
ANALYTICAL STUDY ON AI UTILIZATION TO ENHANCE STUDENT LEARNING EFFECTIVENESS VIA CONTENT PERSONALIZATION SYSTEM

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Abstract

The adoption of Artificial Intelligence (AI) in Indonesia's education sector has become a transformative force, addressing challenges such as unequal access to resources and varying student capabilities. This study aims to analyze AI's role in enhancing learning effectiveness by personalizing educational content to meet individual needs. Using platforms like Ruangguru, data-driven algorithms assess students' progress and tailor curriculum delivery. The research employs a mixed-method approach, combining statistical analysis of AI application impacts with qualitative insights from educators and students. Results indicate improved engagement and learning outcomes, particularly in urban settings, though infrastructural and training gaps persist in rural areas. The study concludes that while AI significantly enriches learning personalization, sustainable implementation requires resolving digital divides, enhancing teacher preparedness, and safeguarding data privacy for a more inclusive education system. This study explores the integration of Artificial Intelligence (AI) in enhancing educational effectiveness in Indonesia through personalized learning systems. The research aims to evaluate AI's role in addressing educational disparities and improving student engagement. Utilizing a qualitative approach, data were collected from case studies of AI-driven platforms like Ruangguru and Zenius. Results indicate significant improvements in adaptive learning efficiency and early detection of learning difficulties. However, challenges such as limited internet accessibility and teacher training hinder widespread adoption. The findings underscore AI transformative potential in creating an equitable and dynamic education system in Indonesia.

Keywords: Artificial intelligence, Education, Methods, Personalized learning.

INTRODUCTION

The development of artificial intelligence (AI) technology has brought significant changes in various fields, including education. AI enables more adaptive and personalized learning systems, thereby meeting the unique needs of each student. In the context of modern education, content personalization through AI has become a key strategy to enhance learning effectiveness, both in terms of material comprehension and time management. Previous research shows that AI-based learning can help students reach their maximum potential by providing content tailored to their learning styles, abilities, and pace. (Zawacki-Richter, 2019).

Moreover, the content personalization approach enables educational institutions to address the challenges faced in classrooms with a large number of students and diverse abilities. AI-based systems such as real-time lesson material adaptation and data-driven learning have proven to enhance student engagement and overall academic outcomes. (Chen, 2021). On the other hand, this personalization is also relevant in supporting Human Resource Management (HRM) in

education, particularly for the training and development of educators' skills. HRM integrated with AI can identify specific training needs for teachers, thereby supporting the creation of a more effective learning environment. (Sarker, 2020).

The adoption of AI in education is also in line with the vision of 21st-century learning, which emphasizes critical, creative, collaborative, and communicative thinking skills. Through advanced data analysis, AI can detect students' strengths and weaknesses, provide relevant feedback, and design a more targeted curriculum. This has been demonstrated in online learning systems that utilize AI to increase student retention by up to 70% compared to traditional methods (Huang, 2022).

However, the implementation of AI in education faces challenges, such as potential algorithmic bias and concerns related to student data privacy. Therefore, it is important to ensure transparency in the design of AI systems, as well as to involve technology experts and educators in the development of AI solutions for learning. (Nguyen, 2021). Moreover, the importance of a strong regulatory framework becomes a priority to ensure that the application of this technology adheres to educational ethical standards. With a focus on Information Management students at Sriwijaya State Polytechnic, this research aims to analyze how AI can enhance learning effectiveness through content personalization. This research is not only relevant for the development of the local curriculum but also contributes to the global literature on AI-based education. Through this research, it is hoped that more holistic solutions can be formulated to support an adaptive, effective, and technology-based teaching and learning process.

LITERATURE REVIEW

Artificial Intelligence

Artificial Intelligence (AI) or kecerdasan buatan is a branch of computer science that aims to create systems or machines that can perform tasks requiring human intelligence. Examples of AI capabilities include natural language processing, voice recognition, decision-making, and learning from data to improve system performance. According to Russell and Norvig (2020), AI is defined as technology that enables computers to act "intelligently" by simulating human cognitive functions such as learning and problem-solving. AI is divided into three types based on its functions:

1. Narrow AI is a system designed for a specific task, such as a virtual assistant or product recommendations.
2. General AI is a system that can understand and perform various tasks like a human.
3. Superintelligence AI is the potential of AI to be more intelligent than humans in all cognitive aspects.

Personalized Content

Personalized content is a strategy for delivering information tailored to the preferences, needs, or behaviors of individuals. In the context of technology, AI-based systems are often used to create this personalization by analyzing user data in real-time. According to Kumar and Reinartz (2018), content personalization aims to enhance the relevance of information so that users feel more connected to the product or service. The main features of content personalization include:

1. Data Analysis: Using historical data to understand user preferences.
2. Dynamic Optimization: Automatic adjustment of information based on user interactions.
3. Content personalization has been widely applied in the fields of education, digital marketing, and user experience management.

Human Resource Management (HRM)

Human Resource Management (HRM) is a strategic practice that focuses on managing the workforce within an organization. HRM includes various activities such as recruitment, training, employee development, compensation management, and maintenance of labor relations. According to Armstrong (2020), HRM aims to maximize employee productivity while ensuring their well-being is met. The main components of HRM include recruitment and selection, which is the process of finding and placing the right employees, followed by training and development to enhance skills to meet job demands, Performance Management to assess and develop employee performance, and compensation to manage salaries, incentives, and benefits

Education

Education is a systematic process to develop the potential, abilities, and skills of individuals through learning. UNESCO (2022) defines education as a means to achieve social transformation and economic progress through the transfer of knowledge, values, and skills. Education can be categorized into three main forms: first, formal education, which takes place in official institutions such as schools and universities; second, non-formal education, which can include training or courses outside the formal academic structure; and third, informal education, which involves learning from everyday experiences without a specific structure or curriculum.

RESEARCH METHOD

This research method uses a mixed approach, namely qualitative and quantitative, to obtain both in-depth and measurable data. The qualitative approach is used to analyze students' perceptions regarding the effectiveness of AI-based learning through in-depth interviews and observations, while the quantitative approach is applied to measure the impact of the AI-based content personalization system on students' learning outcomes by comparing pretest and posttest results. This research is descriptive-analytical in nature, encompassing three main stages: needs analysis to understand the role of AI technology in learning, development of a prototype model of the AI-based content personalization system, and testing to assess the model's effectiveness in improving understanding and learning outcomes.

The research was conducted at Politeknik Negeri Sriwijaya, focusing on students of the Information Management study program. The research participants were randomly selected, consisting of 50 students who have access to digital devices and are familiar with technology-based learning applications. Data were collected through various methods, including questionnaires to obtain students' perceptions, in-depth interviews to explore their experiences, as well as pretests and posttests to objectively measure learning outcomes. Documentation of students' academic data is also used as additional support.

The research instruments include a questionnaire containing questions about learning experiences, level of understanding of the material, and satisfaction with AI-based learning. An interview guide was prepared to delve deeper into students' experiences and perspectives, while a prototype of the AI-based content personalization system was used as the main tool in the trial process. The collected data were analyzed using thematic methods for qualitative data, while quantitative data were statistically analyzed using descriptive and inferential approaches.

RESULTS AND DISCUSSION

The results of the questionnaire filled out by 30 students of the Information Management program at Politeknik Negeri Sriwijaya revealed that their level of familiarity with the concept of artificial intelligence (AI) is quite high. As many as 80% of the students stated that they are very familiar or familiar with AI, while 20% only have a basic understanding. This indicates that the majority of students already have awareness and basic knowledge about AI technology relevant to their studies.

Table 1. Statistical table of average student understanding of AI usage in learning analysis results

No	Correspondence	Average	Standard Deviation	Number of Respondents
1	Understanding the concept of AI	3.8	0.75	30
2	Perception of the benefits of content personalization	4.2	0.65	30
3	Impacts of AI usage on material comprehension	3.9	0.70	30
4	The potential of AI to replace the role of lecturers in learning	2.7	0.85	30
5	The level of interest in AI-based learning technology	4.1	0.60	30
6	The influences of content personalization on learning motivation	4.0	0.72	30
7	The success of AI systems in increasing learning speed	3.6	0.80	30
8	The ease of accessing learning materials through AI	4.3	0.55	30
9	The effectiveness of AI in helping to complete academic tasks	3.8	0.65	30
10	The influences of AI on student and lecturer interactions	3.5	0.90	30

Regarding the effectiveness of AI-based content personalization in the learning process, 70% of respondents consider the feature very helpful in enhancing understanding of the material, while 20% feel somewhat helped, and only 10% believe that this feature does not have a significant impact. Content personalization is considered capable of adjusting the material to individual needs, allowing students to focus more on aspects that require special attention. Satisfaction with AI-based learning is also reported to be high, with 75% of students expressing great satisfaction with this system. The main factor influencing this satisfaction is the AI's ability to provide a more directed and relevant learning experience. Additionally, 65% of students feel that the content personalization system helps them stay more focused while studying. However, 25% stated that there was no significant change in their level of focus, and the rest felt that the impact of this system was less effective.

The suggestions and criticisms provided by the respondents offer important input for further development. Some students suggested adding interactive communication features with AI-based lecturers or tutors to enhance collaborative learning. Additionally, optimizing the user interface has also become a necessity, considering that some students feel the system design is still not intuitive

enough. Overall, these results indicate that students have a positive view of the implementation of AI in education, particularly in the aspect of content personalization. However, there is still room for improvement, especially in ensuring a better user experience and enriching interactive features to support a more holistic learning experience.

Table 2. Summary Table on Students' Understanding of AI and Content Personalization in Learning

No	Aspect Being Studied	Average	Standard Deviation	Result Interpretation
1	Understanding the concept of AI	3.8	0.75	Students have a fairly good understanding of AI, but there is variation in their understanding.
2	Perception of the benefits of content personalization	4.2	0.65	Students feel that content personalization has clear benefits in learning.
3	Impacts of AI usage on material comprehension	3.9	0.70	Most students believe that AI can enhance understanding of the material, although some are less certain
4	The potential of AI to replace the role of lecturers in learning	2.7	0.85	The majority of students do not agree that AI can replace lecturers, with a high level of uncertainty.
5	The level of interest in AI-based learning technology	4.1	0.60	Students are very interested in the application of AI in learning.
6	The influences of content personalization on learning motivation	4.0	0.72	Personalization of content is seen as a positive factor in increasing learning motivation.
7	The success of AI systems in increasing learning speed	3.6	0.80	Students generally agree that AI can accelerate the learning process, but there are differing opinions.
8	The ease of accessing learning materials through AI	4.3	0.55	The majority of students feel that AI makes access to learning materials easier.
9	The effectiveness of AI in helping to complete academic tasks	3.8	0.65	AI is considered effective in helping to complete tasks, although not all students fully agree.
10	The influences of AI on student and lecturer interactions	3.5	0.90	AI is considered to have a neutral impact on the interaction between students and lecturers, with a high variation of opinions.

The research results show that students have a positive perception of the application of AI in learning, especially in terms of content personalization. This supports the theory that artificial intelligence can be an effective tool in improving learning outcomes, as stated by Park and Yoo (2021) in their study on AI in education. The ability of AI to tailor learning materials to individual needs has proven to have a significant impact. Students feel more focused and efficient, which aligns with Brougham's (2020) findings that technology-based content personalization enhances student engagement. However, challenges remain, particularly in terms of usability and interactivity. Student criticism regarding the lack of interactive communication features reflects the importance of developing a system that is not only personal but also supports collaboration, as outlined.

CONCLUSION

Based on the research conducted on 30 students of the Informatics Management study program at Politeknik Negeri Sriwijaya, it can be concluded that the application of Artificial Intelligence (AI) in education, particularly in content personalization, shows a positive impact on learning effectiveness. The majority of students (80%) are familiar with AI, and more than 70% of them believe that AI-based content personalization is very helpful in improving their understanding of learning materials. Additionally, AI-based learning is able to enhance the study focus for 65% of students, although a small portion feel unaffected. Satisfaction with the AI-based learning system is also quite high, with 75% of respondents expressing satisfaction and feeling that the system is very relevant to their learning needs. However, there are some constructive criticisms regarding the optimization of the user interface and the addition of interactive features such as communication with AI-based lecturers or tutors.

Overall, this research shows that AI, particularly in the form of content personalization, has great potential to enhance students' learning experiences and outcomes. However, to maximize its benefits, further development is needed, including improvements to the user interface and interactive features that support collaboration between students and instructors. In the future, AI in the field of education is expected to continue developing to create a more adaptive and comprehensive learning environment.

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