ANALYSIS OF THE EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE-BASED ADAPTIVE LEARNING SYSTEMS IN IMPROVING STUDENT LEARNING MOTIVATION

Marwati Abd. Malik [1]; **Mas'ud B.**[2]

[1,2]Universitas Muhammadiyah Parepare

Author Correspondence Email: marwati.pare63@gmail.com

ABSTRACT

The study aims to analyze the effectiveness of adaptive learning systems based on artificial intelligence (AI) in improving student learning motivation. The study focused on three main aspects: student learning motivation levels, the effectiveness of adaptive learning systems, and the factors that influence the efficiency of these systems. The study used a survey method with a questionnaire instrument distributed to students using an AI-based adaptative learning system. The data collected were analyzed using descriptive statistics to describe the level of motivation for learning, the system's efficiency, and factors influencing it. AI-based adaptive learning systems are effective in providing material that matches students' abilities, providing helpful feedback, and adapting learning methods to individual learning styles. Furthermore, factors such as the availability of technology facilities, the ability to use technology, academic support, the quality of materials, and the flexibility of learning times play an important role in improving the efficiency of the system. Therefore, AI-based adaptive learning systems are effective in increasing student learning motivation. The system provides a personalized and responsive learning experience to individual needs, thereby enhancing students' understanding, confidence, and learning spirit. To ensure optimal efficiency, there is a need for improvements in technology facilities, training for students and lecturers, as well as the development of quality materials.

Keywords: Adaptive learning systems, artificial intelligence, learning motivation, learning effectiveness, higher education.

1). INTRODUCTION

Background of the Problem

In the era of Society 5.0, technology plays an increasingly important role in various aspects of life, including the field of education. One of the prominent technological developments is artificial intelligence (AI), which has transformed the way we access and utilize information. In the context of education, artificial intelligence offers great potential to enhance the effectiveness of learning through adaptive learning systems. Several research findings highlight the importance of AI in higher education for various purposes such as profiling and prediction, evaluation and assessment, adaptive and

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

91 | ICONETT-2024

personalized systems, as well as intelligent tutoring system (Hinojo-Lucena et al., 2019); (Lin et al., 2023); (Zawacki-Richter et al., 2019); (Holmes et al., 2019);(Helen & Diane, 2023). AI-based adaptive learning systems are designed to tailor materials and teaching methods according to the needs, abilities, and learning styles of each individual, providing a more personalized and responsive learning experience compared to traditional learning methods.

Learning motivation is a key factor in the academic success of students. Motivated students tend to be more active in the learning process, have resilience in the face of challenges, and achieve better academic results. Therefore, finding ways to enhance learning motivation is a top priority in higher education. AI-based adaptive learning systems have the potential to be an effective solution in this regard. Various studies have shown that the use of technology in education can enhance student motivation and engagement. AI-based adaptive learning systems can improve learning effectiveness by providing a more personalized experience that responds to students' needs. These systems adjust content and teaching methods based on the analysis of students' learning activity data, which can boost their motivation and involvement in the learning process (Zhao et al., 2022); (Adedoyin & Soykan, 2023).

Several previous studies have shown that technology adaptation in education can provide various benefits, including increased academic engagement and efficiency in time and costs. AI-based systems can significantly enhance student engagement by providing faster feedback and personalized learning (Kamalov et al., 2023). However, there is still little research that specifically analyzes the effectiveness of artificial intelligence-based adaptive learning systems in enhancing student motivation, particularly in higher education.

Therefore, the general aim of this research is to fill that gap by evaluating the extent to which AI-based adaptive learning systems can enhance college students' learning motivation. Thus, this study will explore and analyze how AI-based adaptive learning systems can influence students' learning motivation, as well as identify the factors that support or hinder the effectiveness of such systems. The results of this research are expected to make a significant contribution to the development of more effective and innovative learning methods in higher education.

Statement of the Problem

In the era of Society 5.0, the application of technology, especially artificial intelligence (AI), in education is increasingly on the rise. AI-based adaptive learning systems have the potential to enhance

student motivation and engagement by providing personalized and responsive learning experiences. However, there is still limited research specifically evaluating the effectiveness of AI-based adaptive learning systems in improving college students' learning motivation. Therefore, in-depth research is needed to fill this gap and provide clearer insights into the impact of AI-based adaptive learning systems on college students' learning motivation.

Based on the background of the problem and the statement of the problem, the research formulation is as follows: (1) How effective is the artificial intelligence-based adaptive learning system in enhancing students' learning motivation? (2) What are the factors that influence the effectiveness of artificial intelligence-based adaptive learning systems in enhancing student motivation? (3) To what extent can AI-based adaptive learning systems provide a personalized and responsive learning experience that meets the individual needs of students?

Based on the problem formulation above, the research objectives are formulated as follows: (1) To analyze the effectiveness of an artificial intelligence-based adaptive learning system in enhancing student motivation in higher education. (2) To identify the factors that influence the effectiveness of an artificial intelligence-based adaptive learning system in improving student motivation. (3) To evaluate the extent to which an artificial intelligence-based adaptive learning system can provide a personalized and responsive learning experience that meets the individual needs of students.

2) METHODS

This research employs a survey method as the primary approach to collect data on the effectiveness of AI-based adaptive learning systems in enhancing student motivation. Surveys are a commonly used method in educational research because they allow researchers to obtain direct data from respondents regarding their perceptions, experiences, and attitudes toward specific phenomena (Kurniawati, 2017).

The research variables consist of three: (1) learning motivation, (2) the effectiveness of AI-based adaptive learning systems, and (3) factors influencing the effectiveness of AI-based adaptive learning systems. Each variable has its own indicators as follows:

1) The indicators of learning motivation are (a) Learning motivation using an AI-based adaptive learning system. (b) Interest in the subject matter with an AI-based adaptive learning system. (c) Enthusiasm for attending lectures with the presence of an AI-based adaptive learning system. (d)

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

93 | ICONETT-2024

Helping students understand the subject matter better with an AI-based adaptive learning system. (e) Students feeling confident in learning with the assistance of an AI-based adaptive learning system.

2). The indicators of the effectiveness of an AI-based adaptive learning system are: (a) Providing learning materials that match the students' abilities. (b) The feedback given by the AI-based adaptive learning system is very helpful for students. (c) Adjusting the learning methods to my learning style. (d) Effective in helping students achieve their learning goals. (e) Easy access to learning materials.

3) The factors that influence effectiveness are: (a) The availability of adequate technological facilities supports the use of AI-based adaptive learning systems. (b) My ability to use technology affects the effectiveness of AI-based adaptive learning systems. (c) Support from lecturers and academic staff influences my learning experience with AI-based adaptive learning systems. (d) The quality of the materials provided by the AI-based adaptive learning system greatly affects learning effectiveness. (e) The flexibility of study time offered by the AI-based adaptive learning system helps me learn better.

The instrument used in this study is a questionnaire specifically designed to measure three main variables: learning motivation, the effectiveness of the adaptive learning system, and the factors that influence the effectiveness of that system. This questionnaire consists of a series of closed-ended questions using a 1-5 Likert scale, where respondents are asked to indicate the extent to which they agree or disagree with the given statements. The Likert scale was chosen for its ability to quantitatively capture the intensity of respondents' perceptions, thereby facilitating subsequent statistical analysis (Khadka et al., 2023).

The data collection process was carried out by distributing questionnaires to students who have used the AI-based adaptive learning system for at least one semester. The sample selection was conducted purposively, with the criterion that the students who became respondents had direct experience using the system. This purposive sampling approach was chosen to ensure that the data obtained is relevant to the research objectives and reflects the real experiences of students in the context of AI-based adaptive learning (Etikan et al., 2016). Sampel The sample for this research consists of 90 respondents, who are second-semester students in the Mathematics Education PPG program. This class was chosen because it is one of the study programs where most of the learning is adaptive and AI-based, implemented by the lecturers and including researchers.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

94 | ICONETT-2024

After the data has been collected, the next stage is data analysis using descriptive statistics. Descriptive statistics are used to describe the distribution of data, such as the mean, median, and standard deviation, as well as to provide an overview of the level of student learning motivation, the effectiveness of the AI-based adaptive learning system, and the factors that influence the effectiveness of that system. The use of descriptive statistics in this research allows the researcher to analyze the data systematically and identify patterns that emerge from the respondents' responses (Flick, 2018).

In addition, in the data analysis, reliability and validity testing of the questionnaire instrument was also conducted to ensure that the instrument used has internal consistency and truly measures what it is supposed to measure. Reliability testing was performed using Cronbach's alpha coefficient, where an alpha value above 0.70 is considered to indicate good reliability. Meanwhile, the validity of the questionnaire was tested through exploratory factor analysis (EFA) to ensure that the items in the questionnaire clustered according to the constructs being measured (Taber, 2018).

The results of the data analysis are then presented in the form of tables and graphs to facilitate interpretation. Tables are used to display descriptive statistics for each variable, while graphs are used to visually illustrate the distribution of scores and the relationships between variables. This data visualization is important to provide a clear picture of the research findings and to support the arguments built upon that data (Hair et al., 2019).

In the context of this research, the survey method was chosen for its advantages in collecting data from a large population with efficiency in time and cost. Additionally, surveys allow researchers to measure complex variables, such as learning motivation and system effectiveness, in a structured and measurable way. The use of questionnaires as a survey instrument also provides flexibility for respondents to answer questions honestly and without pressure, resulting in data that is more accurate and reflects their real experiences (Bryman, 2016).

Finally, the use of descriptive statistics in data analysis helps researchers simplify and summarize information from large amounts of data into a form that is easier to understand and interpret. Descriptive statistics not only assist in identifying general patterns in the data but also in discovering anomalies or variability that may become the focus of further research. Thus, the research method used in this study is designed to provide a comprehensive overview of the effectiveness of AI-based adaptive learning systems in the context of higher education (Dornauer et al., 2023).

3) RESULTS AND DISCUSSION

This research aims to analyze the effectiveness of an AI-based adaptive learning system in enhancing students' learning motivation. Based on the analysis of data obtained through the questionnaire survey, the main findings of this research are as follows:

A. **Results of the analysis of student learning motivation data.**

Based on the results of the data analysis from the research related to student learning motivation, which can be seen in table A1 below:

Table 1. Student Learning Motivation

Frekuensi	SCORE OF STUDENT LEARNING MOTIVATION				
	1	2	3	4	5
M.F1	1	2	4	44	39
M.F2	1	1	8	52	28
M.F3	2	0	9	45	34
M.F4	2	0	6	48	34
M.F5	3	0	12	49	26
TOTAL	9	3	39	238	161
AVERAGE	1,67	0,83	7	40,33	27,67
STANDARD DEVIATION	0,84	0,89	3,03	3,21	5,22

Based on the table presented, the research results regarding student learning motivation show a varied frequency distribution across five motivational factors (M.F1, M.F2, M.F3, M.F4, M.F5) with scores on a Likert scale from 1 to 5. Here is a detailed description of the results:

1. Frequency Distribution:

The majority of students gave high scores to the factors of learning motivation, with the highest frequency at scores of 4 and 5. Overall, there were 238 respondents who gave a score of 4 and 161 respondents who gave a score of 5. This indicates that most students have a high level of learning motivation. The frequency of the lowest score (score 1) is very low, with only 9 cases across all factors, indicating that very few students reported very low learning motivation. Score 2 also shows a low frequency with only 3 cases.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
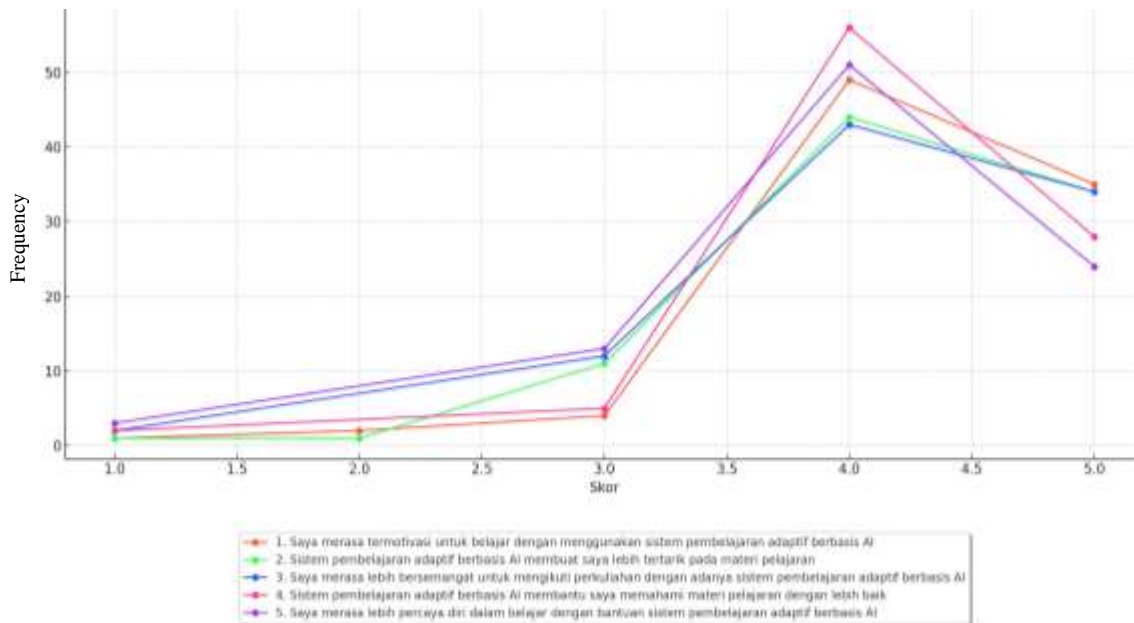South Sulawesi-Indonesia

96 | ICONETT-2024

2.   Average Learning Motivation:

The average motivation score for each factor is high, particularly with a score of 4 averaging 40.33 and a score of 5 averaging 27.67. This indicates that, in general, students feel sufficiently motivated to very motivated in their learning context. The averages for the low scores (1 and 2) are very small, at 1.67 and 0.83 respectively, further indicating that only a few students experience low motivation.

3.   Variability (Standar Deviasi)

The highest standard deviation is found in the score of 5 (5.22), indicating a greater variation in the distribution of motivation at the highest score. This suggests that while many students feel highly motivated, there is also variation in the intensity of motivation among them. The standard deviation for the score of 4 is 3.21, which also indicates a considerable variation in this group, although it is more stable compared to the score of 5. The standard deviations for the low scores (1 and 2) are relatively small (0.84 and 0.89), indicating greater consistency among students reporting low motivation.

To clarify the depiction of student learning motivation, it can be seen in the following graph:

Distribution Of Motivation Scores Based On Indicators

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

97 | ICONETT-2024

The line chart above shows the distribution of motivation scores based on five indicators in a single graph. Each colored line represents a different motivation indicator:

1. I feel motivated to learn using an AI-based adaptive learning system (orange color).
2. The AI-based adaptive learning system makes me more interested in the subject matter (green color).
3. I feel more enthusiastic about attending lectures with the presence of an AI-based adaptive learning system (blue color).
4. The AI-based adaptive learning system helps me understand the subject matter better (pink color).
5. I feel more confident in learning with the help of an AI-based adaptive learning system. (warna ungu)

Overall, the results of this study indicate that the majority of students have a high motivation to learn, with most scores distributed at values of 4 and 5. The high variability in scores suggests that although many students are highly motivated, this level of motivation varies among individuals. Low scores are relatively rare, indicating that only a few students feel less motivated. This finding indicates that the learning system used is likely effective in motivating students; however, attention needs to be given to those at the lower end of the motivation spectrum to ensure that all students remain motivated in their learning.

B. The Effectiveness of Adaptive Learning Systems

Table 2 Effectiveness of AI-Based Adaptive Learning Systems

FREQUENCY	STUDENT LEARNING EFFECTIVENESS SCORE				
	1	2	3	4	5
E.F1	1	3	12	60	14
E.F2	1	1	7	54	27
E.F3	2	2	14	55	17
E.F4	2	1	5	53	29
E.F5	2	0	5	43	40
TOTAL	8	7	43	265	127
AVERAGE	1,5	1,5	7,67	44,83	22
STANDARD DEVIATION	0,55	1,14	4,16	6,21	10,36

Based on the presented table 2, the research results regarding the effectiveness of the AI-based adaptive learning system, measured through five effectiveness factors (E.F1, E.F2, E.F3, E.F4, E.F5)

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

98 | ICONETT-2024

using a Likert scale from 1 to 5, show a varied frequency distribution. Here is a detailed description of the results:

1. Frequency Distribution:

The highest frequency is at a score of 4, with a total of 265 respondents giving this rating. This indicates that the majority of students consider the learning system to be quite effective. Score 5, which indicates the highest level of effectiveness, also has a fairly high frequency with 127 respondents. This indicates that many students feel the learning system is very effective. The frequency of low scores (1 and 2) is very small, with only 8 and 7 cases respectively. This shows that only a few students feel the learning system is less effective or not effective at all.
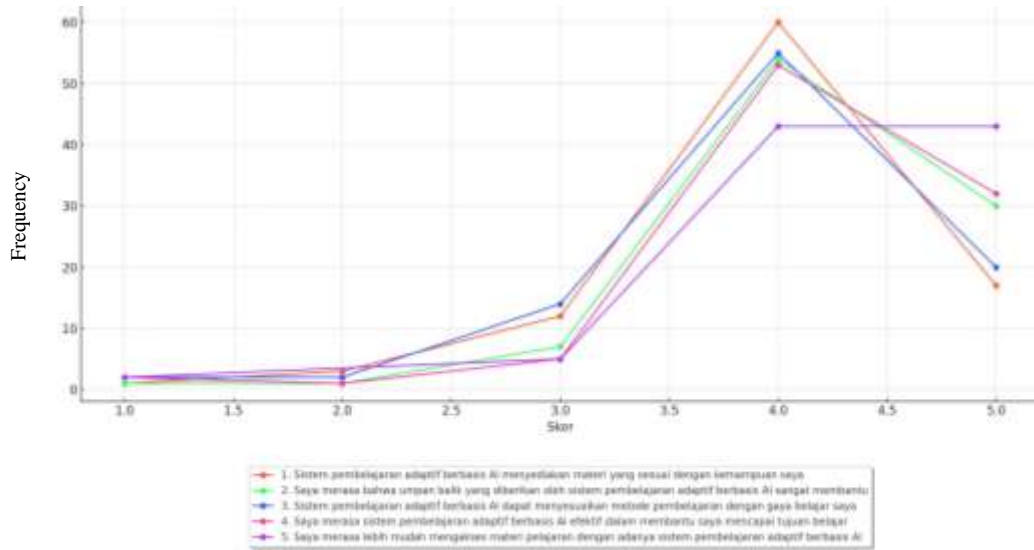
2. Average Effectiveness Score

The average effectiveness scores for each factor show high values at score 4 (average 44.83) and score 5 (average 22). This indicates that, in general, students assess the AI-based adaptive learning system as effective. The average for low scores (1 and 2) is very small, at 1.5 each, suggesting that only a small fraction of students consider this learning system to be less effective.

3. Variability (Standard Deviation):

The highest standard deviation is found in score 5 (10.36), indicating a significant variation in the perception of effectiveness among students who gave the highest ratings. This can indicate that although many students feel that this system is very effective, the intensity of their assessments varies. The standard deviation for a score of 4 is 6.20, indicating a lower yet still significant variation among students who feel that this system is effective. The standard deviations for the lower scores (1 and 2) are smaller (0.54 and 1.14), showing greater consistency among students who rate this learning system as less effective.

For a clearer picture of the effectiveness of the AI-based learning system, it can be seen in the following graph:

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

99 | ICONETT-2024

Distribution Of Effectiveness Scores Based On Indicators

The graph above shows the distribution of effectiveness scores based on five indicators in a single chart. Each colored line represents a different effectiveness indicator:

1. The AI-based adaptive learning system provides materials that match my abilities (orange).

2. I feel that the feedback given by the AI-based adaptive learning system is very helpful (green).

3. The AI-based adaptive learning system can adjust the learning methods to my learning style (blue).

4. I feel that the AI-based adaptive learning system is effective in helping me achieve my learning goals (pink).

5. I find it easier to access study materials with the presence of the AI-based adaptive learning system. (warna ungu)

Overall, the results of this study indicate that the majority of students assess the AI-based adaptive learning system as effective, with most scores distributed at levels 4 and 5. This suggests that the system successfully meets the learning needs of students and is considered a useful tool in supporting their learning process. The higher variability in the score of 5 indicates differences in satisfaction levels among those who are very fond of this system. Meanwhile, low scores are relatively rare, indicating that only a small number of students feel that this learning system is less effective. This finding indicates that although the system is generally well accepted, there is room for improvement, particularly in addressing the variability in perceptions of effectiveness among students. AI-based adaptive learning systems are considered effective by students in various aspects. Most respondents

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

100 | ICONETT-2024

gave high scores on indicators such as the alignment of the material with their abilities, the assistance provided by system feedback, and the system's ability to tailor learning methods to individual learning styles. The effectiveness of this system is evident from the AI's ability to provide relevant materials that support students' learning objectives, ultimately enhancing their learning outcomes.

C. Factors that influence the effectiveness of AI-based adaptive learning systems.

Based on the results of the data analysis from the research regarding the factors that influence the effectiveness of AI-based adaptive learning systems, it can be shown in the following table 3:

Table 3 Factors Influencing the Effectiveness of the System

FREQUENCY	SCORE FACTORS THAT AFFECT SYSTEM EFFECTIVENES				
	1	2	3	4	5
F.F1	2	1	12	47	28
F.F2	2	0	9	52	27
F.F3	1	1	11	51	26
F.F4	2	0	12	57	19
F.F5	2	0	8	53	27
TOTAL	9	2	52	260	127
AVERAGE	1,67	0,67	9,17	44	22
STANDARD DEVIATION	0,45	0,6	1,82	3,61	3,65

Based on the table presented, the research results regarding the factors influencing the effectiveness of AI-based adaptive learning systems, measured through five factors (F.F1, F.F2, F.F3, F.F4, F.F5) using a Likert scale from 1 to 5, show an interesting distribution of frequency and variability. Here is a detailed description of the results:

1. Frequency Distribution:

The majority of respondents gave high scores to the factors influencing the effectiveness of the system, with the highest frequency at score 4 (260 respondents) and score 5 (127 respondents). This indicates that most students feel these factors have a significant impact on supporting the effectiveness of the learning system. Score 3 had a lower frequency, with 52 respondents. This suggests that there are some students who feel these factors only moderately influence effectiveness, but not significantly. Low scores (1 and 2) were very rare, with only 9 respondents giving a score of 1 and 2 respondents

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

101 | ICONETT-2024

giving a score of 2. This indicates that very few students feel these factors have no impact or only a slight impact on the effectiveness of the system.
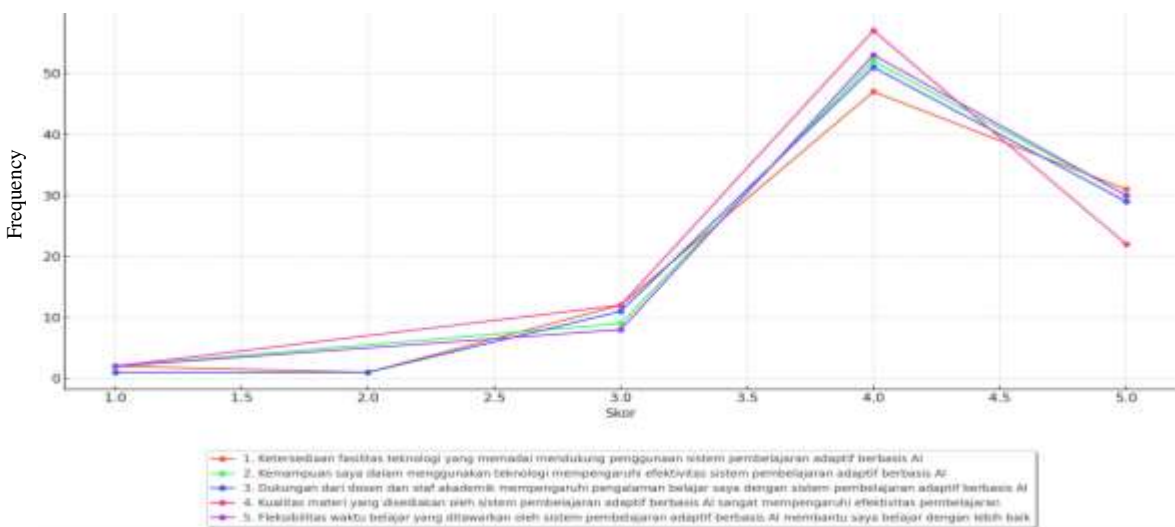
2. Average Score of Factors

The average highest scores are at 4 (44) and 5 (22), indicating that, in general, students believe these factors significantly influence the effectiveness of the learning system. This suggests that factors such as the availability of technology, academic support, and the quality of materials play a crucial role in determining how effectively an AI-based adaptive learning system can function. The average score at 3 is 9.17, indicating that a small number of students feel the influence of these factors is somewhat significant, but not dominant.

3. Variability (Standard Deviation):

The highest standard deviation was found in score 4 (3.61) and score 5 (3.6), indicating a significant variation in students' perceptions of the influence of these factors on the effectiveness of the system. This indicates that although the majority of students feel these factors are important, there are differences in the intensity of the perceived influence. The standard deviations for the low scores (1 and 2) are smaller (0.45 and 0.55), indicating greater consistency among students who rate these factors as less influential.

For a clearer picture of the factors influencing the effectiveness of AI-based adaptive learning systems, please refer to the following graph:

Distribution Of Effectiveness Scores Based On Indicators

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

102 | ICONETT-2024

The graph above illustrates the distribution of scores for the factors influencing the effectiveness of AI-based adaptive learning systems based on five main indicators. Each colored line represents a different factor indicator:

1. The availability of adequate technological facilities supports the use of AI-based adaptive learning systems (orange).

2. My ability to use technology affects the effectiveness of AI-based adaptive learning systems (green).

3. Support from lecturers and academic staff influences my learning experience with AI-based adaptive learning systems (blue).

4. The quality of materials provided by AI-based adaptive learning systems greatly affects learning effectiveness (pink).

5. The flexibility of study time offered by AI-based adaptive learning systems helps me learn better. (warna ungu)

This graph shows that all measured factors have a high score distribution at values 4 and 5, indicating that each of these factors significantly influences the effectiveness of the AI-based adaptive learning system. The availability of technological facilities, the ability to use technology, academic support, the quality of materials, and time flexibility all play crucial roles in enhancing students' learning experiences with this system. These results underscore the need for attention to each factor to ensure the optimal effectiveness of the AI-based adaptive learning system.

The results of this study indicate that the factors influencing the effectiveness of AI-based adaptive learning systems are considered very important by the majority of students, with most scores distributed at values of 4 and 5. This emphasizes that factors such as the availability of technology, the quality of academic support, and the relevance of the subject matter play a significant role in the successful implementation of this system. Although there is some variability in student perceptions, these findings overall indicate that to achieve optimal effectiveness, special attention must be given to the management and enhancement of these supporting factors. The rarely occurring low scores also suggest that only a few students feel these factors are less influential, indicating that the majority of students agree on the importance of these factors in supporting their learning.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

103 | ICONETT-2024

Research Findings

This research aims to analyze the effectiveness of an AI-based adaptive learning system in enhancing students' learning motivation. Based on the analysis of data obtained through the questionnaire survey, the main findings of this research are as follows:

1. Increasing Student Learning Motivation

The analysis results show that the majority of students have a high level of learning motivation when using an AI-based adaptive learning system. The average motivation score is above 4 on a 1-5 Likert scale, indicating that this system successfully motivates students to be more engaged in the learning process. This finding supports the hypothesis that AI-based adaptive learning systems can enhance students' intrinsic motivation by providing a more personalized learning experience that meets individual needs.

2. The Effectiveness of Adaptive Learning Systems

AI-based adaptive learning systems are considered effective by students in various aspects. The majority of respondents gave high scores on indicators such as the alignment of materials with their abilities, the assistance provided by system feedback, and the system's ability to adjust learning methods to individual learning styles. The effectiveness of this system is evident in AI's capability to provide relevant materials and support students' learning goals, ultimately enhancing their learning outcomes.

3. The Influence of Technological Factors and Academic Support

Factors influencing the effectiveness of AI-based adaptive learning systems include the availability of technological facilities, students' ability to use technology, and support from faculty and academic staff. These findings indicate that although AI-based adaptive learning systems have great potential, their success heavily relies on adequate technological infrastructure and the support provided by the academic environment. Students who have access to good technology and receive support from their lecturers tend to be more successful in making optimal use of this system.

4. Quality of Materials and Flexibility of Study Time

The quality of the materials provided by the AI-based adaptive learning system and the flexibility of study time offered are also important factors that influence the effectiveness of learning. Students assess that materials tailored to their abilities and the flexibility in scheduling study time help them

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

104 | ICONETT-2024

achieve better academic results. Time flexibility allows students to learn at their own pace, which enhances the efficiency and effectiveness of the learning process.

5. Variability in Learning Experiences

Although the findings generally show positive results, there is variation in students' learning experiences with the AI-based adaptive learning system. Some students reported challenges in adapting to the new technology or felt that the academic support they received was insufficient. This indicates that to achieve maximum effectiveness, this system needs to be further tailored to the diverse needs and conditions of the students.

6. Student Satisfaction with the Learning System

Most students show a high level of satisfaction with the use of AI-based adaptive learning systems. This satisfaction is closely related to their perception of the system's effectiveness in providing appropriate materials, offering useful feedback, and supporting individual learning styles. This high level of satisfaction indicates that the system is well-received by students and has the potential for broader implementation across various educational institutions.

Based on the findings above, it can be concluded that AI-based adaptive learning systems have great potential in enhancing student motivation and overall learning effectiveness. However, to achieve optimal results, it is important to consider supporting factors such as adequate technology, academic support, quality of materials, and flexibility in learning time. This research also highlights the importance of adapting systems to the individual needs of students to ensure that all students can benefit from this technology.

Discussion of Research Results

The findings from this research indicate that AI-based adaptive learning systems significantly enhance students' learning motivation. These results align with previous research indicating that the use of learning technology tailored to individual needs can enhance student engagement and motivation. For instance, a study by (Jeno, 2021) found that technology-based learning systems that provide personalized learning experiences can boost students' intrinsic motivation, which in turn positively affects their learning outcomes. This finding emphasizes that personalization in learning, which is at the core of AI-based adaptive learning systems, is a key factor in enhancing learning motivation.

Paper presented at The 1ˢᵗ ICONETT on August 21ˢᵗ-22ⁿᵈ, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

105 | ICONETT-2024

In addition, the effectiveness of the AI-based adaptive learning system, measured through the relevance of the material, the quality of feedback, and the ability to adjust learning methods to individual learning styles, shows positive results. This research aligns with the study conducted by (Li et al., 2023), where they found that learning systems that can adjust teaching methods to the needs and preferences of students are more effective in helping students achieve better academic outcomes. In this context, AI-based adaptive learning systems not only provide relevant materials but also offer feedback that supports the deeper development of students' understanding and skills.

Factors influencing the effectiveness of adaptive learning systems, such as the availability of technological facilities and academic support, are also important findings. Research by (Phan et al., 2022). shows that strong technological infrastructure and adequate support from instructors are crucial for the successful implementation of learning technologies in educational settings. This finding shows that although AI-based adaptive learning systems have great potential, their success heavily depends on a supportive environment, including adequate access to technology and active involvement from educators.

The quality of the materials provided by the AI-based adaptive learning system is also identified as an important factor in the effectiveness of learning. This research is consistent with the study conducted by (Schunk & DiBenedetto, 2020), which highlights the importance of material quality in digital learning. According to them, materials tailored to the abilities and needs of students not only enhance the effectiveness of learning but also boost students' motivation and engagement in the learning process. In this context, AI-based adaptive learning systems that provide relevant and beneficial materials for students have proven effective in supporting the achievement of learning goals.

The flexibility of study time offered by AI-based adaptive learning systems is also recognized as an important factor influencing learning effectiveness. This finding aligns with a study conducted by (Gaspard, H., 2020), which found that flexibility in managing study time allows students to learn at their own pace, enhancing the efficiency and effectiveness of the learning process. This flexibility enables students to learn anytime and anywhere, according to their needs and schedules, allowing them to be more focused and productive in their studies.

The variability in student learning experiences with AI-based adaptive learning systems is also an interesting finding. Although most students report a positive experience, some students face challenges in adapting to new technology or feel they are not receiving adequate academic support.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

106 | ICONETT-2024

This shows that although this technology has a lot of potential, there is still room for improvement in providing more comprehensive support for all students. Research by (Scherer, R., Howard, S. K., Tondeur, J., & Siddiq, 2021) shows that the success of educational technology implementation often depends on how well the system can be adapted to user needs and the support provided by educational institutions.

Overall, the findings from this research make an important contribution to the existing literature on the effectiveness of AI-based adaptive learning systems. The results of this study indicate that this system is not only effective in enhancing students' learning motivation but also in providing a personalized learning experience and supporting the achievement of academic goals. However, the success of this system also heavily relies on supporting factors such as technological infrastructure, quality of materials, flexibility of time, and adequate academic support. This research emphasizes the importance of considering all these factors when designing and implementing AI-based adaptive learning systems in higher education environments.

Weaknesses and Limitations of the Research

Although this research provides significant insights into the effectiveness of AI-based adaptive learning systems, there are several weaknesses and shortcomings that need to be acknowledged. First, this research uses a survey method with a questionnaire instrument that relies on the subjective perceptions of students. This can lead to bias in the results, as respondents may provide answers that are deemed most socially acceptable, rather than what they actually feel. In addition, the data collected is purely descriptive and does not include an analysis of causal relationships, so it cannot definitively explain whether the increase in motivation and learning effectiveness is truly caused by the use of AI-based adaptive learning systems.

Second, this research is limited to a sample of students who have used an AI-based adaptive learning system within a single educational institution. This may limit the generalization of the findings to a broader context or to student populations with different characteristics. In addition, external factors that may influence the results, such as variations in academic support or access to technology, are not fully controlled. Further research involving larger and more diverse samples, as well as employing more in-depth research methods such as experiments or longitudinal studies, is needed to strengthen these findings.

Paper presented at The 1ˢᵗ ICONETT on August 21ˢᵗ-22ⁿᵈ, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

107 | ICONETT-2024

Advantages of Research

One of the main advantages of this research compared to other relevant studies is its comprehensive approach in evaluating the effectiveness of AI-based adaptive learning systems from various aspects, including learning motivation, system effectiveness, and the factors influencing the successful implementation of this technology. Additionally, this research successfully identified and empirically measured various relevant indicators using structured methods, thus providing a holistic view of students' experiences in using this system. This research also emphasizes the importance of considering supporting factors such as technological infrastructure and academic support, which are often overlooked in other studies that focus solely on the technology itself.

4). CONCLUSIONS

Based on the results of the research and discussions that have been conducted, several key conclusions can be formulated as follows:

1. Effectiveness of AI-Based Adaptive Learning Systems:

   AI-based adaptive learning systems have proven to be effective in enhancing students' learning motivation in higher education. The majority of students consider this system to be a useful tool, with high scores distributed in the 4 and 5 range. This system is capable of providing a more engaging, personalized, and tailored learning environment that ultimately supports active student involvement in the learning process.

2. Factors Affecting System Effectiveness:

   The effectiveness of AI-based adaptive learning systems is significantly influenced by several key factors, such as the availability of adequate technology, the quality of academic support, and the relevance of the learning materials. These factors are crucial in ensuring that the system can operate optimally and have a positive impact on student motivation and learning outcomes. Although most students experience benefits from this system, the variability in perceptions of effectiveness indicates that special attention needs to be given to addressing individual differences and ensuring that all students can reap the maximum benefits.

3. Personal and Responsive Learning Experience:

AI-based adaptive learning systems successfully provide a more personalized and responsive learning experience tailored to the individual needs of students. Students feel that this system is capable of adapting content and learning methods according to their preferences and abilities, which enhances the relevance and effectiveness of the learning process. However, the variability in satisfaction indicates that there is a need for further adjustments to ensure that this system can more holistically meet the needs of all students.

Research Recommendations

1. Development of Technology and Infrastructure:

It is recommended to enhance the technological infrastructure in educational institutions to better support the implementation of AI-based adaptive learning systems on a larger scale. This includes providing better access to the necessary hardware and software, as well as ensuring the stability and reliability of the internet network.

2. Training and Development of Student Skills:

It is important to organize training programs for students in the use of AI-based adaptive learning systems. This training will help students optimize their use of this technology, enhance their self-efficacy in utilizing technology, and maximize the benefits of adaptive learning systems.

3. Academic Support and Faculty Interaction:

Another recommendation is to strengthen academic support and enhance interaction between faculty and students in the context of using adaptive learning systems. Faculty should receive specialized training in utilizing this system to provide more effective feedback and support the individual learning needs of students.

4. Further Research:

It is recommended to conduct further research involving a larger and more diverse sample, as well as using more in-depth research methods such as longitudinal studies. This research will help identify additional factors that may influence the effectiveness of AI-based adaptive learning systems.

Implications of the Research

1. Improvement of Learning Quality:

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

109 | ICONETT-2024

The direct implication of this research is the enhancement of learning quality in higher education through the use of AI-based adaptive learning systems. With this system, students can gain a more personalized learning experience tailored to their individual needs, which ultimately can improve their academic outcomes and learning satisfaction.

2. Development of a More Responsive Curriculum:

The findings of this research encourage the development of a more responsive and flexible curriculum that can be adjusted to the abilities and learning preferences of students. This will enable educational institutions to be more effective in supporting students' academic development.

3. Empowering Students in the Learning Process:

With an AI-based adaptive learning system, students have the opportunity to be more active in managing their own learning. This implication is important for encouraging learning autonomy, which is one of the keys to achieving academic success.

4. Technology-Based Education Policy:

This research also has important implications for education policy, where educational institutions need to consider the broader adoption of adaptive technology as part of their learning strategies. This includes better planning in resource allocation to support the development of technology and training for faculty and students.

These recommendations and implications are expected to provide clear guidance for educational institutions, policymakers, and researchers in developing and implementing AI-based adaptive learning systems to enhance the quality of education in the future.

REFERENCES

Adedoyin, O. B., & Soykan, E. (2023). Covid-19 pandemic and online learning: the challenges and opportunities. *Interactive Learning Environments*, *31*(2), 863–875. https://doi.org/10.1080/10494820.2020.1813180

Bryman, A. (2016). *Social research methods*. Oxford university press.

Dornauer, V., Netzer, M., Kaczkó, É., Norz, L.-M., & Ammenwerth, E. (2023). Automatic Classification of Online Discussions and Other Learning Traces to Detect Cognitive Presence. *International Journal of Artificial Intelligence in Education*. https://doi.org/10.1007/s40593-023-00335-4

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1–4.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

110 | ICONETT-2024

Flick, U. (2018). *Triangulation in data collection*. The SAGE handbook of qualitative data collection.

Gaspard, H., et al. (2020). *Are motivational beliefs universally beneficial for educational achievement? Journal of Educational Psychology.*

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24.

Helen, C., & Diane, B. (2023). *Artificial intelligence in higher education: the state of the field.*

Hinojo-Lucena, F.-J., Aznar-Díaz, I., Cáceres-Reche, M.-P., & Romero-Rodríguez, J.-M. (2019). A tour of Open Universities through literature: A bibliometric analysis. *International Review of Research in Open and Distributed Learning*, *20*(4), 116–131.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education promises and implications for teaching and learning.* Center for Curriculum Redesign.

Jeno, L. M. (2021). *The interplay of intrinsic and extrinsic motivation in students' learning: A self-determination theory perspective. Frontiers in Psychology*No Title.

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: Towards a sustainable multifaceted revolution. *Sustainability*, *15*(16), 12451.

Khadka, J. K. J., Joshi, D. R., Adhikari, K. P., & Khanal, B. (2023). Teachers' Humanistic Role in Teaching Mathematics Online During the COVID-19 Pandemic in Nepal. *International Journal of Distance Education Technologies*, *21*(1), 1–19. https://doi.org/10.4018/ijdet.324951

Kurniawati, putri. (2017). EDUCATIONAL RESEARCH Competencies for Analysis and Applications. In *Universitas Nusantara PGRI Kediri* (Vol. 01).

Li, H., Zhu, S., Wu, D., Yang, H. H., & Guo, Q. (2023). Impact of information literacy, self-directed learning skills, and academic emotions on high school students' online learning engagement: A structural equation modeling analysis. *Education and Information Technologies*, 1–20. https://doi.org/10.1007/s10639-023-11760-2

Lin, C.-C., Huang, A. Y. Q., & Lu, O. H. T. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. *Smart Learning Environments*, *10*(1), 41.

Phan, T. T., Do, T. T., Trinh, T. H., Tran, T., Duong, H. T., Trinh, T. P. T., Do, B. C., & Nguyen, T.-T. (2022). A Bibliometric Review on Realistic Mathematics Education in Scopus Database between 1972-2019. *European Journal of Educational Research*, *11*(2), 1133–1149. https://doi.org/10.12973/eu-jer.11.2.1133

Scherer, R., Howard, S. K., Tondeur, J., & Siddiq, F. (2021). *Profiling teachers' readiness for online teaching and learning in higher education: Who's ready? Computers in Human Behavior,.*

Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology*, *60*, 101832.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

111 | ICONETT-2024

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*, 1273–1296.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1), 1–27.

Zhao, J., Awais-E-Yazdan, M., Mushtaque, I., & Deng, L. (2022). The impact of technology adaptation on academic engagement: a moderating role of perceived argumentation strength and school support. *Frontiers in Psychology*, *13*, 962081.

Paper presented at The 1st ICONETT on August 21st-22nd, 2024
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

112 | ICONETT-2024