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Exploring the Challenges of Curriculum Development in the Era of Artificial Intelligence: A Systematic Review

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Keywords: Artificial Intelligence, Curriculum Development, Systematic Review, Challenges

Authors:

Aima Shafiq:(Corresponding Author)
PhD Scholar, Department of Educational Research and Assessment, University of Okara, Punjab, Pakistan.
(Email: Aima.shafiq786@gmail.com)

Rukhsana Yahya: PhD Scholar, Department of Educational Research and Assessment, University of Okara, Punjab, Pakistan.

Salma Waheed: PhD Scholar, Department of Educational Research and Assessment, University of Okara, Punjab, Pakistan.

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Title

Exploring the Challenges of Curriculum Development in the Era of Artificial Intelligence: A Systematic Review

Authors:

Aima Shafiq:(Corresponding Author)
PhD Scholar, Department of Educational Research and Assessment, University of Okara, Punjab, Pakistan.
(Email: Aima.shafiq786@gmail.com)

Rukhsana Yahya: PhD Scholar, Department of Educational Research and Assessment, University of Okara, Punjab, Pakistan.

Salma Waheed: PhD Scholar, Department of Educational Research and Assessment, University of Okara, Punjab, Pakistan.

Contents

Abstract

The rapid integration of artificial intelligence (AI) in all domains of society is reshaping the academic landscape, calling for a change in curriculum design and delivery. This systematic review investigates how the educational system is changing to adapt its curriculum to align with the opportunities and challenges created by AI technologies. The four primary theoretical frameworks include Constructivist Learning Theory, Technological Pedagogical Content Knowledge (TPACK), Digital Capital Theory, and the 21st-Century Skills Framework in the framework of AI education teaching, technical and equity dimensions. The results show that when AI promises personal education, administrative performance, and modern teaching methods, there are important gaps in curriculum education, the preparation of teachers, and moral integration. In combination with current global literature, this study provides valuable insights for teachers, policymakers, and curriculum designers in the AI-powered world.

Keywords:

Artificial Intelligence, Curriculum Development, Systematic Review, Challenges

Introduction

The rapid spread of artificial intelligence (AI) has basically changed the landscape of modern society, in which we live, work, and learn bringing profound implications across all sectors. From self-driven cars to healthcare diagnosis, the effect of AI is widespread and accelerating. In the realm of education, AI offers opportunities to enhance learning experiences, smooth administrative processes, and offer personalized experiences. However, it also raises complex questions regarding how educational curricula should evolve to leverage AI's potential while addressing issues of equity, access, and ethical responsibility (Abbasi, Wu, & Luo, 2025; Ejjami, 2024).

This systematic review seeks to answer a central question: How is the educational curriculum being constructed to deal with the challenges and opportunities offered by the integration of artificial intelligence (AI)? The study critically reviews the ongoing curriculum design changes, identifying challenges, modern solutions, and gaps that need to be filled in the context of AI integration in education. By combining recent international research on this article, this review provides a comprehensive overview of how the educational system is responding to the AI revolution, both at K -12 and higher education levels. (Lampou, 2023; Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). Its purpose is to present viable insights that will inform teachers, policymakers, and curriculum designers in the formation of educational methods that are consistent with the dedicated technical landscape.

Despite the rapid progress in AI and its growing application in education, there is still a significant difference in the literature on how to include the skills related to the curriculum AI and tackle the unique challenges facing these technologies (Holmes, Bialik, & Fadel, 2022; OECD, 2023). Although AI is recognized as an essential source of personal education, automation, and administrative performance in education, there is little regard for curriculum structures, teaching methods, and the wider implications of the integration of important moral protection into the educational system.

This review tries to fill the gap by assessing the current research on how the curriculum is being changed to connect AI in a way that not only promotes technical skills but also promotes moral reasoning, digital literacy, and critical thinking skills (Su & Zhong, 2022; Karataş, Eriçok, & Tanrikulu, 2025). These findings will be valuable to teachers and policymakers who have to ensure that the education system remains in a world where AI technologies are re-forming how knowledge is created, disseminated, and implemented (Ng, Nicholas, & Williams, 2021; Ejjami, 2024). Furthermore, it highlights the challenges faced by teachers, including teachers' preparation, digital inequality, and distribution of resources, and will find out how modern curriculum designs are addressing these obstacles. (UNESCO, 2023).

The core objective of this systematic review is to combine existing literature on the integration of AI in the curriculum in various educational contexts (Flechtner & Stankowski, 2023). In particular, this review will analyze how AI is being integrated into curriculum development at various educational levels (K-12 and higher education). It will identify the challenges faced by educational institutions in adopting curricula to integrate AI technologies, including teachers' training, access to technology, and curriculum elasticity (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). In addition, the review will look for modern solutions that have been suggested or implemented to tackle these challenges, such as adding AI ethics, digital literacy, and interfaith skills to the curriculum (Boulton, Kent, & Williams, 2022; Cabero-Almenara, Ruiz-Palmero, & Palacios-Rodríguez, 2022).

Curriculum development is a systematic process through which the educational content has been designed, supplied, and diagnosed to meet the needs of learners (Ng, Nicholas, & Williams, 2021). In the AI era, this process should be adaptable, dynamic, and ahead. The review argues that the development of the curriculum should not only be prepared to include AI as a tool but also to teach students how to critically engage with AI technologies (Holmes et al., 2022). It requires an intercontinental approach that connects articles such as AI ethics, digital literacy, cybersecurity, and data science, ensuring that students have the ability to understand and navigate both technical skills and AI's social implications (Karataş et al., 2025; Luckin, Holmes, Griffiths, & Forcier, 2016).

In conclusion, this systematic review contributes to a growing body of research on AI-driven curriculum transformation. By consolidating current evidence, identifying challenges, and outlining solutions, it provides valuable guidance for educators, policymakers, and curriculum designers. The review underscores the urgent need for flexible, ethical, and inclusive curriculum strategies that prepare students for the AI era. Through investments in teacher training, technological infrastructure, and curriculum innovation, education systems can ensure learners are not left behind in the AI revolution (Eynon, 2020; UNESCO, 2023).

Research Approach

A comprehensive study was done to compile research on the challenge of curriculum development in the era of artificial intelligence. The evaluation process was completed between January 2025 and March 2025. The following research methodology describes the procedures used in this systematic review:

Table 1

Step	Information
Search Techniques	Important electronic databases like Science Direct, World of Science (WoS) Journal, SAGE Journals, and Education Resources Information Centre (ERIC) were searched. Titles incorporated the search terms, Including relevant keywords and abstracts, such as "challenges in AI Education," "AI in the curriculum" "development of curriculum "and "artificial intelligence." 100 things were located in this initial search.
Remove Duplicate Data	Duplicate articles from the first list were discovered and removed, leaving 98 items for further analysis.
Screening of Titles and Abstracts	The remaining 98 papers were evaluated based on their relevance to the study issue, empirical nature, and language (English). When these criteria were used, 74 articles were removed.
Eligibility Evaluation	The remaining articles were evaluated based on their relevance to AI integration in formal education settings. Inclusion criteria required the use of empirical research (quantitative, qualitative, or mixed methods), a focus on curriculum development from primary to higher education, and publication in peer-reviewed journals between 2015 and 2025. Studies are needed to examine the practical challenges or policy responses related to AI in education. Articles not addressing curriculum-level implications or limited to technical AI models without educational context were excluded.
Last Decision	24 publications that complied with the criteria were part of the systematic review. The selected papers were research articles that complied with the requirements and were written in English.
PRISMA Principles	The review procedure was organized and open-minded since it followed the Preferred Reporting Objects for Systematic Reviews (PRISMA) standards. The PRISMA flow diagram was used to illustrate the systematic review's flow.

Screening Article

A total of 100 articles were identified by the initial search in multiple educational databases. The duplicate articles of the first list were discovered and removed, leaving 98 items for further analysis. 74 articles were excluded after implementing the titles and summary quality and the quality of the discharge was retained and 24 articles were retained for a full text review. After a thorough review of these complete texts against the standard 24, 24 was considered eligible and was included in a systematic review.

The review process included a rigorous screening and choice method to ensure that high-quality research articles were included, which directly solved the challenges of curriculum development in the era of artificial intelligence. The 24 articles selected formed the basis for the results of curriculum growth challenges and the synthesis of insights in the era of artificial intelligence.

Theoretical Framework

Curriculum development in the AI era is not just about the educational principle, it is a dynamic process that reflects the changing of educational parables, digital changes, and global trends in innovation. This study draws upon the four frameworks Constructivist Learning Theory, the Technological Pedagogical Content Knowledge (TPACK) Framework, Digital Capital Theory, and the 21st-Century Skills Framework. Where they are used, deepening our understanding of how the educational system should be developed in response to the facts of the AI-capable

environment. The center of this framework is the idea of constructive learning, which is deeply rooted in the works of Piaget and Vygotsky and has been increased by modern scholars. The construction process emphasizes the focused perspective for education, where knowledge is actively built through mutual interaction and experience. These theoretical lenses are especially relevant when interpreting the role of AI in personal education, as they highlight the importance of actively engaging with technology to create understanding. In AI-Enhansced classrooms, the principles of the construction process support the use of Income Technologies and Intel (Ng, Nicholas, & Williams, 2021).

The completion of this approach is the knowledge of the Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Kohler. TPACK provides a model to understand the integration of technology in educational practice, emphasizing the need to combine teachers to combine material knowledge, educational skills, and technical skills to effectively teach teachers in digitally enriched classrooms. Since AI has become the central part of modern education, TPACK offers a valuable structure to identify the difference in the training of teachers and highlights the need to align AI tools with sound teaching strategies. The integration of AI in curriculum development should not be seen only as extra, but as a change - with the help of teachers, teaching methods innovate and develop new teaching perspectives that better meet the requirements of the rapidly developed technical landscape. The TPACK indicates that teachers not only need to understand the content they are taught but also have to master the educational principle to make students effectively incorporate with technology. In this regard, the framework emphasizes the importance of professional development programs that provide teachers with the skills to add AI to their teaching methods, which they can use AI tools as part of a large seminary strategy rather than isolated elements. (Boulton, Kent, & Williams, 2022).

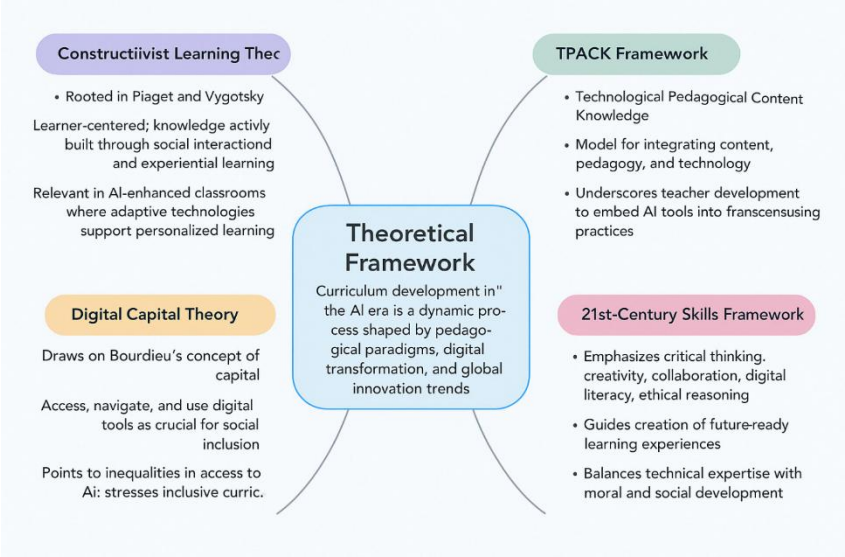
Another important ideological lens is the digital capital theory, which attracts the concept of Bordeaux's capital and emphasizes the cultural and social importance of digital access and ability. In today's educational environment, the ability to access, navigate, and use digital tools - digital tools - plays an important role in determining the educational success and social participation of the learner. In the context of curriculum development, digital capital theory urges planners and teachers to recognize the differences in digital resources and access to AI technologies. The purpose of deliberately eliminating these divisions without policies is that AI integration will increase the current educational inequality, especially for backward groups or in the educational systems. Digital Capital is not just a means to assess preparations. It also works as a fundamental leader to create a more comprehensive curriculum that ensures equal access to technology for all students. In the AI era, where access to technology is a key factor in success, this theory calls for a systematic effort to democratic resources and create a learning environment where all students, regardless of their backgrounds, have the opportunity to develop digital skills needed for development in the AI-powered world (Cabero-Almenara, Ruiz-Palmero, & Palacios-Rodríguez, 2022; UNESCO, 2023).

The immediate need for curriculum reform is the 21st-century skill framework, which is developed by 21st-century skills, such as educational alliances, and has been promoted globally through OECD-related measures. This framework supports the integration of key capabilities. This ability is not only required, but it is necessary for students to visit the future through AI technologies in the future. Although technical skills are important, it is important for students to develop the skills needed to think and engage morally with the AI system. This framework serves as a comprehensive leader for curriculum developers, which provides a future-prepared template that ensures that the curriculum remains relevant in a period of rapid technical change. By emphasizing the balanced integration of technical, academic, and social ability, the 21st-century skill framework develops students not only as consumers but also as critical thinkers, innovators, and moral decision-makers Holmes, Bialik, & Fadel, 2022; OECD, 2023).

Together, these four theoretical foundations provide a comprehensive and integrated basis for understanding the multi-dimensional challenges of curriculum development in the AI era. They emphasize the importance of designing a

curriculum that is not only responsible for the technical innovations of AI but also capable of promoting equal, comprehensive, and future-based qualifications. In the development of the AI-powered curriculum, alignment between theory and the process is essential to prepare students for a world where technological development will continue to create every aspect of their lives. TPEC, digital capital theory, and 21st-century skills can develop constructive principles with the framework, developing the educational system, which supports the learning agency, promotes digital literacy, and enriches students with these skills. Since AI is continuing to change education, these ideological lenses offer important insights to develop an adaptive, incorporated, and future-visible educational system that is able to respond to the challenges facing AI's rapid evolution.

Figure 1



Methodology

The researcher used a complete approach to organize articles in this review. The researcher looked at many databases, such as Google Scholar, Kam, and Eric. "Challenges in AI education," "Curriculum in curriculum "Curriculum development" and "Artificial intelligence". And other similar titles were in our search. We assured to include research, we focused on articles published between 2015 and 2025.

According to the researcher, the screening method for the results was two steps. The researcher reviewed the books throughout this stage. To find out summary posts, which can be in line with the requirements to be added. In the era of artificial intelligence, articles seeing the challenges of curriculum development were considered. Unrelated articles were not taken for the sake of. WE More Full Diagnosis of Capacity, We have drawn full text articles from the selected research of the stage at this stage. According to the requirements of this review, the articles were included by the researcher. Experimental research investigations use quantitative, qualitative, or mixed approaches. To summarize the research conducted, the researcher collected information from the selected articles. The data collected includes the writer (languages) and the year of publication.

Research Design and Method Employed

Information about participants, including settlement details and job and organizational features, was collected. In the era of artificial intelligence, the tools used to assess the challenges of curriculum growth were described. Recent studies have unveiled valuable insights about the challenges of curriculum growth in the era of artificial intelligence. Using the techniques of mixed methods, the results of these selected studies were fully analyzed. The study was included in the modification and mediation of the variables, and the technique of hassle synthesis was applied to evaluate and stabilize the results. This includes identifying repeated topics, patterns, and discrimination. The purpose of the coalition

synthesis is to build a compelling story to clarify the challenges of curriculum development in the era of artificial intelligence, which considers a spectrum of context and moderate factors. Calebber and rigor were examined to ensure the authenticity of the selected research investigation.

Various studies of quality diagnosis were used to use appropriate tools for different types of study design. Individual study limits, such as sample bias or procedures, were highlighted to make joint results to make contexts. The systematic diagnosis method ensured a complete and neutral search, selection, and summary of related studies related to the challenges of curriculum development in the era of artificial intelligence. These results provide insights that help understand this important link in the academic context. Organized reviews suggested suggestions on the basis of the results that were summarized for educational practice and policy. The suggestions provided for future study articles needed investigations into additional cross-cultural studies, long-term design, and special moderate and mediation processes.

Results

This systematic review includes ten peer review studies published between 2015 and 2025. These studies were conducted in numerous educational settings in countries like Pakistan, India, China, Finland, South Korea, Malaysia, the United Kingdom, and the United States. Each study saw how the educational system was molding its curriculum to maintain the growing use of artificial intelligence. Common research topics included teachers' manufacture, access to technology, digital inequality, and teaching approaches. All studies were based on real-world data and were particularly focused on the challenges facing schools and institutions when updating their curriculum in response to AI.

Definitions of Curriculum Development in the Era of Artificial Intelligence

Artificial intelligence (AI), both teachers and schools, must tackle the challenges that integrate curriculum. When schools update their curriculum in a timely and anxious way, it helps to run the classrooms easily, promotes teachers' confidence, and encourages teaching methods. (Ng, Nicholas, & Williams, 2021). It also plays an important role in ensuring that all students have equal opportunities to learn and improve the overall effectiveness of the system (OECD, 2023). Research shows that when curriculum changes are made through teamwork and with the full support of school-led support, it is much easier to adjust for everyone (Boulton, Kent, & Williams, 2022).

Since AI continues to affect education, it is important to understand how teachers and decision-makers are responding. Studies have pointed out a number of strategies that schools use to handle these changes (Holmes, Bialik, & Fadel, 2022; UNESCO, 2023). Just as different situations in order to handle the dispute require different views, updating the curriculum of the AI -era is to use flexible, co -operation strategies that meet the needs of each school.

Measuring Instruments

Researchers have used different tools to better understand the challenges and effects of bringing artificial intelligence (AI) into curriculum development. A commonly used tool education survey has AI integration, showing how AI is ready for AI, and how relevant is the current curriculum in the AI-powered world (Ng, Nicholas, & Williams, 2021). Other studies use structural questionnaires to measure how teachers are using digital teaching methods and how they understand the moral aspect of AI (Boulton, Kent, & Williams, 2022). Most data comes from school leaders, curriculum planners, and teachers. Many of these studies include interviews or open questions to collect deep insights (Cabero-Almenara, Ruiz-Palmero, & Palacios-Rodríguez, 2022; UNESCO, 2023). By combining the numbers with real feedback and experiences, researchers get a complete picture of how the schools are dealing with the changes in the curriculum brought by AI.

Discussion

In the era of artificial intelligence, curriculum development (AI) research research methods, institutional planning, and its significant impact on students have become increasingly focused on education research. This systematic review brought out the results obtained from ten relevant studies to better understand how the education system was responding to the challenges of integrating AI into its curriculum. The results of the review offer

valuable insights into how schools and teachers are molding. Overall, these results clarified the urgent need for responsible and mutual cooperation strategies in the development of the curriculum to maintain coordination with the AI rapid progress.

Limitation and Further Studies

Despite providing insights on curriculum development in the era of artificial intelligence, many limits should be considered. Cantonment is an example of possible sources of prejudice depending on the superiority of study designs and self-informed measurements. Due to a lack of studies, which especially indicates curriculum development and artificial intelligence, additional studies are also needed. Future research projects can deepen the importance of context and curriculum development in the era of artificial intelligence.

Conclusion

This systematic review offers a comprehensive look at how the integration of artificial intelligence (AI) is creating curriculum development in today's educational system. By combining the results obtained from various studies, the review highlights key challenges facing schools - such as teachers' manufacture, access to digital tools, and ethical and comprehensive curriculum design. These results include important messages for policymakers, educators, and curriculum planners.

Reviews make it clear that to successfully adapt the curriculum to AI's requirements, thinking, planning, cooperation, and ongoing assistance are required. Education leaders and decision makers are encouraged to promote the skills needed to guide this change-such as promoting innovation, promoting professional development, and maintaining open lines of communication with teaching staff. Investing in these areas can help create a more flexible and ready-made curriculum that not only supports teachers but also improves students' learning results. By taking these steps, educational institutions can stay ahead of technological change and ensure that both teachers and students are ready for the AI-powered world.

Recommendations for Additional Studies

Although this systematic review provides a solid foundation for understanding the challenges of curriculum development in the era of artificial intelligence (AI), there are still many fields that need deep research. Future research should examine how these challenges interact with other important factors, such as encouraging teachers, participation of students, and school leadership. Since the educational systems are very different in cultures and regions, it is also important to discover how AI-related curriculum changes in different countries and educational settings.

Researchers should consider the basic factors that may affect how schools can react to AI integration - such as institutional support, digital culture, or teachers 'trust in teachers' technology. These elements can either strengthen or weaken the way to adopt curriculum changes. By studying these more complex relationships, future research can help us better understand how AI supports the development of effective and sustainable curricula in the world.

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