, UK

Abstract

This paper explores recent advancements and implications of artificial intelligence (AI) technology, with a specific focus on Large Language Models (LLMs) like ChatGPT 3.5, within the realm of higher education. Through a comprehensive review of the academic literature, this paper highlights the unprecedented growth of these models and their wide-reaching impact across various sectors. The discussion sheds light on the complex issues and potential benefits presented by LLMs, providing a comprehensive overview of the field's current state.

In the context of higher education, the paper explores the challenges and opportunities posed by LLMs. These include issues related to educational assessment, potential threats to academic integrity, privacy concerns, the propagation of misinformation, Equity, Diversity, and Inclusion (EDI) aspects, copyright concerns and inherent biases within the models. While these challenges are multifaceted and significant, the paper emphasises the availability of strategies to address them effectively and facilitate the successful adoption of LLMs in educational settings.

Furthermore, the paper recognises the potential opportunities to transform higher education. It emphasises the need to update assessment policies, develop guidelines for staff and students, scaffold AI skills development, and find ways to leverage technology in the classroom. By proactively pursuing these steps, higher education institutions (HEIs) can harness the full potential of LLMs while managing their adoption responsibly.
In conclusion, the paper urges HEIs to allocate appropriate resources to handle the adoption of LLMs effectively. This includes ensuring staff AI readiness and taking steps to

modify their study programmes to align with the evolving educational landscape influenced by emerging technologies.

Keywords: ChatGPT; large language models; higher education; policy; AI literacy; EDI; bias; academic integrity; misinformation; privacy; copyright; opportunities.

Introduction

Recent advancements in artificial intelligence (AI) technology, particularly Large Language Models (LLMs), have attracted unprecedented attention with the introduction of ChatGPT 3.5 – the chatbot that became available to the general public in November 2022. The app has become the fastest-growing online application in history, reaching an estimated 100 million monthly active users in just two months after its launch (Reuters, 2023). The record user growth rate is part of a trend where technology adoption accelerates, reaching more users in shorter timeframes. ChatGPT is capable of generating human-like responses using natural language, essentially leading to an expert system that is available on demand. The user communicates with the system by using natural language or prompts, which are then interpreted by the statistical model. This model uses its training data to produce an answer (Haleem et al., 2023). While chatbots are not a new invention, ChatGPT has brought several advancements to generative AI, including improved contextual understanding, language generation, task adaptability, and multilingual proficiency. It can understand the context of a conversation and generate relevant responses, making it more effective at mimicking human-like interactions. Its advanced language generation capabilities allow it to produce coherent, contextually accurate, and grammatically correct text. Furthermore, ChatGPT can be fine-tuned for specific tasks or domains, increasing its versatility across various industries and applications (Ray, 2023). The scientific community acknowledges its capabilities and the potential to significantly impact scientific research and various industries, including IT, education, travel, tourism, transport, hospitality, finance, and marketing. However, various authors point to its limitations, controversies, and future challenges (Stokel-Walker and Van Noorden, 2023; Ray, 2023; Dwivedi et al., 2023).

This paper focuses on the impact of generative AI, such as ChatGPT, on Higher Education Institutions (HEIs), and offers a systematic review of the main themes related to generative AI and its impact on higher education. The aim is to provide academics and academic institutions with guidance on how to navigate through the considerations associated with the technology and inform their practices. The importance of addressing the topic is evident since generative AI has 'taken the world by storm, with notable tension transpiring in the field of education' (Lim et al., 2023). Various authors recognise threats associated with this technology related to plagiarism and academic integrity (Crawford et al., 2023; Eke, 2023; Stokel-Walker, 2022; Amani et al., 2023), bias (Cooper, 2023; Dwivedi et al., 2023; Rich and Gureckis, 2019), inaccuracy and misinformation (Currie, 2023; van Dis et al., 2023), data and privacy concerns (Wang et al., 2023; Tredinnick and Laybats, 2023), copyright (Strowel, 2023), and broader impact on skills and education. Besides mentioning challenges for HEIs, some authors also see opportunities for student learning, feedback, and assessment design (Sullivan et al., 2023; Rasul et al., 2023; Kasneci et al., 2023; Crowford et al., 2023), emphasising the positive role AI can play in education. Others call for education and guidelines and regulations (Rudolph et al., 2023). The Quality Assurance Agency (QAA, 2023) for Higher Education acknowledges the challenges AI tools like ChatGPT pose to academic integrity, while recognising their potential to facilitate deeper learning and enhance educational inclusivity and accessibility. Furthermore, the Department for Education (2023) stresses the ethical use of AI tools in education, emphasising data privacy, preventing malpractice, and using professional judgment to validate AI-generated content. While emerging technologies like generative AI have a role, a rigorous, knowledge-focused curriculum remains vital to prepare students, including teaching proper and safe use of these tools.

Plagiarism, academic integrity, and assessment design

Evaluating generative AI’s performance across academic disciplines

The possibility of using generative AI as a plagiarism tool affecting academic integrity appears to be the main concern. In a study at the University of Minnesota Law School, ChatGPT was tasked with answering actual law school exams: 95 multiple choice and 12 essay questions. Using the school's regular grading method, ChatGPT achieved an

average grade of C+, indicating its capability to address complex legal queries to a certain extend (Choi et al., 2023). Terwiesch (2023) analysed ChatGPT's capability in an MBA Operations Management final exam. ChatGPT displayed competence in operations management and case analysis but struggled with basic calculations and intricate problems, potentially due to difficulty in deeply comprehending and applying concepts. However, it does adjust responses based on human cues.

Rudolph et al. (2023a) found ChatGPT adept at elucidating concepts like quantum computing with real-world instances. However, it has drawbacks: a word cap, inability to craft visuals, and sporadic network glitches. While it can generate a 500-word essay, the content often lacks depth and proper citations. Nikolic et al. (2023) further benchmarked ChatGPT in varied engineering tests, revealing mixed performance across assessment types. ChatGPT outperformed most students on a common economics course test in the USA. Compared to student results, ChatGPT scored in the 91st percentile in Microeconomics and the 99th in Macroeconomics. This exam is a standard multiple-choice comprehension test of economics with textbook answers, so ChatGPT's results should not be unexpected (Geerling et al., 2023). Finally, Gilson et al. (2023) evaluate the performance of ChatGPT on questions within the scope of the United States Medical Licensing Examination and demonstrate that the model attains a score comparable to that of a third-year medical student. Moreover, the authors underscore the capability of ChatGPT to offer logical coherence and contextual information in the majority of its responses.

It is vital to recognise that these tests were from early 2023. Since then, ChatGPT has undergone enhancements, boasting increased computational power, internet browsing, plug-in access, and a new model featuring advanced reasoning and creativity (Open AI, 2023a). Choi et al. (2023) address optimising ChatGPT through prompt engineering, emphasising tone, word limits, citation clarity, and essay structure. Succinct directives and grasping the model's context significantly boost its efficacy. Moreover, throughout 2023, various closed-source and open-source models were released, with ChatGPT 4.0 being the top performer, while the performance of various other models matched or even surpassed that of ChatGPT 3.5 according to certain benchmarks. The availability of these models, many of which are free to use (though the free variants come with limitations), further complicates the landscape of AI content generation (Chen et al., 2023).

Threat to academic integrity

ChatGPT is known for its human-like writing, with studies showing even expert scientists can struggle to distinguish between its AI-generated abstracts and those by humans (Else, 2023). Trained on extensive data, it is competent across disciplines. While ChatGPT can undeniably be used for academic cheating, at the point of writing, there is limited actual evidence of a mass-scale cheating taking place. A survey in January 2023 with over a thousand university students revealed that more than one-third were using ChatGPT for their assessments. Among these, 75% believed it was cheating but still used it (Intelligent, 2023). Increasing reliance on this tool amplifies concerns about academic honesty and plagiarism risk (Stokel-Walker, 2022). Tlili et al. (2023) found an overwhelmingly positive Twitter sentiment about ChatGPT's educational use. Haensch et al. (2023) analysed the top 100 English TikTok videos related to ChatGPT, totalling 250 million views. Prominent topics were essay writing, coding, and evasion techniques. Given TikTok's 3.7 million active UK users, with 26% aged 18-24 (Bendix, 2023), the potential for covert cheating is significant. Moreover, both Tlili et al. (2023) and Haensch et al. (2023) emphasise very little discourse related to negative aspects of using generative AI in education, meaning that systems such as ChatGPT may be used without much reflection and evaluation. Traditional plagiarism-detection tools are rendered ineffective in this context, as AI is becoming increasingly proficient at imitating human-like text and AI-generated text is deemed original and thus undetectable (Dwivedi et al., 2023.), leading to a performance that is only marginally better than a random classifier (Sadasivan et al., 2023) Moreover, the existing AI detection tools are prone to false positives and false negatives due to variable human writing styles (Dalalah and Dalalah, 2023). Even if some potentially feasible solutions such as credible AI detection tools and watermarking of AI-generated output, students may also opt to edit the AI-generated outputs or use other tools to make the results less identifiable as machine-generated (Lancaster, 2023). Finally, there are reports of bias against non-native English writers due to the design of the detection tool which looks for low perplexity writing as a marker for AI-generated text, and it penalises non-native speakers with limited linguistic impressions (Liang et al., 2023). The same study finds that the detection tool is also bypassed by changing prompting strategy.

Rethinking assessment design

The literature identifies multiple solutions to the above problem. Gonsalves (2023) suggests that educators using multiple choice test for assessment may consider outsmarting the system by taking advantage of the current limitations of generative AI platforms, such as their inability to interpret visual media or understand up-to-date information beyond its training data. For instance, multiple choice questions could incorporate visual elements, such as images, figures, or charts, and require students to interact with these elements. They can also use a series of related questions that demand correct answers before progressing, known as conditional logic branching questions. Additionally, questions that require students to apply concepts to current events or recent case studies can challenge the AI's ability to provide accurate responses. Moreover, making all answer options plausible and relevant can necessitate a deeper understanding of the subject matter to identify the correct answer. However, designing such tests may be more time consuming, difficult to do in certain subjects, and as technology improves, attempts to out-design chatbots might prove fruitless in the long term (Mills, 2023). For instance, while ChatGPT 3.5 does not have internet access, OpenAI allows its newer model GPT 4.0 internet access through the Bing search engine or third-party plug-ins (Wiggers, 2023). Educators could also reconsider the types of questions they ask students, placing emphasis on those that demand analysis rather than mere recollection of rules and definitions (Choi et al., 2023). Other authors echo this sentiment and recommend avoiding assignments and exams that are overly formulaic, to the point where it becomes indistinguishable if they were completed by a computer. Instead, the focus should be on crafting assessments that encourage the development of students' creative and critical thinking skills (Rudolph et al., 2023a, Stokel-Walner, 2022). Another option is to execute certain assessments during class (Rudolph et al., 2023a), create innovative and varying assessment formats (Gimpel et al., 2023; Cooper, 2023; Nikolic et al., 2023), enable students to freely express their genuine interests through writing, ensuring their voices are heard and their opinions hold significance (McMurtrie, 2022), and create authentic assessments that are meaningful, intrinsically motivating students to use their knowledge and skills in a way that mirrors real-world contexts (Rudolph et al., 2023b; QAA, 2023; Sullivan et al., 2023). Finally, introducing assessment methods where students are assessed based on their approach, process, draft submissions, reflections, and interaction with the content, rather than solely on the end result (Smith and Francis, 2023). Overall, the emergence of generative AI technology and its associated threat to

academic integrity present an opportunity for educators to revisit and update their assessment strategies, making the process more relevant and engaging.

Available solutions

In order to respond, HEIs need to create clear policies for the deployment of AI which is a vital step towards cultivating a learning environment where this technology is adopted responsibly and with transparency (Gimpel et al., 2023). Secondly, there is the need to review and update misconduct policies to clarify what uses of AI may be counted as plagiarism and what are best practices to ensure academic integrity is upheld (Lim et al., 2023; Ventayen, 2023). Students may be required to report the aids used during a course, for example, listing the tools, the fields of application of these tools, and recording, for example, the prompts when using AI tools such as ChatGPT. Exceptions can be made to the rules outlined, which will be communicated to the students in advance (Gimpel et al., 2023). However, this approach, while logical, may be challenging to implement as it would require additional resources to assess students' submissions. Moreover, there would be the need for collaboration and oversight to ensure that educators allow their students to use AI tools in a coherent way to avoid situations where using AI for a specific purpose is allowed and encouraged in one module but prohibited in another.

Further, HEIs need to ensure that the students are familiar with the policies related to academic integrity and comprehend the potential repercussions of engaging in academic misconduct (Atlas, 2023). Greater effort must be placed on future proofing subjects and degrees (Crawford et al., 2023) and educators should review and adapt their current assessment practices (Nikolic et al., 2023, Sansom, 2023; Vantayen, 2023; Currie, 2023; Amani et al., 2023). However, little is known about teachers' knowledge and skills to integrate AI-based tools (Celik, 2023). Thus, it is also pivotal to support academic staff and ensure their AI readiness (Wang et al., 2023) and accept the need to adapt to technological changes and get autonomy to do so in the way that fits their respective modules and fields (Lim et al., 2023). They need to have sufficient resources and training to implement the changes (Rudolph et al., 2023). Overall, great challenges lie ahead for HEIs which need to realise the importance of adapting to the world with universally available AI by ensuring leadership and availability of sufficient and appropriate resourcing.

As discussed in this paper, numerous issues arise when using AI in education. Therefore, it becomes crucial for teachers to initially focus on understanding what AI can offer them and how they can adapt to an education system enhanced by AI (Hrastinski et al., 2019). Finally, from the practical perspective, it is important to be transparent and collaborative and ensure a consistent approach in utilising AI.

Copyright concerns

One of the main concerns related to ChatGPT and other LLMs is the risk of violating intellectual property rights. As ChatGPT is trained using a large amount of text data, such as books, articles, and other written materials, some of the training data may be copyrighted (Karim, 2023). In the realm of AI development, the prevailing belief is that the larger the training data set, the better the results. OpenAI's GPT-2 model was trained using a data set that comprised 40 gigabytes of text. GPT-3, the model upon which ChatGPT is built, utilised a significantly larger data set of 570 GB. The size of the data set used for OpenAI's most recent model, GPT-4, has not been disclosed (Heikkilä, 2023). Therefore, using generative AI leads to substantial risks of accidental plagiarism and copyright infringements (Gimpel et al., 2023).

For instance, it has been reported that two authors have filed a lawsuit against OpenAI, alleging that their copyrighted books were used to train the AI model, ChatGPT, without their permission. The authors claim that the AI was able to generate very accurate summaries of their novels, which they believe indicates their works were unlawfully ingested and used in the training process, and that OpenAI has unfairly profited from stolen writing and ideas (Creamer, 2023). In a separate case, Google, along with its parent company Alphabet and AI subsidiary DeepMind, has been accused in a lawsuit of scraping user data without consent and violating copyright laws to train its AI products. A similar class action lawsuit had previously been filed against OpenAI (Dixit, 2023). The case may hinge on whether courts view the use of copyrighted material in this way as 'fair use' or as simple unauthorised copying.

Further, it is important that copyrights differ between jurisdictions. The US operates on the principle that once something is public, it loses its privacy, which is not aligned with

European legal principles. According to OpenAI, their models undergo training using publicly accessible content, licensed content, and content reviewed by humans. However, this falls short of the standards set by the GDPR which gives individuals as ‘data subjects’ certain rights, including the right to be informed about the collection and use of their data, as well as the right to have their data removed from systems, regardless of whether it was initially public (Heikkilä, 2023).

The copyright concerns are valid but should be looked at by the appropriate regulators while universities should recognise these issues and advocate for clarity regarding the training data underpinning LLMs. Initially, raising awareness among students and faculty about potential copyright violations is vital. Over time, institutions should align with providers who can verify their training data's copyright legitimacy. For instance, Adobe's 'Firefly', a generative AI image tool, guarantees commercial usage safety, offering IP indemnification as it is trained on company-owned images (Gold, 2023). It has been reported that technology companies are in talks with leading media organisations about using their news content for AI training (Criddle et al., 2023). Google has updated privacy terms which now clearly state their right to use publicly available data for AI model training. This essentially provides them a 'legal' pass to harness user-generated data. Critics argue that Google leverages its dominant position to sidestep potential intellectual property lawsuits and access invaluable data for AI enhancement without incurring costs (Dixit, 2023). Finally, Bloomberg, the information provider for financial services that is also used by over 300 universities worldwide (Bloomberg, 2023a), is developing a new generative AI model, trained on an extensive variety of financial data owed by the company (Bloomberg, 2023b). While this model is likely to be only available to subscribing HEIs, it shows the possibility of data providers developing LLMs using their own data, thereby effectively tackling copyright-related concerns. Universities need to monitor these developments and endorse such models and initiatives.

Equality, Diversity and Inclusion (EDI)

ChatGPT has been widely criticised for producing biased and discriminatory content, which has been caused by using training data that reflects the biases of society (Weinberger, 2019; Dwivedi et al., 2023). It appears that conversational AI often replicates

and even intensifies the same biases that frequently mislead humans, including availability, selection, and confirmation biases (van Dis et al., 2023). Overall, LLMs can perpetuate and amplify existing biases and unfairness in society, which can negatively impact teaching and learning processes and outcomes (Abdelghani et al., 2023). It is crucial to understand that ChatGPT does not operate based on ethical principles, nor can it discern between right and wrong, or truth and falsehood. This tool merely gathers data from the databases and texts it processes online, thereby inheriting any cognitive biases present in that information (Sabzalieva and Valentini, 2023). OpenAI has recognised this issue and claims to have fine-tuned ChatGPT 4.0, achieving an 82% reduction in the model's tendency to produce disallowed content compared to its predecessor. Additionally, GPT-4 is 29% more aligned with company safety policies on sensitive data handling (OpenAI, 2023b). Yet, Zou et al. (2023) found a way to circumvent the guardrails of nearly all open-source LLMs, which are designed to prevent harmful outputs. Furthermore, Hartmann et al. (2023) highlight ChatGPT's pro-environmental, left-libertarian bias.
While AI poses challenges, it also offers solutions to bolster equality, diversity, and inclusion. Chatbots can promote inclusivity for disadvantaged students and those with diverse backgrounds or disabilities. They can handle course queries, direct students to resources, provide materials suited to different learning styles (Gupta and Chen, 2022), and simplify complex ideas, benefiting those with communication challenges (Hemsley et al., 2023). ChatGPT offers opportunities to enhance academic success for diverse student groups. Non-native English speakers can use ChatGPT for grammar feedback and as a semi-translator for complex terms, aiding comprehension (Sullivan et al., 2023). For neurodivergent students, AI can assist in time management, information processing, and thought organisation (McMurtrie, 2023). AI can also support adaptive writing and highlight essential information in various formats (Kasneci et al., 2023). Moreover, the fact that AI may produce biased responses represents a valuable opportunity to raise awareness and engage in a discussion about inherent biases which are present in society and therefore reflected in the LLM’s training data (Heaven, 2023).

Generative AI, when used appropriately in education, offers significant potential to enhance EDI and promote inclusive learning. With the rise of various models, it is imperative for HEIs to ensure equal access to technology. This includes guaranteeing the inclusivity of tools like ChatGPT and addressing digital disparities (Lim et al., 2023). Furthermore, it is crucial to inform both students and staff about the limitations of these

models. HEIs must also draft AI policies that cater to the diverse needs of the entire academic community (McMurtrie, 2023). In conclusion, while the ability of AI to bolster EDI is clear, the risks associated with AI use can be managed. However, it requires HEIs to invest significant time and effort to devise and implement suitable practices to achieve their objectives.

Information privacy

Another obstacle to adopting ChatGPT lies in concerns over privacy and security. Given the vast data processed by ChatGPT's machine learning algorithms, it is vulnerable to cyberattacks, risking unauthorised access or misuse of sensitive information (Dwivedi et al., 2023). Concerns also arise from how ChatGPT uses the information from its interactions (Azaria, et al., 2023). Tlili et al. (2023) examined OpenAI's policies and found that while conversations with ChatGPT are stored and used to improve its performance, the specifics of storage and use are not entirely clear.

The privacy implications of ChatGPT are particularly relevant for learners and educators who may lack in-depth knowledge of technology and privacy. Young learners could unintentionally share personal details with ChatGPT, underscoring the need to protect the privacy of users, particularly the younger demographic. Regulators in Europe and the US echo these concerns. In 2023, Italy restricted ChatGPT access due to privacy and age-verification issues. OpenAI responded by addressing and clarifying these privacy matters (McCallum, 2023). The US Federal Trade Commission is also scrutinising OpenAI for potential false or harmful statements about real individuals and its data privacy methods (BBC News, 2023). Similarly, Japanese authorities have voiced privacy concerns, emphasising the need to weigh these against the benefits of generative AI (Kaur, 2023). HEIs must ensure that staff and students are well-informed about AI-related privacy concerns, emphasising the avoidance of sharing personal or sensitive data. It is vital for HEIs to stay updated on AI advancements, collaborating with providers that uphold transparent privacy policies. By doing so, institutions can maintain best practices in AI utilisation. Although HEIs should recognise the potential for privacy breaches, their role is not to police AI systems but to foster a secure learning environment that benefits from AI. Regulation should be left to the designated authorities and HEIs should follow these

regulation and guidelines. In summary, while privacy issues are genuine, they should not hinder AI's integration into higher education.

Misinformation

Prior to ChatGPT, people relied on various methods to filter information, such as verifying the content directly, assessing the knowledge level of the creator, and evaluating language rigour, format correctness, and text length as indicators of reliability. However, ChatGPT's content generation capabilities excel in these aspects, potentially creating a false sense of reliability. Users may fall into the trap of blindly trusting the content generated by ChatGPT (Wu et al., 2023). In fact, LLMs are prone to hallucinations, a phenomenon where the AI model generates inaccurate or outright false information. This is particularly true when asking for a literature reference as generative AI can fabricate convincing titles and authors that do not exist (Burger et al., 2023). Hallucinations from LLMs can mislead and potentially harm users seeking personal advice (Khowaja et al., 2023). Companies developing LLMs are aware of these issues and are working to address them (O'Brien, 2023).

To overcome the limitations of LLMs, it is crucial to inform users about potential inaccuracies, or hallucinations, and to not rely entirely on AI-generated outputs. Students who use such content should strive to verify its accuracy and take responsibility for any factual errors. Moreover, fictional references, which are often markers of AI-generated content, can help educators pinpoint students falsely claiming AI work as their own. Rigorous reference checking could serve as one method of enforcing academic integrity, although this would necessitate additional time for scrutiny. It remains vital for universities to teach the fundamentals of each subject and to supervise the use of AI while equipping their students with a solid foundation in pertinent skills and knowledge. Once students have the necessary knowledge and skills, they can evaluate the outputs generated by AI, weeding out inaccuracies and leveraging the beneficial and helpful components of the responses offered by the technology. This approach fosters the application of critical thinking in their studies.

There is concern that generative AI might inadvertently propagate misinformation. The Covid-19 pandemic illustrated how AI can mass-produce questionable content and amplify misinformation through social media bots (Gisondi, et al., 2023). This risk implies that even well-intentioned users might unknowingly spread fake news. While users should verify AI-provided information, many still fall victim to misinformation (Lim et al., 2023), due to cognitive biases, reliance on headlines, and the persistence of false information (Centre for Information Technology and Society, 2023). Therefore, it is vital to educate students on information quality, enhance critical thinking, and raise awareness about AI's potential to spread misinformation.

Opportunities

The widespread integration of LLMs in higher education can offer substantial advantages for students and faculty. As tools like ChatGPT become more common at work, graduates must be equipped with the right knowledge and skills to use them adeptly. This entails understanding AI capabilities and limitations, and their ethical and societal implications. This skill development could be scaffolded and progressively developed through strategic curriculum design and embedded into assessments (Cradle, 2023). Thus, embedding AI literacy in graduate skills can enhance their employability in a rapidly evolving job market.

First, HEIs must educate students on navigating AI-related challenges, as detailed earlier in this report. Next, they should introduce basic prompt engineering, enabling effective model communication. Most crucially, HEIs need to develop use cases for generative AI models in educational settings that are relevant for graduate jobs and enhance graduate outcomes as well as the student journey. By following these steps, HEIs would fully include AI literacy in graduate skillsets boosting their employability and readiness for the swiftly changing employment landscape.

Developing use cases for generative AI is a significant challenge for educational providers. LLMs possess notable capabilities for education, but these are yet to be fully explored. Academic literature offers various examples of such capabilities. Mollick (2022) recommends having students assess ChatGPT's responses or compare a ChatGPT-produced research paper with the original to bolster their critical thinking skills. Generative

AI platforms can be viewed as a valuable reservoir of ideas and motivation, providing a starting point for students as they can assist with topic brainstorming and creativity when developing project ideas (Javid et al., 2023). Gilson et al. (2023), note that ChatGPT's initial answer could prompt further questioning and encourage students to apply their knowledge and reasoning skills, while Rudolph et al. (2023) state that generative AI could be used as an aid to improve writing and research skills. ChatGPT is a versatile tool that can produce more than just text. It is capable of generating computer code snippets in different programming languages, crafting tables and lists, and creating Excel formulas. While these outputs may require some editing and verification, ChatGPT undeniably serves as a valuable time-saving resource (Centre for Teaching and Learning, 2023). Overall, generative AI may support research, writing, and data analysis which effectively opens new possibilities for educators and students, potentially unleashing their digital creativity. This technology may assist in creation of inventive assessments which could promote creativity and critical thinking skills, contributing to comprehensive and meaningful evaluation of learning outcomes (Rasul et al., 2023). From the student perspective, AI-powered tools can assist in problem solving (Rudolph et al., 2023) and help to foster the creative process (McMurtie, 2023). Finally, generative AI may provide personalised learning opportunities, for instance, it may develop educational materials and content that are customised to a student's individual interests, abilities, and learning objectives. In addition, it also offers immediate feedback and advice, assisting students in rectifying mistakes and enhancing their study techniques (Javaid at al., 2023; Yu and Guo, 2023).

Summary

The rapid advancement and spread of Generative AI and LLMs, most notably represented by ChatGPT 3.5, is a testament to the transformative nature of modern AI. Their multifaceted attributes not only underscore heightened efficiency but also democratise AI, making it an accessible tool for diverse audiences. Its applications, ranging from simple text generation to intricate code creation, mark a new era where technology is both an aid and a collaborator.

One of the immediate impacts has been on education, and this paper outlines challenges associated with a wide-scale adoption of LLMs, but also offers solutions and presents

opportunities to leverage technology by institutions and educators to enhance the learning experience. Firstly, HEIs must update their assessment offence policies and review their current assessment strategy. Secondly, they need to educate both students and staff to manage various ethical challenges, as it remains imperative to strike a rational balance, nurturing innovation while safeguarding ethical integrity. Thirdly, HEIs must explore use cases and the potential of generative AI to be integrated in their syllabus, offering the opportunity for students to learn how to use LLMs in an academic context and, in the future, in professional settings. This involves equipping students with such skills through scaffolding and progressively developing AI skills throughout university courses. HEIs need to realise the scale of the AI transition and devote adequate resources to ensure staff AI readiness and prepare to make necessary changes to their teaching, learning and assessment practices as well as assess the need for reviewing module and programme learning outcomes. Currently, generative AI is still a relatively novel technology, therefore the question of how to successfully integrate it within higher education remains unanswered. Academic literature points to multiple opportunities, but educators need to be given the necessary autonomy and training to start experimenting with generative AI. These efforts must be supervised, coordinated and evaluated, involving an open dialogue with the relevant stakeholders. To achieve that, creating academic or management roles responsible for this transition should be considered.

Generative AI and LLMs, with their capacity for personalised lessons and engaging with complex subjects, hold the potential to transform traditional classroom settings. Integrating these AI models into curricula can nurture creativity, promote critical thinking, and prepare students for a future where AI collaboration is commonplace in professional life. Through aiding research, boosting writing skills, and enabling innovative problem-solving, this technology is set to enhance the educational landscape, and HEIs need to adopt and take advantage of this technology.

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Author details

Michal Bobula is a Senior Lecturer and Programme Leader for Accounting and Finance at the University of the West of England in Bristol, UK (UWE Bristol). He is a member of the

university AI community of practice and co-leads the efforts to incorporate generative AI into teaching, learning, and assessment strategies in the College of Business and Law.

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