AI-Powered Curricula: Unpacking the Potential and Progress of Generative Technologies in Education

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Abstract

The aim of this narrative review is to understand how Artificial Intelligence (AI), specifically generative AI (e.g. ChatGPT) is thought to be used to support teachers in content authoring and curriculum production. Our findings indicate that Generative AI is envisioned as a co-design partner in enhancing educational content such as rubrics, lesson plans, interactive exercises, analogies, reflective questions, and case studies tailored to learning goals and instructional needs. The literature suggests that the key issues with the use of ChatGPT in education can be summarised mainly around its accuracy, and reliability, and its potential to lead to plagiarism. The analysis of empirical studies on the use of generative AI in higher education revealed first insights into themes such as ChatGPT's role in administrative tasks, varied perceptions of AI, generational differences in attitudes, multifunctional roles of ChatGPT, concerns about academic integrity and need for AI literacy, and the call for teaching philosophy reform, around assessment.

Keywords: generative AI, LLMs, ChatGPT, curriculum production, content authoring

Introduction

Artificial Intelligence (AI) has been in the news again and heralded a new AI boom. Natural Language Processing (NLP) stands out as a significant domain, facilitating machines to interpret and generate human language, thereby potentially bridging the communication gap between humans and computers (Liddy, 2001; Rafail and Freitas, 2020). Grounded in linguistic theories, advancements in NLP have birthed tools such as chatbots and intelligent tutoring systems. Large Language Models (LLMs), notably the Generative Pre-trained Transformer (GPT-3) (Floridi & Chiriatti, 2020), represent significant progress in this field. AI-powered NLP technology enables conversational interfaces, such as chatbots and virtual assistants, to answer learners' questions and provide guidance in a conversational manner.

The adoption of ChatGPT has been phenomenal in the last few years. It is one of the fastest-growing consumer applications (Hu, 2023). ChatGPT is trained to “generate humanlike text based on a given prompt or context. It can be used for a variety of NLP tasks, such as text completion, conversation generation, and language translation” (Baidoo-Anu, 2023, p. 4). The language model behind ChatGPT has been developed utilizing an extensive, unlabelled dataset comprising a diverse array of texts, predominantly from sources such as Wikipedia and numerous other websites. This dataset encompasses material primarily in English, yet it also includes content in a variety of other languages (Floridi and Chiriatti, 2020).

Since the emergence of ChatGPT and similar tools, they have become more accessible and user friendly, thus significantly increasing public attention (NeJame et al., 2023). The abilities of ChatGPT to carry out complex tasks have caused mixed feelings among educators as this advancement in AI seems to revolutionize existing educational praxis, which are discussed next. This is followed by the analysis of the literature for two research questions. The aim of this narrative review is to answer the following research questions: 1) How is AI envisioned to be used to support curriculum production? 2) What are emerging insights from empirical studies that use AI to support curriculum production?

Methodology

The literature to answer the above questions has been searched on Google Scholar and The Open University's library by using the following keywords: ((Artificial Intelligence) OR (AI) OR (AIED)) OR (Large language models) OR (LLM) OR (ChatGPT) OR (Generative AI)) AND ((Higher Education) OR (University) OR (Education)) AND ((Content Authoring) OR (Curriculum production) OR (Course production) OR (Course Content)). A structured rapid literature review approach (Smela et. al, 2023) was undertaken to identify relevant studies involving a search of peer-reviewed literature databases, and an Internet search to identify relevant grey literature, including newspaper articles and blog posts.

The focus has been on publications over the last five years, specifically the last two years for any ChatGPT related literature. We included peer-reviewed articles in English, reporting on AI within education primarily at university level, and indexed in these international databases: EBSCO Education Source, ERIC, Web of Science and Scopus (covering titles, abstracts, and keywords). Database search has returned 139 articles, grey literature was searched in Google with the first 50 citations screened for relevance.

Following the removal of duplicate records (n=4), titles and abstracts were screened for relevance to the research questions in the preliminary review. Each article was skimmed with an inclusion criterion: its relevance to the AI, higher education, LLMs, and whether the study reflects on views and conceptions of people on using AI, and if it is related to content authoring/curriculum/module production. Following the first phase of selection we excluded 79 articles. The most common reason for discarding a paper was that it simply did not address the usage of LLM in education but rather in a different context. Identified papers which have met the inclusion criteria were tabulated and grouped in a spreadsheet by the type of research, research question, design, quality, sample size, most important findings, limitations, and results summarised for each. In total, we carefully reviewed 41 articles, of which 17 was empirical studies.

Debate and Key Issues

The rise of generative AI has brought with it concern and controversy. Since ChatGPT has been open to public use, it has become the centre of ongoing debate regarding the potential negative effects that it can have on teaching and learning. "Generative AI has been identified by many higher education experts as one of the most disruptive technologies of our time" (EDUCAUSE, 2023, p. 21). With the potential to create text, images, and sounds in ways that sometimes convincingly mimic human creation, this technology has the potential to impact instructional materials, assessments, and more. "This is a much bigger disruption than the pandemic," stated Emad Mostaque, founder and CEO of Stability AI, to an audience at Goldman Sachs 2023 Disruptive Technology Symposium in London, by pointing to the fact that AI LLMs successfully writing software code and OpenAI's ChatGPT can pass Google's exam for a high-level software engineer, even though it's a non-specialized model.

Reviewing the literature from 2022-2024 the key issues with the use of ChatGPT in education can be summarised mainly around its accuracy, and reliability, and its potential to lead to plagiarism. This was also noted by other researchers such as Lim et. Al (2023) and Kasneci (2023).

Accuracy: Three papers are identified in this theme stating there are significant concerns regarding the factual accuracy of ChatGPT and similar models, which may propagate biases, outdated information, and even fabricate non-existent references (Baidoo-Anu 2023; Kim, J.K. et al., 2023; Lo, 2023). This inaccuracy is attributed to bias or the limited scope within the data used to train the model. The need for transparency in distinguishing between human and AI authorship in academic contributions is emphasized.

Reliability: Three papers mentioned that the ChatGPT's propensity to produce "hallucinations" or false information poses a risk to students' learning and critical judgment, potentially leading to the acceptance of inaccurate information (Loos, Gröpler, and Goudeau, 2023; Kasneci, 2023; Liu, 2023). Critics worry about the negative impact on students' critical thinking and problem-solving skills, highlighting the necessity of educating students about the limitations and ethical implications of generative AI.

Plagiarism and Academic Integrity: Five papers stated that some of the most vigorous objections to using generative AI in higher education are related to academic integrity, as students can use it to cheat on assignments and exams, which can be undetected by traditional plagiarism detection software. The discussion extends to the broader implications of generative AI in perpetuating biases and the importance of digital literacy

and human oversight. (Zhai, 2022; Lo, 2023; Pelletier et al., 2022; Loos, Gröpler, and Goudeau, 2023; Webb, 2023).

Higher Education and AI: Fourteen articles mentioned that the response to ChatGPT in higher education is mixed, with some institutions banning its use due to concerns over accuracy, plagiarism, and dependency on AI outputs, while others see it as an opportunity for constructive use (Liu, 2023; Mowreader, A, 2023; Wood, 2023; Lukpat, 2023; Cassidy, 2023; McCallum, 2023; D'Emilio and O'brien, 2023; Brodkin, 2023; Ryan-Mosley, 2023; Thorp, 2023; Dwivedi et al. 2023). Instances of restrictive actions include banning by universities in Hong Kong, mixed responses in the UK, and access restrictions in New York City and Seattle schools, alongside Italy's block over privacy concerns. OpenAI's lack of transparency and the movement towards regulation, such as the EU AI Act, reflect growing concerns about AI's role in education.

RQ1: Potential Uses and Benefits of AI in curriculum production

One of the promising applications of Generative AI in higher education is seen in its potential to assist educators in generating course materials, including summaries, quizzes, and discussion prompts. By synthesising and rephrasing existing content, Generative AI can save time and effort for educators, allowing them to focus on more complex aspects of course design and pedagogy (Alshater, 2022; Terwiesch, 2023). Based on a review by Chen et al., (2023) on AI in Education, using a qualitative research approach, it was found that AI systems have enabled the customisation and personalisation of curriculum and content according to students' needs, leading to improved learning experiences, and overall educational quality.

With the rise of Generative AI, the integration of AI in Education has seen significant advancements. Generative AI is increasingly being used for a range of purposes: from creating instructional content, and providing automated assessment feedback, and to supporting academic services (Pelletier et al., 2022). A course designer could develop highly engaging course content simply by providing a Generative AI engine with a few sophisticated text prompts that are aligned with student learning outcomes. Based on Nagy (2024), Rahman and Watanobe (2023), Michel-Villarreal et. al (2023), Liu & Wang (2023) and Herft (2023), the list below summarised in which way Generative AI can be used as a co-design partner, to enhance the content by:

- creating prompts for open-ended questions that align with the learning goals and success criteria of the unit of instruction.
- generating quality rubrics that clearly and concisely explain exactly what students need to accomplish to be successful in the various required levels of proficiency.
- creating prompts for formative assessment activities that provide ongoing feedback to inform teaching and learning.
- helping in creating lesson plans for specific courses, developing customized resources, and learning activities, carrying out assessment and evaluation, and supporting the writing process of research.
- suggesting ideas for graphical content.
- creating ways to make content more engaging with interactive exercises and simulations.
- creating analogies to turn abstract concepts into concrete ones.
- generating reflective questions based on course readings or video scripts.
- generating student learning tasks and feedback based on existing course content.
- generating engaging video scripts based on existing written content, including suggesting on-screen graphics.
- generating scenarios or case studies based on existing content.

RQ2: Insights from empirical studies

The analysis involved identifying themes and patterns across 17 empirical studies within the literature concerning the use of Generative AI in higher education. The analysis encompassed perceptions of AI, generational differences in attitudes towards AI, and the multifunctional roles of ChatGPT as summarised in Table 1 below.

Theme	Description
Administrative Tasks	ChatGPT is effective in handling administrative and admission processes in educational settings (Kumar & Raman, 2022).
Perceptions of AI	Students generally have positive perceptions of AI, influenced by prior exposure (Lin, Huang & Yang, 2023; Ali et al., 2023; Eysenbach, 2023) but are hesitant about AI replacing faculty roles (Kumar & Raman 2022; Eysenbach, 2023; Rospigliosi, 2023).
Generational Differences	Differences in acceptance and perceptions of generative AI between Gen Z students and Gen X/Millennial educators, with the latter showing more cautiousness (Chan and Lee, 2023).
Roles of ChatGPT	ChatGPT serves as an interlocutor, content provider, teaching assistant, and evaluator in educational settings (Jeon & Lee, 2023).
Concerns and Limitations	Issues related to academic integrity, lack of citation capabilities, and the need for human-centered AI approaches (Perkins, 2023; Rospigliosi, 2023).
AI Literacy	The importance of upskilling in AI competencies and AI literacy in education and the need for tailored curricula and teaching strategies (Tlili et. al 2023; Ng et. al, 2023; Long & Magerko, 2020).
Using ChatGPT for Research	The potential of ChatGPT in supporting qualitative research, enhancing efficiency, and aiding non-native speakers in language comprehension (Yan et. al, 2023).
Teaching Philosophy Reform (Assessment Reformation)	Need for a new teaching philosophy to integrate chatbots effectively in education especially around assessment (Tilli et al., 2023). Need for innovate assessment practices to focus more on higher order thinking skills and authentic evaluations.

Table 1. Themes from empirical studies that use AI in curriculum production.

Conclusion

This rapid literature review captures the current enthusiasm for Generative AI and the thinking into how generative AI can aid curriculum production, revealing insights across two research questions. It highlights AI's pivotal role in enhancing efficiency and effectiveness in creating educational content, such as quizzes, simulations, and personalized learning materials, through automated generation and customization according to students' needs. The cited empirical studies underscore the benefits of AI in saving time, allowing for tailored educational experiences, and presenting both challenges and opportunities in pedagogical practices as discussed in section RQ2. Additionally, insights into generational differences in perceptions of AI, the multifaceted roles of generative AI like ChatGPT in education, and the ethical considerations surrounding AI use are highlighted in these studies.

From this literature review, we can see that it potentially offers an opportunity as a co-design partner in course development. This can be realised in two ways: a) to support the development of learning artefacts, such as written text, assessment, graphics, and interactive content, enabling us to enhance the overall course quality with the same resource as previously discussed in RQ1 data analysis section; and b) to streamline administrative tasks, freeing up time for educators to focus on more strategic and creative aspects of course creation as discussed in RQ2 data analysis section. By embracing generative AI, it is thought that we can enhance the learning experience of students and create efficiencies in our work as educators.

In conclusion, while generative AI offers substantial opportunities to enhance educational practices and outcomes, strategic and ethical considerations must guide its integration into educational landscape. The future direction involves not only maximizing AI's educational benefits but also cultivating AI literacy among educators and students to ensure responsible use. This comprehensive approach will enable the educational

sector to navigate the evolving landscape of AI technologies, fostering an environment where learning is both enriched and aligned with the ethical standards of the digital age.

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