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The Application of Artificial Intelligence in Personalized Learning in Vietnamese Higher Education: Current Situation and Implementation Model

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ABSTRACT: This study investigates the application of artificial intelligence (AI) in personalized learning within Vietnamese higher education in the context of digital transformation. Based on a literature review and comparative analysis, the research clarifies the current status of AI implementation in personalized learning at universities, while identifying major barriers related to technological infrastructure, learning data, digital competence, governance–legal mechanisms, and stakeholder collaboration. The findings reveal that several solutions—such as AI-integrated learning management systems, learner-support chatbots, and learning analytics tools—have been initially adopted. However, these efforts remain fragmented, lack standardization, and have yet to form a coherent approach. Accordingly, the paper proposes an AI implementation model consisting of five components: technological infrastructure, learning data, digital competence, governance–legal mechanisms, and multi-stakeholder collaboration. This model can serve as a reference framework for Vietnamese higher education institutions in developing AI adoption roadmaps to enhance the effectiveness of personalized learning and promote sustainable digital transformation in education.

KEYWORDS: personalized learning, digital transformation, higher education, implementation model, artificial intelligence

1. INTRODUCTION

Higher education today is strongly influenced by the digitalization process, which is evident in the transformation of training organization and learning management [2]. In this context, artificial intelligence (AI) has been applied as a solution to restructure teaching and learning activities toward greater flexibility, thanks to its capacity to process large-scale data and generate personalized learning recommendations [1,3]. One notable approach is the adjustment of learning activities based on learner data. AI-powered platforms analyze learners' behaviors and progress, thereby adapting learning content, designing appropriate pathways, and providing personalized feedback. This enhances learning effectiveness and fosters students' active engagement [3,4]. In Vietnam, several higher education institutions have piloted the integration of AI into online learning systems and teaching-support tools. However, implementation remains unsystematic, constrained by technical infrastructure, unstandardized learning data, uneven digital competence among faculty and students, and an incomplete legal framework [8]. Consequently, the outcomes of AI adoption have not yet met initial expectations. While many international studies have provided in-depth analyses of AI in education, most domestic research has focused only on specific aspects [1]. Therefore, a more comprehensive approach is needed to develop an implementation model tailored to Vietnam's practical conditions. In response to this need, the present study pursues two objectives: (i) to analyze the current status and barriers in applying AI for personalized learning in Vietnamese universities; and (ii) to propose a systematic implementation model, informed by international experience, to improve effectiveness and sustainability in the digital transformation of higher education.

2. RESEARCH CONTENT

2.1. Theoretical framework and research methodology

Personalized learning can be understood as the process of adjusting training content, teaching methods, and learning pace based on the individual characteristics and needs of each learner [3]. In higher education, this approach contributes to the shift from a uniform teaching model to a learner-centered organization of learning, in which students play a more active role in accessing and acquiring knowledge [4]. In this context, AI serves as a technological foundation enabling the large-scale implementation of personalized learning. By analyzing learning data, AI systems are capable of identifying behavioral patterns, assessing levels of comprehension, and recommending content tailored to each individual [1]. Moreover, AI supports the adjustment of learning material difficulty and generates feedback during the learning process, helping learners continuously improve their outcomes [4]. The recent development of generative AI technologies has further expanded the potential applications in education. These tools allow for more flexible design of learning content and support the creation of exercises and feedback adapted to specific contexts [6]. However, the effectiveness of AI adoption depends not only on technological capabilities but also on the quality of input data, the maturity of technical infrastructure, and learners' ability to use digital technologies [9].

Regarding research methodology, this study employs a literature synthesis approach combined with content analysis and comparison. Data were collected from scientific publications, reports by international organizations such as OECD, UNESCO, and the World Bank, as well as

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studies related to AI applications in higher education [1,11]. The selection of materials was based on relevance, timeliness, and reliability of sources. On this basis, the research systematizes content, analyzes the current situation in Vietnam, and compares it with international experiences to highlight similarities and differences, thereby deriving insights of reference value. The analytical framework of the study is structured around four key dimensions: technology, data, human factors, and institutional mechanisms. This approach enables a comprehensive examination of the issue and provides a foundation for proposing an AI implementation model for personalized learning that is suitable for the practical conditions of Vietnamese higher education.

2.2. Current status of AI application in personalized learning

At the international level, the exploitation of AI in personalized learning activities has reached a relatively advanced stage and is often implemented through systematic approaches. In many countries, AI is directly integrated into learning management platforms, thereby supporting the collection and analysis of learner-related data to adjust content and guide learning pathways in accordance with individual capabilities [1,9]. In addition, the emergence of adaptive learning platforms, virtual assistants, and learning behavior analytics tools has enhanced the ability to support learners during the learning process. These tools not only provide feedback throughout learning but also enable early identification of potential difficulties learners may encounter, thus offering timely and more individualized support [5]. The recent development of generative AI technologies has further expanded the scope of applications in education. With these tools, learning content can be designed more flexibly, exercises can be adapted to specific contexts, and feedback can be personalized to a higher degree [6]. In countries such as the United States, the United Kingdom, Singapore, and South Korea, AI is no longer implemented in isolation but has become an integral component of higher education development strategies based on digital foundations, with strong interconnections among technology, data, and governance policies [1,7].

In this context, personalized learning is regarded as a crucial element within the digital education ecosystem, rather than merely a separate supportive solution. The differences between approaches in developed countries and Vietnam are illustrated through comparative criteria presented in Table 1.

Table 1. Comparison of AI implementation in personalized learning between international contexts and Vietnam

Criteria	International	Vietnam
Level of implementation	Systematic, large-scale	Fragmented, uneven
Technological infrastructure	Advanced, AI integrated into LMS	Unsynchronized, limited resources
Learning data	Standardized, interoperable	Fragmented, lacking standardization
AI applications	Adaptive learning, virtual teaching assistants, learning analytics	AI-integrated LMS, chatbots, basic analytics
Legal framework	Well-developed, supported by national strategies	In progress, not yet complete
Digital competence	High, with structured training	Uneven
Collaboration	Strong among univ*]*, ersities, enterprises, and government	Limited

Source: Compiled by the authors from [1], [5], [8 [9]

In Vietnam, the integration of AI into personalized learning activities remains at an early stage of implementation. The most common applications primarily focus on AI-integrated learning management systems, learner-support chatbots, and several basic data analytics tools [8,9]. These solutions have initially improved access to learning materials, accelerated feedback, and enhanced interaction in digital learning environments. Some higher education institutions have also experimented with using AI to suggest learning pathways and monitor students' progress. However, implementation across institutions lacks consistency and largely depends on the specific conditions of each university. Institutions with advantages in technical infrastructure or partnerships with technology enterprises tend to access more advanced solutions, while many others face difficulties due to limited financial resources and technological capacity. Moreover, learning data are not yet organized in a centralized manner and do not follow a unified standard, creating challenges for system integration. At the same time, the legal framework related to the use of AI in education is still under development, resulting in fragmented implementation and the absence of coherent coordination [8]. Overall, although AI has begun to be applied in personalized learning in Vietnam, its level of development remains significantly behind that of developed countries, particularly in terms of systematization, integration, and implementation effectiveness. This situation provides an important basis for further analysis of barriers and the development of an implementation model suited to the practical conditions of Vietnamese higher education.

2.3. Barriers to AI implementation

Although AI has begun to be introduced to support personalized learning activities in Vietnamese higher education institutions, its practical implementation still faces numerous systemic obstacles that limit both effectiveness and scalability. One prominent issue relates to technical infrastructure. In many cases, existing technological systems do not fully meet the requirements for processing large-scale data or operating intelligent learning platforms. The lack of synchronization among servers, networks, and end-user devices makes it difficult for AI applications to maintain stable performance, particularly in tasks requiring continuous processing and near real-time feedback [8]. In addition to technological factors, learning data also represents a critical bottleneck. At present, learner-related information is often stored across multiple systems such as training management platforms, online learning environments, and digital repositories. The absence of a unified data standard complicates connectivity and integration, thereby reducing the potential for data exploitation in AI applications and limiting the effectiveness of personalized learning solutions [1,9]. Furthermore, digital competence among stakeholders remains uneven. A portion of faculty members have not been adequately equipped with the knowledge and skills needed to integrate AI into teaching activities, while students primarily engage with AI tools at a basic level. This disparity prevents the full potential of AI technologies from being effectively realized in practice [10]. Another barrier arises from institutional and ethical considerations. Regulations related to data security, privacy, algorithmic transparency, and academic

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accountability have not yet been fully developed. This creates concerns during the implementation and use of AI in educational environments, particularly when involving learners' personal data [1,11].

These factors are not isolated but closely interconnected. Limitations in technological infrastructure reduce data processing capacity; unstandardized data undermines algorithmic effectiveness; while incomplete digital competence and legal frameworks continue to hinder large-scale deployment. These challenges indicate that the application of AI in higher education cannot be approached solely from a technological perspective, but must be examined within the overall relationship among data, human factors, and institutional mechanisms. Therefore, overcoming current barriers and enhancing implementation effectiveness requires a systematic and integrated approach. This forms the foundation for proposing an implementation model tailored to the practical conditions of Vietnamese higher education, as discussed in the following section.

2.4. AI implementation model for personalized learning

Based on the analysis of current implementation practices and the limitations identified, this study proposes a comprehensive approach to applying AI in personalized learning. The model consists of five key components: technological infrastructure, learning data, digital competence, governance–legal mechanisms, and stakeholder collaboration. These elements do not exist independently but are closely interconnected, collectively forming the foundation for effective and sustainable AI implementation [1,9].

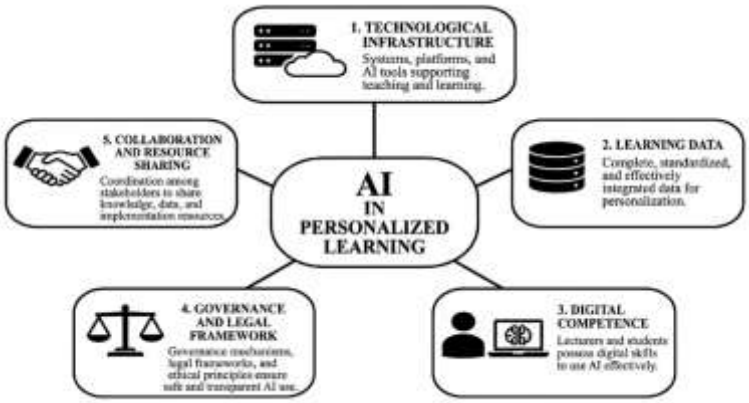


Figure 1. AI implementation model in personalized learning

(Source: Model developed based on the author's synthesis of research findings)

In the proposed structure, technological infrastructure serves as the foundation of the entire system. Investments in solutions such as servers, cloud computing platforms, AI-integrated learning management systems, and high-speed connectivity infrastructure ensure the capacity to process large-scale data and support responsive learning interactions. The maturity of infrastructure directly influences scalability and future system interoperability [8]. Learning data are considered a critical input for personalization. When data are systematically collected, centrally organized, and aligned with common standards, AI algorithms can effectively analyze learners' behaviors, competencies, and needs. This provides the basis for generating appropriate learning recommendations while reducing data fragmentation across systems [1,9]. Moreover, the effectiveness of AI implementation depends on participants' digital competence. Faculty members need the ability to integrate AI tools into instructional design, while students must actively engage with digital learning platforms. Enhancing digital skills not only enables better utilization of existing tools but also supports continuous learning in digital environments [10]. Governance and legal mechanisms play a guiding and regulatory role in implementation. Establishing regulations related to data security, privacy, algorithmic transparency, and academic accountability helps mitigate risks and build trust in the application of AI in education [1]. Additionally, multi-stakeholder collaboration is essential for scaling implementation. Coordination among regulatory agencies, educational institutions, and technology enterprises contributes to mobilizing financial, human, and technical resources. Strengthening international cooperation and sharing digital learning resources also facilitates access to advanced technologies and enhances domestic implementation capacity [9]. The components of the model are mutually reinforcing. Infrastructure and data provide the technical foundation for AI systems; digital competence ensures effective utilization; governance mechanisms guide and regulate processes; while collaboration expands and sustains implementation. For the model to be effectively applied in practice, regulatory agencies must provide strategic direction, while educational institutions should proactively invest in infrastructure, standardize data, and enhance digital competence among faculty and students. Overall, the five-component model offers a systematic approach to applying AI in personalized learning. Its key contribution lies in simultaneously addressing technological, data, human, and institutional factors within a unified structure, thereby supporting higher education institutions in developing implementation roadmaps aligned with practical conditions and long-term development goals.

2.5. Implications of model implementation for Vietnamese higher education

The implementation of the AI model for personalized learning in Vietnamese universities should be approached in a systematic manner, with clear roadmaps and coordinated efforts among multiple stakeholders. First, government agencies need to play a guiding role by issuing policies, data standards, and regulations on information security, privacy, and academic accountability in the use of AI in education. These are essential conditions for establishing a safe, transparent, and unified legal framework for higher education institutions.

For universities, AI implementation should not be limited to the use of individual tools such as chatbots, learning management systems, or data analytics software, but should be integrated into the institution's overall digital transformation strategy. Higher education institutions should prioritize investment in technological infrastructure, standardization and interoperability of learning data, and the enhancement of digital

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competence among faculty and students. When infrastructure, data, and human resources are interconnected, AI can effectively identify learners' needs, propose suitable learning pathways, and provide timely feedback.

In addition, the involvement of technology enterprises and related partners is crucial in providing technical solutions, intelligent learning platforms, and implementation resources. Collaboration among universities, enterprises, and government agencies helps reduce the burden of individual investments while facilitating the sharing of experiences, digital learning resources, and data for personalized learning. Furthermore, expanding international cooperation enables Vietnamese universities to access advanced models, technologies, and governance standards for AI.

Thus, the five-component model is not only significant as a theoretical framework but can also serve as a practical guiding tool. Implementation should be carried out in phases: beginning with an assessment of readiness in infrastructure, data, and digital competence; followed by the selection of appropriate AI applications; and finally, the completion of governance mechanisms and expansion of collaboration to ensure sustainability.

3. CONCLUSION AND RECOMMENDATIONS

3.1 Conclusions

The findings indicate that the integration of AI into personalized learning activities is gradually becoming a clear orientation in higher education within the current context of digitalization. With its ability to process learning data and generate tailored recommendations, AI contributes to the development of flexible learning pathways, thereby improving the learning experience and enhancing learner autonomy. However, practical implementation in Vietnam reveals that AI adoption still faces significant limitations related to technological infrastructure, data organization, readiness in digital competence, and the maturity of regulatory frameworks. These factors hinder the necessary level of integration and pose challenges to scaling up implementation. The five-component model proposed in this study provides a systematic reference framework in which technology, data, human factors, governance, and collaboration are considered in an interconnected manner. This approach enables higher education institutions to design implementation roadmaps aligned with practical conditions, rather than applying isolated technological solutions. For the model to be effectively implemented, coordination among stakeholders is essential. Government agencies play a guiding role by developing policies and completing the legal framework; universities must proactively invest in infrastructure, reorganize data, and enhance digital competence among faculty and students; while technology enterprises can provide solutions and resources. At the same time, expanding international cooperation contributes to accessing new experiences and technologies. Overall, the application of AI in personalized learning is not merely a technical solution but is closely linked to the long-term development orientation of higher education. The proposed model can serve as a reference framework for building AI implementation strategies, supporting institutions in adapting to innovation requirements in the digital education context.

3.2 Recommendations

For government agencies, it is essential to continue refining policies and the legal framework for AI applications in higher education. The focus should be on establishing regulations concerning learner data security, privacy, academic accountability, algorithmic transparency, and ethical principles for AI use in educational environments. In addition, common standards for learning data, interoperability among digital platforms, and minimum requirements for AI systems used in universities should be issued. These measures will provide the foundation for universities to implement AI in a unified, safe, and controllable manner.

For universities, AI application in personalized learning should be considered a central component of their digital transformation strategy, rather than merely the adoption of isolated technological tools. Institutions need to develop implementation roadmaps aligned with practical conditions, beginning with assessments of readiness in technological infrastructure, learning data, and digital competence of faculty and students. Based on this, universities should prioritize investment in intelligent learning management systems, standardization and interoperability of learning data, and gradually deploy tools such as student-support chatbots, learning analytics systems, and personalized learning pathway recommendation platforms.

For faculty members and academic administrators, it is necessary to proactively enhance digital competence and AI literacy in teaching, management, and learner support. Faculty should receive training in digital content design, learning data utilization, and the use of AI tools in lesson development, assessment, and personalized feedback for students. Academic administrators should be capable of analyzing data to monitor learning progress, identify early risks, and support decision-making in academic management. Strengthening the capacity of these groups is a critical condition for ensuring AI is used appropriately and effectively in practice.

For students, it is important to develop the ability to use AI proactively, responsibly, and in accordance with academic standards. Students should be equipped with skills to leverage AI tools for self-learning, resource searching, practice, feedback, and personalized learning pathway development. At the same time, they must be aware of AI's limitations and risks, verify information, protect personal data, avoid overdependence on technology, and refrain from using AI in ways that violate academic integrity. When learners use AI responsibly, personalized learning can truly enhance autonomy and learning effectiveness.

For technology enterprises and related partners, stronger collaboration with universities is needed in developing, piloting, and transferring AI solutions suited to the practical conditions of Vietnamese higher education. Enterprises can support the development of intelligent learning platforms, learning analytics systems, virtual assistant tools, and data security solutions. Collaboration between universities and enterprises should aim for long-term goals, ensuring that technological solutions not only meet technical requirements but also align with educational objectives, learner characteristics, and institutional capacities.

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