APPLICATION OF ARTIFICIAL INTELLIGENCE IN DESIGNING AND EVALUATING UNIVERSITY CURRICULA IN THE CONTEXT OF DIGITAL TRANSFORMATION

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Abstract: In the era of digital transformation, artificial intelligence (AI) offers unprecedented opportunities to innovate the design and evaluation of university curricula in line with international standards. This paper adopts a literature review approach, drawing on global research, policy reports, and accreditation frameworks (AUN-QA, ABET, CDIO) to analyze the role of AI. Findings reveal that AI supports the identification of learning outcomes, optimizes content and instructional organization, and enhances the quality of assessment and accreditation. The paper also highlights challenges in Vietnam and proposes directions for applying AI to improve higher education quality in the new context.

Keywords: Artificial intelligence, curriculum, higher education, evaluation, digital transformation

1. Introduction

Amidst globalization and rapid digital transformation, higher education worldwide is facing both unprecedented challenges and opportunities. The swift development of emerging technologies such as artificial intelligence (AI), Big Data, Machine Learning, and Learning Analytics has fundamentally reshaped teaching, learning, and curriculum design and evaluation. According to UNESCO (2023), digital transformation in education is no longer a mere trend but a prerequisite for ensuring quality, adaptability, and sustainability in global higher education systems.

AI holds a pivotal role with its capacity to personalize learning pathways, support the identification of learning outcomes, optimize curriculum content, and improve assessment efficiency. Research by Shimray and Subaveerapandiyan (2025) demonstrates that integrating AI into higher education enhances flexibility, enriches learner experience, and contributes to shaping data-driven education models. Moreover, international accreditation frameworks such as AUN-QA, ABET, and CDIO increasingly encourage AI adoption to ensure transparency, objectivity, and effectiveness in curriculum evaluation.

In Vietnam, digital transformation has been identified as a strategic priority in education development. The Prime Minister's Decision on "Digital transformation in education and training to 2025, with orientation to 2030" (2021) underscores the commitment to applying technology, particularly AI, in reforming governance and training activities in universities. However, implementation remains challenging due to uneven infrastructure, a shortage of high-quality human resources, and limited readiness to shift towards digitized and technology-integrated training models.

Against this backdrop, research into AI applications in curriculum design and evaluation in Vietnamese higher education is urgent. Such efforts not only aim to enhance quality in line with international standards but also enable institutions to adapt to digital transformation, meet the rising demands of the labor market, and align with global integration trends.

2. Content

2.1 Theoretical foundations of curriculum design and evaluation

2.1.1. Concept of university curricula under international standards

University curricula under international standards is a program designed and implemented based on globally recognized standards, ensuring transparency, consistency and meeting the requirements of the international labor market. Frameworks such as AUN-QA, ABET and CDIO are typical representatives of education quality accreditation models applied by many countries.

AUN-QA focuses on the compatibility between output standards and social needs and lifelong learning capacity (Tran Nhat Tan, 2020). ABET emphasizes education based on output standards (OBE), ensuring that learners achieve the identified core competencies (Nguyen & Nguyen, 2013). Meanwhile, CDIO emphasizes a training model that combines theory with practice and develops design-operation thinking through real projects (Pham et al., 2020).

Integrating international standards in program design helps improve training quality and integration capabilities, while also aligning with the digital transformation orientation in modern education

2.1.2. Outcome-based education (OBE)

OBE is a curriculum development model that places the competencies learners acquire after the learning process at its core. Rather than emphasizing teaching content or duration, OBE requires a clear specification of learning outcomes in terms of knowledge, skills, and attitudes that students must achieve. Based on these outcomes, appropriate content, teaching methods, and assessment strategies are then designed (Spady, 1994).

The OBE model has been widely implemented across many countries and serves as the foundation for international accreditation systems such as ABET and AUN-QA. According to ABET (2023), curriculum design must ensure coherence between educational objectives, learning outcomes, and assessment methods within a continuous improvement cycle. In the context of digital transformation, OBE also facilitates the integration of technologies such as learning analytics, artificial intelligence, and adaptive learning, thereby enhancing training quality and personalizing students' learning journeys (Nguyen et al., 2020).

2.1.3. The role of AUN-QA, ABET, and CDIO standards in quality assurance

In the context of globalization and digital transformation in education, international accreditation frameworks play a pivotal role in ensuring and enhancing the quality of higher education programs. Among the most widely adopted standards today are AUN-QA, ABET, and CDIO. While each system embodies its own philosophy, they all converge on the common goal of fostering learner competencies and driving continuous improvement.
AUN-QA (ASEAN University network – Quality assurance) is a quality assurance framework designed for universities in Southeast Asia. It emphasizes a comprehensive evaluation process, ranging from program objectives, learning outcomes, course content, and teaching methods to stakeholder feedback (Nguyen et al., 2017). Participation in AUN-QA accreditation enables institutions to strengthen their self-assessment capacity and advance regional educational integration.

ABET (Accreditation board for engineering and technology) is a globally recognized accrediting body in engineering and technology, with a strong focus on outcome-based education. ABET requires clear evidence of student competencies and alignment between program objectives, teaching activities, and assessment methods, all embedded within a continuous improvement cycle (ABET, 2023).

CDIO (Conceive – Design – Implement – Operate) , developed by MIT, is an educational framework that highlights the connection between academic knowledge and practical engineering skills. More than a set of standards, CDIO represents a training philosophy that integrates project-based learning, experiential education, and design thinking throughout the entire learning process (Pham et al., 2020).

Integrating these standards into curriculum design and accreditation not only helps Vietnamese universities progressively meet regional and international benchmarks, but also lays the foundation for innovation in educational governance, thereby addressing the demand for high-quality human resources in the digital era.

2.2. Application of artificial intelligence in curriculum design

2.2.1. AI in supporting the identification of learning outcomes and educational objectives

In outcome-based curriculum design for higher education, identifying the core competencies that learners must acquire plays a central role. Artificial Intelligence (AI) is opening new possibilities by analyzing large-scale datasets on labor markets, skill requirements across professions, and global trends, thereby proposing relevant and continuously updated learning outcomes (Chakraborty & Miettinen, 2023).

Machine learning algorithms are capable of processing millions of job postings and professional competency databases such as ESCO (EU) and O*NET (USA). From these sources, they can identify both technical skills and transferable soft skills that are prevalent across different fields of study. This information supports universities in developing learning outcomes aligned with societal needs, while adjusting educational objectives to correspond with national and international competency frameworks (Nguyen & Tran, 2022).

Moreover, AI facilitates the analysis of alumni data and employer feedback to assess the alignment between training objectives and employment realities. Predictive analytics models help detect shifts in occupational requirements, thereby providing timely and evidence-based recommendations for updating program objectives (Zawacki-Richter et al., 2019).

Integrating AI into the stage of defining learning outcomes not only enhances the accuracy and adaptability of curricula, but also enables educational institutions to build a flexible, market-oriented program development ecosystem that is well-suited to the digital transformation era.

2.2.2. AI in analyzing workforce demands and forecasting future skills

Artificial Intelligence (AI) enables the analysis and prediction of career trends by leveraging large-scale datasets from job postings, labor market reports, and professional social networks. Through machine learning techniques and natural language processing, AI can identify the skills currently prioritized by employers, thereby supporting universities in adjusting curricula to better align with real-world demands (OECD, 2021; Chakrabarti et al., 2023).

AI is also employed to forecast future skill requirements using time-series analysis and predictive modeling. Cross-disciplinary competencies such as data analytics, critical thinking, digital literacy, and adaptability are emerging as universal demands across multiple sectors (World Economic Forum, 2020). Integrating these analytical insights into curriculum design helps ensure stronger alignment between education and employment, particularly in the context of digital transformation.

2.2.3. Optimizing content, course structure, and knowledge volume

AI supports the optimization of academic programs by analyzing learning data, student feedback, and practical requirements from industry. Through machine learning algorithms and learning analytics, AI can identify overlapping, ineffective, or outdated content, thereby assisting in streamlining courses and restructuring curricula towards greater simplicity, efficiency, and flexibility (Zawacki-Richter et al., 2019).

AI also has the capacity to recommend the distribution of knowledge across courses based on their alignment with learning outcomes, level of difficulty, and optimal study duration. This enables learners to achieve better results within a reasonable timeframe. Furthermore, the application of AI in curriculum simulation models allows institutions to test the logical coherence and operational feasibility of new programs in advance, thereby reducing risks during actual implementation (Chakraborty & Miettinen, 2023).

2.3. Application of AI in teaching and assessment

2.3.1. Adaptive learning

Adaptive learning is one of the most prominent applications of AI in modern education. Adaptive learning systems employ AI to collect and analyze learner data in real time—including study progress, comprehension levels, errors, and interaction behaviors—in order to design personalized learning pathways for each student (Zawacki-Richter et al., 2019).

Unlike traditional one-size-fits-all teaching methods, adaptive learning allows the adjustment of content, format, and pace according to individual needs and abilities. For instance, high-performing students may be recommended advanced materials, while those facing difficulties are guided to revisit foundational content, supplemented with tailored learning suggestions (Baker & Smith, 2019).

Adaptive learning not only enhances academic performance but also strengthens learner autonomy and motivation. In the context of digital transformation, it represents a crucial solution that enables higher education to shift from a "one for all" model to a "one for each" approach in a flexible and scientifically grounded manner.

2.3.2. Artificial intelligence in developing question banks and automated grading

AI is playing an increasingly vital role in automating assessment activities in higher education. One of its most notable applications is the development of intelligent question banks and automated grading systems. AI can analyze curricula, learning outcomes, and student data to generate and recommend assessment questions across multiple cognitive levels-from recall to application and analysis-ensuring diversity, relevance, and balanced content (Tang et al., 2021).

In addition, AI-powered automated grading systems are capable of evaluating essays, reports, or student presentations quickly and consistently. These systems employ natural language processing (NLP) to analyze structure, content, and semantics, thereby providing scores along with personalized feedback (Balfour, 2013). This not only saves time for instructors but also enables timely feedback, contributing to improved learning outcomes.

The integration of AI into assessment further enhances reliability, objectivity, and scalability, making it possible to conduct evaluations effectively in large classes or online learning environments.

2.3.3. Monitoring learning progress, early feedback, and dropout risk detection

One of the key applications of AI in higher education is monitoring students' learning progress to provide early feedback and detect potential dropout risks. Through digital learning platforms, AI can collect real-time data such as login frequency, assignment completion rates, and interactions with learning materials and discussion forums (Ifenthaler & Yau, 2020).

Using machine learning algorithms, AI systems analyze learning behaviors to identify abnormal patterns-such as declining engagement, lower grades, or interruptions in study activities-in order to issue alerts about risks of lagging behind or dropping out. Some systems are even capable of suggesting early interventions, such as sending notifications, adjusting learning materials, or connecting students with academic advisors (Aljohani et al., 2019).

The application of AI in tracking learning progress not only enables personalized learner support but also enhances the efficiency of academic management, particularly in large classes and massive online learning environments.

2.4. The integration of AI with modern educational models

2.4.1. Blended learning và online learning with AI integration

The combination of AI and modern educational models such as blended learning and online learning is opening up significant opportunities for innovation in higher education. AI plays a central role in personalizing learning pathways, automating interactions, and optimizing content delivery in both hybrid and fully online environments

(Holmes et al., 2019).

In blended learning, AI supports effective coordination between face-to-face and online components by analyzing learning data to identify students' strengths and weaknesses, thereby tailoring interactive content accordingly. AI can also recommend study schedules, group activities, or supplementary resources, enabling instructors to enhance teaching effectiveness while maintaining personalization (Zawacki-Richter et al., 2019).

For online learning, AI is particularly valuable in managing large-scale classes, automating grading, monitoring learning progress, and providing timely feedback. Some advanced platforms even integrate academic chatbots, virtual assistants, and recommendation systems that suggest learning materials based on individual needs (Chen et al., 2020).

Integrating AI into blended and online learning not only optimizes the learning experience but also expands access to high-quality education in the context of digitalization and globalization.

2.4.2. Chatbots, virtual teaching assistants, and AI-supported student-instructor interaction

One of the most prominent applications of AI in higher education is enhancing interaction between students and instructors through tools such as chatbots, virtual teaching assistants, and instant AI feedback systems. These tools can answer academic questions, provide guidance on administrative procedures, send study reminders, or offer technical support around the clock, thereby reducing instructors' workload and improving the overall student experience (Winkler & Söllner, 2018).

Academic chatbots employ natural language processing (NLP) to communicate in human-like language, enabling students to easily access knowledge, ask questions about course content, or receive learning material recommendations. In certain cases, virtual teaching assistants can evaluate basic assignments, provide technical guidance, or simulate classroom interactions-particularly valuable in large classes or online learning environments (Chen et al., 2020).

Moreover, AI assists instructors in monitoring student engagement and feedback, allowing for personalized teaching approaches and early identification of learners who require additional support. This contributes to building a positive, flexible, and learner-centered educational environment.

2.5. Challenges and limitations in Vietnam

2.5.1. Technological infrastructure and data

One of the greatest barriers to integrating AI into higher education in Vietnam lies in the inconsistency of information technology infrastructure and the lack of standardized educational data. Many institutions, particularly those outside major urban centers, still face shortages of stable network facilities, dedicated servers, and sufficiently robust learning management systems (LMS) to implement large-scale AI solutions (Nguyen & Pham, 2022).

In addition, the quality and accessibility of learning data remain limited. Numerous universities lack systems for real-time collection and storage of learning data, often relying only on basic grade records. The absence of identity data, behavioral data, and learning feedback makes it difficult for AI algorithms to function effectively in analysis, personalization, or early warning systems (Tran, 2021).

Data sharing among institutions is also restricted due to privacy concerns, insufficient legal frameworks, and the absence of a unified interoperability mechanism across the higher education system. This represents a fundamental challenge that must be addressed before AI can be sustainably deployed.

2.5.2. Faculty and administrative capacity

The competence of faculty members and administrators is a decisive factor in determining the success of AI

adoption in higher education. However, in Vietnam, many lecturers lack foundational knowledge of educational technology, AI, and skills in utilizing learning data. According to a survey by the Ministry of Education and Training (2021), only about 27% of university lecturers possess basic understanding of AI and digital learning tools, with the majority still accustomed to traditional teaching methods.

Furthermore, educational administrators in many institutions are not adequately equipped to develop digital transformation strategies, evaluate the effectiveness of AI implementation, or manage learning data efficiently and in compliance with legal regulations (Nguyen & Le, 2022). Resistance to change, lack of trust in technology, and the absence of specialized training models also reduce the motivation for innovation within universities.

The lack of advanced digital competency training programs for faculty and administrators aligned with international standards constitutes a significant gap that must be filled if AI is to be implemented in a substantive and sustainable manner in Vietnamese higher education.

2.5.3. Policies, finance, and legal framework

The implementation of AI in higher education in Vietnam is facing significant barriers in terms of policy, finance, and legal frameworks. Although the National Digital Transformation Project in Education and Training (Decision 131/QĐ-TTg, 2021) has emphasized the importance of AI, specific policies on implementation guidelines, effectiveness evaluation, and technical standards remain inconsistent and have not kept pace with technological advancements.

From a financial perspective, most public universities struggle to mobilize resources for investment in AI infrastructure, intelligent learning software, and staff training. State budget allocations for digital transformation are still limited, while socialization models have not yet been effectively leveraged (Le & Vu, 2022).

On the other hand, the legal framework concerning personal data protection, learning data sharing, and the use of automated grading systems still contains major gaps. The absence of national standards for educational data governance, along with unclear regulations on rights, responsibilities, and ethical principles in applying AI within academic environments, poses a substantial challenge to the safe and effective adoption of AI across the higher education system.

2.6. Directions and recommendations for Vietnam

2.6.1. Developing digital competence for faculty

Enhancing the digital competence of faculty members is a crucial factor in the integration of AI into higher education. Lecturers not only need to master digital tools but also understand how AI systems operate in order to design interactive teaching content, utilize learning data, and provide effective feedback.

According to UNESCO (2022), faculty digital competence encompasses six key domains: technological literacy, digital pedagogy, learning data utilization, digital security and ethics, content creation, and innovation in teaching methods. However, in Vietnam, many lecturers have yet to access structured training programs aligned with international competency frameworks, particularly in relation to AI applications in teaching.

Therefore, it is essential to establish specialized training programs on digital competence and AI for faculty, based on standardized frameworks that integrate practical training, project-based learning, and updates on emerging technologies. At the same time, universities should encourage the development of internal digital learning communities to share experiences and foster innovation in teaching practices.

2.6.2. Building a shared database for higher education

A shared database is a critical foundation for the effective implementation of AI applications in higher education. Establishing an interconnected data system among institutions enables the aggregation, analysis, and utilization of learning, teaching, assessment, and administrative data, thereby supporting data-driven decision-making and

scientific curriculum improvement.

In Vietnam, however, educational data remains fragmented, insufficiently standardized, and inconsistent across universities. The absence of a unified learner identification system and the lack of open data-sharing mechanisms have limited the scalability of AI solutions. Moreover, there is still no clear legal framework regarding ownership, use, and protection of learning data.

To address these challenges, it is necessary to develop a national higher education data architecture with standardized datasets, transparent sharing regulations, and robust security measures. In addition, strengthening the connection between institutional databases, the Ministry of Education, and relevant agencies will create favorable conditions for AI applications to function effectively, accurately, and reliably.

2.6.3. Shaping program governance models in the context of digital transformation

Digital transformation in higher education does not merely involve the application of technology to teaching; it also requires a fundamental reform of program governance models. Instead of centralized, static, and bureaucratic management, institutions must shift toward flexible, data-driven, and learner-centered governance.

A modern governance model should integrate digital technologies throughout the entire cycle of program design, implementation, monitoring, and continuous improvement. Such a system should be supported by digital learning data platforms, automated feedback mechanisms, performance dashboards, and predictive tools for graduate outcomes. Moreover, the role of program committees must be redefined-from "procedural approval" to "governance based on competencies and learning outcomes."

In Vietnam, shaping a digital governance model demands comprehensive changes in management mindset, data literacy, and a legal environment conducive to innovation. This is an inevitable pathway to enhance the quality, flexibility, and adaptability of academic programs in response to practical demands and the rapid pace of technological change.

2.6.4. Strengthening international cooperation and connecting with global AI platforms

In a context where technology evolves rapidly and transcends borders, strengthening international cooperation and connecting with global AI platforms is a strategic priority for Vietnamese higher education to keep pace with global trends and enhance internal capacity. International educational AI platforms such as IBM Watson Education, Squirrel AI (China), Coursera Lab AI (USA), and OpenEdX provide advanced tools and learning analytics systems that universities can integrate to improve teaching quality and assessment.

International collaboration not only facilitates access to new technologies but also expands opportunities for academic exchange, cross-border training partnerships, and participation in global research networks on AI in education. Furthermore, Vietnam should intensify policy dialogue and share best practices with international organizations such as UNESCO, OECD, and ADB to learn from global experiences in governance and effective investment in digital transformation.

To achieve this, institutions must proactively develop digital integration strategies, enhance faculty competencies in both language and technology, and be prepared to share academic data in line with international standards. This will enable deeper participation in the global AI education ecosystem.

3. Conclusion

AI is playing an increasingly vital role in transforming higher education, particularly in the design and evaluation of outcome-based curricula. With its capacity to analyze big data, personalize learning pathways, optimize content, and automate assessment activities, AI has contributed significantly to enhancing the quality, efficiency, and adaptability of educational systems in the era of digital transformation.

The application of AI not only supports institutions in defining learning outcomes aligned with labor market demands but also enables the development of flexible, learner-centered curricula that comply with international accreditation standards such as AUN-QA, ABET, and CDIO. At the same time, AI helps improve teaching models, strengthen early feedback mechanisms, detect dropout risks, and facilitate data-driven decision-making.

Nevertheless, for AI to truly fulfill its strategic role in higher education, Vietnam must simultaneously address challenges related to technological infrastructure, faculty capacity, learning data, and legal frameworks. In particular, it is essential to establish digital governance models for academic programs, develop comprehensive digital competency frameworks for lecturers, and foster international cooperation in sharing technology and knowledge.

AI is no longer merely a supportive tool; it is becoming a foundational element in shaping modern educational models, aiming toward sustainable development, quality enhancement, and global integration in Vietnamese higher education..

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