The Role of Artificial Intelligence in Curriculum Development and Management

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ABSTRACT

Artificial Intelligence (AI) has surfaced as a revolutionary technology holding immense potential in multiple domains including the field of Education with significant impact in curriculum development and management. This article aims at studying the role of AI in curriculum development and management, exploring how it can improve educational practices and outcomes. A comprehensive literature review to gather relevant information and insights on the role of artificial intelligence in curriculum development and management. Academic journals, conference proceedings, and reputable online sources were searched using the major keywords. The literature review helps establish a solid foundation of existing knowledge and identifies key themes, trends, and research gaps. Also, seven selected case studies and real-world examples are provided of successful implementation of educational institutions, showcasing their impact on student learning outcomes, teacher effectiveness, and administrative processes using Artificial Intelligence. It discusses AI-driven approaches in personalized learning, adaptive assessments, and intelligent content delivery. These case studies and examples highlight the diverse applications of AI in curriculum development and management, demonstrating its potential to enhance learning outcomes, individualize instruction, and streamline administrative processes in education. The article also addresses concerns related to ethics, bias, and the human-AI partnership in curriculum design and implementation. Furthermore, it examines the challenges and opportunities associated with integrating AI into curriculum development processes and recommendations were made.

Keywords: Curriculum Development, Management, Artificial Intelligence, Learning Outcomes, Content Delivery

1. INTRODUCTION

UNESCO International Bureau of Education [12310] & Abdelaziz, 2023) 'Artificial Intelligence'(AI) refers to the theory and development of computer systems able to perform tasks normally requiring human intelligence. In order to achieve transformational change in contemporary curriculum systems and learning environments, we need to engender an orbit-shifting dialogue about the relationship between AI and education, in terms of independent variables (threats), and dependent variables (opportunities).

As noted by the Council of Europe's Committee of Ministers in 2019, artificial intelligence (AI) is increasingly having an impact on education, bringing opportunities as well as numerous threats. (Holmes et al., 2022). Machine Learning (ML) and Artificial Intelligence (AI) are essential drivers of innovation and growth in all sectors, including education. While AI-powered technologies have been around for a while in EdTech, the sector has been sluggish in their acceptance. The pandemic, on the other hand, radically altered the scene, pushing educators to rely on tech for virtual instruction. Now, 86 percent of educators believe that technology should be an integral element of education. (Madhurjya, 2022). Xue & Wang (2022). In their study combines artificial intelligence to promote research on teaching reform, which is aimed at encouraging the implementation of artificial intelligence education and promoting the development of cognitive and pedagogical skills. This object uses the query analysis method to collect the data and analyzes the data based on the distribution technology and the new technological process.

One of the most significant uses of AI in education is in designing and developing a curriculum. AI in curriculum development allows for a completely new process of creating learning content and developing lesson programs. With the rapid development of AI technology in learning and development, the future of instructional design is changing.

2. LITERATURE REVIEW

A few articles and reports from literature were studied. There findings are as presented below:

(Antara, 2023) This article discusses the benefits and opportunities of using AI in curriculum development. It also discusses the challenges and opportunities that come with the use of AI in curriculum development, stating that AI in curriculum development can provide a starting basis and framework for teachers to design lessons. It can also help students who need more explanation or a thorough understanding of a subject. The work emphasized on the speed of instruction designers and educators time by helping them generate ideas, summaries, and course outlines faster and better. However, it comes with challenges, such as the possibility that students may also try to use AI tools to complete assignments.

Harve (2023). The blog post explores the role of Artificial Intelligence (AI) in learning and development. It highlights how AI technologies, such as machine learning and natural language processing, can personalize learning experiences, automate assessments, provide intelligent recommendations, and enhance learner engagement. The post emphasizes the transformative potential of AI in revolutionizing learning and development practices.

(Plitnichenko, 2020). This study observed that global adoption of technology in education is transforming the way we teach and learn, stating that Artificial Intelligence is one of the disruptive techniques to customize the experience of different learning groups, teachers, and tutors. Kandula (2020). The study shows that AI is the backbone of all the information science enabled intelligent tutor systems. These systems help in developing qualities like self-reflection, responsive deep queries, partitioning conflict statements, generating artistic queries, and choice-making skills. Kandula (2020). The study highlighted the importance of ML and AI as essential drivers of innovation and growth in all sectors, including education. It was emphasized the benefits of AI to the students and the educators

Xia & Li (2022). This article explore the development of higher education and the improvement of teaching skills based on artificial intelligence and to analyze the problems and solutions in the process of higher education development. This article used the research methods of specific problems and specific analysis to compare the data and draw conclusions.

Chiu and Chai (2020). This study explores the views of teachers with and without AI teaching experience on key considerations for the preparation, implementation and continuous refinement of a formal AI curriculum for K-12 schools. It drew on the self-determination theory (SDT) and four basic curriculum planning approaches—content, product, process and praxis—as theoretical frameworks to explain the research problems and findings. A semi-structured interviews with 24 teachers—twelve with and twelve without experience in teaching AI—and used thematic analysis to analyze the interview data was conducted. Our findings revealed that genuine curriculum creation should encompass all four forms of curriculum design approach that are coordinated by teachers' self-determination to be orchestrators of student learning experiences. This study also proposed a curriculum development cycle for teachers and curriculum officers.

Igbokwe (2023). This study aims to explore the application of AI in educational management, its benefits and challenges. The research work employs a systematic review methodology, examining the literature on AI in educational management. The study finds that AI has several advantages, including improving student engagement, personalization of learning, and cost-effectiveness. However, AI also poses several challenges, such as ethical concerns, potential biases, and the need for re-skilling the workforce. The research concludes that AI has an enormous capacity to improve educational management, but it must be deployed with care and caution.

3. METHODOLOGY

A comprehensive literature review to gather relevant information and insights on the role of artificial intelligence in curriculum development and management. Academic journals, conference proceedings, and reputable online sources were searched using the major keywords. The literature review helps establish a solid foundation of existing knowledge and identifies key themes, trends, and research gaps. Also, seven selected case studies and real-world examples are provided of successful implementation of educational institutions, showcasing their impact on student learning outcomes, teacher effectiveness, and administrative processes using Artificial Intelligence. The examples were chosen to represent diverse educational settings and levels, providing a holistic view of AI's potential benefits.

4. DISCUSSION CASE STUDIES AND EXAMPLES

These case studies and examples highlight the diverse applications of AI in curriculum development and management, demonstrating its potential to enhance learning outcomes, individualize instruction, and streamline administrative processes in education.

Case Study 1: Michigan Virtual.
Nikolas (2023). Here they explore how AI can be used effectively in curriculum development, when and where it can supplement an SME (subject-matter expert), how it can help individualize student learning, and what considerations need to be made when using AI-based content creation tools.
The experiment was carried out in the following areas and they all have successful outcome:

Jumpstarting content design with AI
Assessment
Extension Activities (Field Trip, Citizen Science Project, Science Fair)
Individualizing student learning with AI
AI in the 5D Process

Case Study 2: Georgia state University and Pounce (a conversational AI system built by <u>AdmitHub</u> and named for the GSU mascot):
Page and Gehlbach (2018), Justin et al. (2021) surveyed how AI is currently impacting four key areas in higher education and the opportunities for growth in the near and distant future.

> Student Acquisition
> Learning and instruction
> Student Affairs
> Institutional efficiency.

In collaboration with Georgia State University (GSU) & Page and Gehlbach (2018) tested whether "Pounce," a conversational AI system built by <u>AdmitHub</u> and named for the GSU mascot, could efficiently support would-be college freshmen with their transition to college. Pounce features two key innovations. First, the system integrates university data on students' progress with required pre-matriculation tasks. Thus, rather than providing generic suggestions, Pounce matches the text-based outreach that students receive to the tasks on which data indicates they need to make progress and therefore may need help.

Case Study 3: Carnegie Learning (Adoptive Learning)
Carnegie Learning is an adaptive learning platform for K-12 math education. The platform uses AI algorithms to analyze student performance data and provide personalized feedback and guidance. Carnegie Learning has been shown to improve student math proficiency by up to two grade levels. (*Math Curriculum & Software Solutions | Carnegie Learning*, 2023)

Case Study 4: Coursera
Ikonomou (2023). Coursera is an online learning platform that offers a range of adaptive learning solutions, including personalized learning paths and individualized feedback. The platform uses AI-powered tools and features, which includes:

Personalized job-aligned learning
Coursera coach powered by generative AI
Expanded language access with ML-powered translations
AI-assisted course building powered by generative AI

The Coursera platform offers personalized, hands-on, and adaptive learning content, empowering employees to practice and master new skills in generative AI, cybersecurity, and other emerging fields. This equips them not only for their current roles but also for future opportunities. With the Coursera, more learners have access to certification.

Case Study 5: IBM Watson's Role in Curriculum Design. Technology for Education Enhancing learning with IBM Watson.

Kerick (2022). The IBM Watson Education team focuses on using AI to improve learning outcomes and implementing solutions that can help students succeed. The platform relies on the Watson AI technology and digital trends to assist teachers with tools that can help improve their performance and effectiveness. The goal of the platform is to facilitate continuous learning. A set of tools is given to each individual to help them thrive in school and beyond.

The different ways in which the IBM Watson Education team uses AI to enhance learning in this digital age include:

Personalizing Educational Content
Intelligent Tutoring
Enhancing Early Childhood Vocabulary Development

Case Study 6: Knewton Adaptive Learning Technology

Knewton utilizes adaptive learning technology created a platform that allows educational institutions and software publishers to tailor educational content for personal use. Started as an online test prep software, Knewton aims to identify the next best step in the user's learning journey. By partnering with leading universities in the US and publishers like Pearson, the adaptive learning platform aims to end the one-size fits all curriculum making personalized curriculum accessible across K-12 and college education. Knewton's solution offers a two-pronged approach on curriculum recommendation guiding students on what the next best thing to learn and how they should do it. The recommendations can be used to drive the complete learning experience or can serve as tailored remediations in response to test performances.

This is achieved through data. Once a student logs in on the platform, every keypress and mouse movement is recorded as a part of the clickstream to understand their behaviour.

The adaptive learning algorithm then uses this data to understand different dimensions of the learning experience such as engagement, proficiency, boredom and frustration measured through time spent on learning modules, error rates, assessments taken etc. For instance, Knewton uses the item response theory to assess and compare proficiency based on an individual's responses to quizzes as compared the overall test taker's demographic. (Alisha et al., 2017)

Case Study 7: Automated Essay Scoring by EdX

(D'Addario, 2017). EdX, an online learning platform, utilizes AI technology for automated essay scoring. Through natural language processing algorithms, the platform can assess and provide feedback on essays submitted by learners. This AI-driven approach saves time for instructors and provides timely feedback to students, enabling them to improve their writing skills. EdX's AI-based essay scoring system has been successfully implemented in massive open online courses (MOOCs), reaching a wide range of learners globally. (*EdX*, MIT and Harvard's non-profit MOOC federation)

5. ETHICAL CONSIDERATIONS IN THE USE OF ARTIFICIAL INTELLIGENCE IN CURRICULUM DEVELOPMENT AND MANAGEMENT

The use of AI in **Curriculum Development and Management** raises ethical concerns that must be addressed. Below are five ethical considerations to keep in mind:

1. Equity and Bias:

Zajko (2022). Artificial intelligence (AI) and algorithmic systems have been criticized for perpetuating bias, unjust discrimination, and contributing to inequality. AI systems are only as fair as the data they are trained on. Bias in data or algorithms can perpetuate inequalities and reinforce existing societal biases. It is essential to address bias in AI systems used for curriculum development and management to ensure equitable access and opportunities for all students (Manyika et al., 2019), (Zajko, 2022). This includes regularly auditing AI systems for bias, promoting diversity in data collection, and involving diverse stakeholders in decision-making processes.

2. Privacy and Data Protection:

AI applications in curriculum development and management often require the collection and processing of personal data. Educational institutions must prioritize data privacy and protection to safeguard student information (https ://unesdoc.unesco.org/home, 2019). This involves implementing robust security measures, obtaining informed consent for data usage, and adhering to relevant data protection regulations, such as the General Data Protection Regulation (GDPR) in the European Union.

3. Transparency and Explainability:

Zajko (2022). Bias in algorithms used by AI is a significant concern, as incorrect programming can result in biased outcomes or the promotion of certain ideologies without transparency. Educators, students, and administrators should have access to clear explanations of how AI systems influence curriculum development and management (Khosravi et al., 2022). Transparency measures, such as providing algorithmic explanations and making decision-making processes auditable, can enhance trust and accountability in AI applications.

4. Ethical Use of Student Data:

AI technologies can generate valuable insights from student data, but it is essential to use this data ethically. Student data should be handled with care, ensuring it is used solely for educational purposes and protecting it from unauthorized access or misuse (Onyejegbu, 2021). Implementing robust data governance policies, obtaining parental consent when required, and anonymizing or de-identifying data where appropriate are crucial steps to ensure ethical use of student data. UNICEF (2021)

5. Human-Centric Approach:

(Parry, 2023) AI should be used to augment human decision-making processes, not replace them. It is crucial to maintain a human-centric approach in curriculum development and management, with educators and administrators retaining control over AI systems and decisions. Involving stakeholders in the design and implementation of AI technologies, providing training and support to educators, and ensuring that AI systems are used to enhance, rather than replace, human expertise are key considerations. UNESCO International Bureau of Education [12310] and Abdelaziz (2021)

6. PROS AND CONS OF USING AI FOR CURRICULUM DEVELOPMENT

From literatures on the use of Artificial Intelligence for curriculum development and management, the following Pros and Cons were gathered and listed below:

Pros
1. Greene (2023) . AI in learning can assist in developing question banks.
2. Provide starting platforms and frameworks for lesson design. (Greene, 2023)
3. According to instrucko (2022). AI Provide a good starting point and spark ideas for course creation or problem-solving for students.
4. Generate course objectives and create a consistent scope and sequence with unit lessons.
5. Personalized Learning: Help students who need further explanation or a deeper understanding. (Instrucko,2022)
6. Potentially save time for SMEs by providing idea generation and summaries.

Cons
1. Replicate safety and a human experience. There are concerns about the replacement of human teachers by AI. (Greene, 2023).
2. Lack of Privacy: There is no way other than to digitize information these days. But much like any other technology, the students' data could also be prone to hacking. If it falls to the wrong hands, schools always run the risk of misuse of personal information. (The Knowledge Review ,2020).
3. Be used as a flippant tool for teachers to create content without thinking about how students can and will use AI to help them with that same content, as doing so will likely result in poor outcomes for teachers and students alike. (Greene, 2023)
4. Cost: According to The Knowledge Review (2020). As brilliant as AI is, it also comes at a high cost. Not only is the price of the product high but also the cost of maintenance and repair.

7. CONCLUSION AND RECOMMENDATIONS

In conclusion, incorporating Artificial Intelligence into curriculum development and management presents a unique opportunity for teachers and students alike. AI has the potential to provide students with personalized and engaging learning experiences, as well as help them develop important 21st-century skills such as critical thinking and problem-solving. However, this integration of technology into the classroom also presents a range of challenges, such as data privacy and ethics, the need for ongoing training and support, and the potential for unequal access to technology and digital skills. Overall, AI shows great potential for revolutionizing how we design and create educational content. However, these powerful tools are not without their limitations and challenges.

While AI can help save time and provide a starting point for designing courses, it cannot replace the expertise that SMEs bring to the table. It's also important to consider the potential issues that could arise from relying too heavily on AI, such as the risk of teachers designing content using AI tools without being mindful of how their students may rely on similar tools to help complete this content. Our teachers ought to learn how to use these tools responsibly and with the intent to provide students with challenges and authentic learning situations rather than using them as a worksheet and test factory. To do this, educators will require training in using AI effectively and its limitations and potential risks.

Despite these challenges, AI has shown itself to be a valuable tool with the potential to improve the educational experience for educators and students alike. It is essential that the education community continue exploring the potential of AI in the classroom and adopt a holistic approach that combines the benefits of AI with the expertise of human educators. By learning how to best utilize this emerging technology, educators can realize the potential of AI in education and create engaging and effective learning experiences for all students. Above all, as AI becomes more integrated into our lives, it is essential to have a diverse group of professionals involved in the development and regulation of AI systems to ensure ethical considerations are taken into account.

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