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Developing an adaptive learning platform based on artificial intelligence (AI) to personalize the learning experience

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Abstract

This study explores the development and user experience of an artificial intelligence (AI)-based adaptive learning platform to personalize the learning experience. The main objective of the study is to elucidate the factors that influence the success of platform implementation and evaluate its impact on learning personalization. Through qualitative research methods, including in-depth interviews, observations, and document analysis, data was collected from stakeholders such as developers, teachers, and students. The results show that close collaboration between technology, education, and user experience design experts is a key factor in platform development. Users appreciated the platform's personalization and interactivity, and pointed out some areas for improvement. This research makes an important contribution to expanding understanding of the development and deployment of AI-based adaptive learning platforms, as well as its impact on personalization of learning experiences. The research results provide practical suggestions for applying AI in education and provide direction for future research in this field.

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1. Introduction

In an educational context that is rapidly transforming under the impact of digital technology, personalizing learning experiences is becoming an urgent requirement to meet the diverse needs of learners (Peng *et al.*, 2019) ^[16]. Personalized learning not only helps optimize each individual's acquisition of knowledge and skills, but also contributes to increased motivation, engagement, and overall learning outcomes (Walkington, 2013) ^[18]. In that context, the application of artificial intelligence (AI) in education, especially in the development of adaptive learning systems, is receiving increasing attention from researchers and educators. education (Xie *et al.*, 2019; Zawacki-Richter *et al.*, 2019) ^[22].

Although the potential of AI to personalize learning is enormous, the successful development and deployment of AI-based adaptive learning platforms still faces many challenges. These challenges include building rich learning databases, developing effective AI algorithms, ensuring user experience, and evaluating the impact of these systems on learning (Baker, 2016; Luckin *et al.*, 2016) ^[1, 11]. Besides, a deeper understanding of the development and deployment of AI-based adaptive learning platforms from the perspective of stakeholders, such as developers, teachers, and learners, is still limited. mechanism in existing studies (Kulik & Fletcher, 2016) ^[9].

Therefore, comprehensive and in-depth research on the process of developing, deploying and evaluating the effectiveness of AI-based adaptive learning platforms is extremely necessary. This research gap requires a combination of qualitative and quantitative research methods, as well as the participation of stakeholders to have a multi-dimensional and practical view of the problem.

Stemming from the above practice, this research was conducted with the goal of exploring the process of developing an adaptive

learning platform based on AI, user experience and its impact on personalization of learning. By applying a qualitative research approach, this study aims to fill the gap in understanding the development and implementation of adaptive learning platforms, while providing valuable information for improving the application of AI in education in general and personalizing learning in particular. The results of the research will make an important contribution to guiding the development and effective application of adaptive learning platforms in the future, thereby promoting innovation and improving educational quality.

2. Theoretical overview

2.1. Theory of adaptive learning

Adaptive learning is a method of teaching and learning in which the content, methods, and pace of learning are adjusted based on individual needs, abilities, and learning styles (Brusilovsky & Peylo, 2003) ^[3]. Adaptive learning theory is based on the principles of personalized learning theory (Bloom, 1984) ^[2] and theory of multiple intelligences (Gardner, 1983) ^[6]. Studies have shown that applying adaptive learning improves learner motivation, engagement, and learning outcomes (Oxman & Wong, 2014; Walkington, 2013) ^[14, 18].

2.2. Theory of artificial intelligence in education

Artificial intelligence (AI) plays an important role in realizing adaptive learning. AI techniques such as machine learning, natural language processing and recommender systems allow the construction of intelligent learning systems, capable of automatically adjusting and personalize learning experiences (Luckin *et al.*, 2016) ^[11]. AIED theory focuses on research and development of intelligent systems to support teaching and learning (Woolf, 2010) ^[19]. AIED combines principles of computer science, cognitive science, and educational learning to create technology solutions that meet the diverse needs of learners (Roll & Wylie, 2016) ^[17].

3. Related research

Many studies have shown the potential of applying AI in education, especially in personalizing learning. For example, research by Kulik and Fletcher (2016) ^[9] synthesizes results from 50 studies on intelligent tutoring systems and shows that these systems significantly improve learning outcomes of learners. The study by Xie *et al.* (2019) ^[20] analyze AI applications in education and highlight their role in promoting personalized learning. However, studies also highlight challenges in developing and deploying AI-based adaptive learning systems, such as designing effective algorithms, ensuring user experience, and evaluating impact of them (Baker, 2016; Luckin *et al.*, 2016) ^[1, 11]. A deeper understanding of the development and deployment of AI-based adaptive learning platforms from the perspective of stakeholders is still limited and requires further research (Kulik & Fletcher, 2016) ^[9].

3. Research Methods

3.1. research design

This study uses qualitative research methods, with a case study design (Yin, 2018) ^[21]. This design allows for an in-depth exploration of a specific case, the development and deployment of an AI-based adaptive learning platform, through the collection and analysis of data from multiple

sources. each other (Creswell & Poth, 2016) ^[20]. The case study design aligns with the goals of the research, helping to shed light on the platform development process, user

experience, and its impact on personalized learning.

2. Sample and how to choose a sample

The study used purposive sampling to select research participants (Patton, 2015) ^[15]. The study sample included stakeholders involved in the development and implementation of the adaptive learning platform, including: (1) platform developers (software engineers, AI experts, experience designers users), (2) teachers and (3) learners. Sample selection criteria were based on direct involvement in the development or use of an adaptive learning platform for at least 6 months. The expected sample size is 20-30 people, ensuring enough rich and diverse information to answer the research question (Morse, 2000) ^[13].

3. Data collection method

The study uses three main data collection methods: (1) semi-structured in-depth interviews, (2) non-participant observation and (3) document analysis (Merriam & Tisdell, 2016) ^[12].

- Semi-structured in-depth interviews were conducted with research participants, based on pre-developed interview guides. Interview questions focused on the platform's development, usage experience, and evaluating its impact on personalized learning.

- Non-participant observations were conducted during learning sessions and using the adaptive learning platform, to collect data about users' actual experiences and their interactions with the platform.

- Document research includes collecting and analyzing documents related to the platform development process, such as design documents, project reports, user manuals, and user feedback.

4. Data analysis method

The collected data were analyzed using qualitative content analysis (Hsieh & Shannon, 2005) ^[8]. The analysis process includes the following steps: (1) coding data, (2) identifying themes and categories, (3) finding relationships between themes and categories and (4) interpret the meaning of the data (Creswell & Creswell, 2018) ^[4]. NVIVO software was used to support the data analysis process.

5. Ensure the reliability and authenticity of the research

To ensure the reliability and validity of the study, the following measures were taken: (1) use multiple data sources (2) perform member checking, (3) thick description and (4) reflective thinking (Lincoln & Guba, 1985) ^[10]. In addition, the research process is described in detail, and the stages of data analysis and interpretation are carried out in a transparent and systematic manner, ensuring the consistency and logic of the research results.

4. Research results

4.1. Describe the process of developing an AI-based adaptive learning platform

Data analysis results show that the process of developing an AI-based adaptive learning platform includes the following main stages: (1) Identifying the needs and goals of the platform; (2) System architecture design and technology

selection; (3) Develop AI algorithms and models; (4) User interface design and learning experience; (5) System testing and fine-tuning; and (6) Implementation and user training.

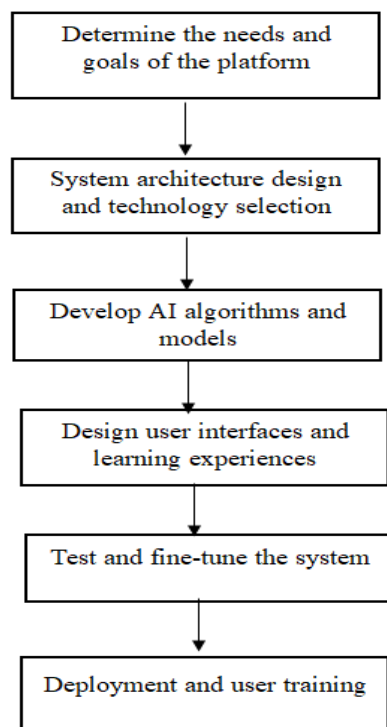


Fig 1: Stages of AI-based adaptive learning platform development

The developers emphasized the importance of close collaboration between technology, education, and user experience design experts throughout the platform development process. They also pointed out key challenges, including: (1) Building a rich and diverse learning database; (2) Develop efficient and scalable AI algorithms; (3) Friendly and easy-to-use user interface design; and (4) Ensure security and confidentiality of user data.

4.2. User experience and feedback about the platform

Interview and observation results show that the majority of users (teachers and learners) evaluate the experience of using the adaptive learning platform positively. They appreciate the ability to personalize content and learning methods based on each individual's needs and progress. Users also appreciate the interactivity and timely support of AI features, such as study material suggestions, automatic feedback, and learning support chatbots.

However, some users also pointed out points that need improvement, including: (1) Increasing the accuracy and relevance of learning suggestions; (2) Improve chatbot's natural language processing ability; and (3) Adding features that support social learning and collaboration.

4.3. The impact of platforms on personalizing learning experiences

Research results show that AI-based adaptive learning platforms have a positive impact on personalizing learning experiences. Teachers and learners both see significant progress in adjusting content and learning methods to suit each individual. Learners report increases in motivation, engagement, and learning outcomes when using the platform. Analysis of data from the system also shows significant improvements in learning time, lesson completion rate and

learner assessment results when using the adaptive learning platform. This result reinforces the effectiveness of applying AI in personalizing learning experiences.

However, the study also points out some challenges in assessing the long-term impact of the platform, especially on the development of higher-order thinking skills and the ability of learners to self-directed learning. Additional longitudinal studies are needed to elucidate the impact of adaptive learning platforms over the long term.

5. Discussion

5.1. Interpretation of research results

The study results provide evidence of the successful development and implementation of an AI-based adaptive learning platform, as well as its positive impact on personalizing the learning experience. This result is consistent with previous studies on the potential of AI to promote personalized learning (Kulik & Fletcher, 2016; Xie *et al.*, 2019) ^[9, 20].

However, the study also points out challenges in platform development, such as building a rich learning database, developing effective AI algorithms, and ensuring data security. These challenges reflect common problems in applying AI to education, as mentioned in previous studies (Baker, 2016; Luckin *et al.*, 2016) ^[11].

5.2. Compare the results with theory and previous studies

This research result strengthens and expands the theory of adaptive learning and AI applications in education. Specifically, the study provides empirical evidence of AI's ability to support adaptive learning, consistent with the principles of personalized learning theory (Bloom, 1984) ^[2] and multiple intelligences theory. (Gardner, 1983) ^[6].

At the same time, this study contributes to the knowledge base on AI applications in education by providing insights into the development and implementation of an AI-based adaptive learning platform, an aspect is still limited in previous studies (Kulik & Fletcher, 2016) ^[9].

5.3. Limitations of the study and future research directions

Despite the encouraging results, this study still has some limitations that need to be considered. First, the study only focused on one specific case, so the generalizability of the results may be limited. Second, the study relied mainly on qualitative data, so more quantitative studies are needed to evaluate the impact of adaptive learning platforms more comprehensively.

In the future, more research is needed on the application of AI in personalizing learning across different contexts and audiences, to expand understanding of the effectiveness and challenges of this method. In addition, longitudinal studies are needed to evaluate the long-term impact of adaptive learning platforms on learners' development, especially in terms of higher-order thinking skills and self-directed learning ability.

Other research directions include: (1) Developing methods to evaluate and improve the transparency, accountability and fairness of AI systems in education; (2) Explore the combination of AI and traditional pedagogical methods to optimize the learning experience; and (3) Research on ethical and social aspects of applying AI in education.

6. Conclude

6.1. Summary of key findings

This study explored the development and deployment of an AI-based adaptive learning platform, the user experience, and its impact on learning personalization. The results show that the platform development process requires close coordination between technology, education and user experience design experts, and faces many challenges such as building a database, developing AI algorithms and ensuring data security.

Users, including teachers and learners, were generally positive about the experience of using the platform and its ability to personalize learning. Research results also show the positive impact of the platform on learners' motivation, engagement and learning outcomes. However, more research is needed to evaluate the long-term impact of adaptive learning platforms on learner development.

6.2. Research contributions

This research has made an important contribution to the knowledge base on the application of AI in education, specifically in the development and deployment of adaptive learning platforms. The research results provide practical evidence of the feasibility and effectiveness of using AI to personalize learning experiences, while also pointing out challenges and issues that need to be addressed in the development and implementation process. Deploy these systems.

By applying a qualitative research approach, this study provided an in-depth and comprehensive perspective on the adaptive learning platform development process, from the perspectives of different stakeholders. The research results not only strengthen and extend the theory of adaptive learning and AI applications in education, but also provide practical suggestions for improving the design, development and deployment of AI platforms. Similar platforms in the future.

6.3. Implications for policy and practice

The results of this study provide many important policy and practice implications for the development and application of AI-based adaptive learning platforms. First, education policymakers need to be well aware of AI's potential to personalize learning and invest adequate resources to promote research and development of adaptive learning platforms.

Second, educational institutions need to consider integrating adaptive learning platforms into their teaching and learning strategies, and be prepared in terms of infrastructure, human resources, and expertise. Subjects to effectively deploy these systems.

Third, developing adaptive learning platforms requires close collaboration between technology, education, and user experience design experts, as well as the participation of other stakeholders such as educators, staff and learners. This requires a change in approach and coordination between relevant fields and units.

Finally, there is a need for clear policies and regulations regarding data protection and user privacy in the development and deployment of AI-based adaptive learning platforms. This will help increase user trust and acceptance of these new technologies.

In summary, this research has contributed to clarifying the development and application of AI-based adaptive learning platforms, and opened up many future research and development directions. Continued investment in research

and deployment of AI-based adaptive learning solutions in a responsible and sustainable manner will play an important role in improving the quality and effectiveness of education in the digital era.

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