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Research Article

The role of artificial intelligence in personalizing educational content: Enhancing the learning experience and developing the teacher's role in an integrated educational environment

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ABSTRACT

This study sought to investigate the effects of employing artificial intelligence (AI) on the customization of educational content and the enhancement of academic performance and engagement among students and teachers. The research involved a sample of ninth-grade students and their educators from diverse subjects, utilizing questionnaires to evaluate their expectations and experiences with AI in education. The data were examined utilizing statistical techniques including means, standard deviations, and one-way ANOVA. The findings indicated that students held strong positive expectations regarding the influence of AI on the personalization of educational content, suggesting that customizing material to their specific needs would enhance their academic performance and boost engagement with the learning resources. Teachers concurred with the significance of AI in improving content personalization, especially given the difficulties encountered with conventional techniques. The study indicated that educators from various disciplines exhibited no significant differences in their evaluations of AI's influence on education, implying that this technology may be advantageous across multiple courses. Furthermore, both educators and learners anticipated that AI would deliver swifter and more efficient feedback, hence improving the educational experience and engagement within the classroom. The study advocated for the incorporation of AI into educational curricula and the establishment of training programs for educators on the appropriate utilization of this technology. It also recommended undertaking additional long-term experimental research to assess the effects of AI over prolonged durations and within broader student populations. The study advocated for the enhancement of technology infrastructure to facilitate the effective integration of AI in educational settings, hence promoting more tailored and efficient learning experiences.

Keywords: artificial intelligence, personalizing educational content, integrated educational environment

INTRODUCTION

In recent years, the globe has experienced unparalleled improvements in technology across multiple domains, with the education sector being a principal beneficiary of this progress. Artificial intelligence (AI) has emerged as a pivotal technical instrument that has profoundly influenced the educational process. AI can evaluate extensive datasets to tailor instructional materials according to the specific requirements of each

learner, a principle referred to as personalized learning (Luckin et al., 2016). Personalized learning is predicated on the notion that each student has distinct talents and capacities, necessitating an educational system tailored to address these particular requirements, hence yielding superior educational outcomes and an overall elevation in the quality of education.

This study is based on the principle of personalized learning, which promotes customized educational experiences for each student according to their individual requirements and interests. Furthermore, it references Gardner's (1983) theory of multiple intelligences, which asserts that students exhibit various intelligences (linguistic, logical, musical, kinesthetic, social, etc.), necessitating diverse pedagogical approaches that correspond to these distinct intelligences. Additionally, the study employs the adaptive learning theory, highlighting the imperative of modifying instructional strategies based on the student's advancement and continual requirements (Holmes et al., 2019).

Research demonstrates that employing AI to customize instructional content is among the most inventive methods for improving education. Instructional systems can utilize machine learning algorithms to analyze students' learning habits and deliver tailored instructional recommendations (Abuhassna et al., 2024). Research indicates that these approaches enhance academic performance and promote constructive interactions between students and educational material, so rendering the learning experience more engaging and inspiring (Holmes et al., 2019; Mustapha et al., 2023; Zawacki-Richter et al., 2019). Integrating AI with Piaget's (1954) constructivist theory is essential, as it enables students to construct their own knowledge through ongoing interaction with their educational environment.

The growing implementation of AI technologies in education accentuates the teacher's function as a crucial component in the learning process. Van et al. (2021) Instead of supplanting the instructor, AI augments their function as a guide and mentor in the educational process. AI enhances educational outcomes by delivering accurate analytical data regarding each student's performance, enabling teachers to optimize the allocation of time and instructional materials. Furthermore, the teacher's human function is crucial in providing feedback and emotional support to students–an element that technology cannot entirely supplant (Holmes et al., 2019). This illustrates a distinct connection between AI and the theory of multiple intelligences, enabling educators to utilize this interaction to tailor guidance for each student based on their specific forms of intelligence.

Samsul et al.'s (2023) contemporary technologies that enhance AI in education encompass augmented reality (AR) and virtual reality (VR). These technologies offer interactive teaching experiences, allowing students to implement theoretical principles in virtual worlds that replicate reality. Studies demonstrate that these technologies improve students' comprehension of intricate topics by providing experiential learning and practical application opportunities (Bacca et al., 2014). Moreover, these tools promote critical thinking and creativity by creating instructional environments that facilitate discovery and interaction.

Alserhan et al.'s (2023) teacher's responsibility in this setting is to facilitate students' utilization of these technologies to augment their critical thinking skills. The teacher assumes the role of a facilitator of learning rather than explicitly imparting information, in accordance with the constructivist theory, which asserts that learning is most effective when pupils actively construct their own knowledge (Piaget, 1954). Moreover, AI assists educators in evaluating student performance and providing suitable educational recommendations, thereby addressing learning disparities and enhancing the quality of education.

Research indicates that AI can deliver precise and instantaneous evaluations of student performance, hence enhancing the educational process. AI systems can provide individualized feedback to students based on their performance in assessments, facilitating ongoing enhancement of their abilities and comprehension of the subject matter (Luckin et al., 2016). The system may analyze students' learning patterns and recommend tailored learning pathways to enhance their academic advancement (Zawacki-Richter et al., 2019).

Furthermore, AI optimizes the administration of time and educational resources. Through the analysis of student performance data, AI can provide recommendations for optimizing lesson time and generate comprehensive reports for teachers regarding pupils in need of more support. This enhances the efficacy of the teaching process and promotes more integration.

The incorporation of AI into education encounters numerous obstacles. A significant problem is the necessity of training educators to proficiently utilize technology. Moreover, disparate access to technology can generate disparities between pupils with access to these resources and those without (Popenici & Kerr, 2017). Notwithstanding these limitations, research indicates that the advantages of employing AI in education surpass these obstacles, particularly when these tools are incorporated in accordance with modern educational ideas.

In summary, the application of AI in education signifies a substantial advancement in enhancing the quality and effectiveness of educational practices. AI can enhance student-teacher interaction and foster a more inclusive and successful learning experience by personalizing educational content and delivering precise and timely assessments. Furthermore, the integration of AI with VR and AR technology creates new opportunities for providing novel educational experiences that enhance students' critical and creative thinking skills. This research demonstrates how technology and novel pedagogical theories can synergistically enhance the learning experience.

Problem Statement

Conventional education presents a considerable obstacle in a time of swift technological progress, as several educational frameworks depend on rigid, non-tailored pedagogical approaches that inadequately address the unique requirements of pupils (Abuhassna & Alnawajha, 2023a). In conventional classes, all students are presented with an identical curriculum, irrespective of their academic levels, abilities, and individual interests. This results in significant disparities in comprehension and performance across students, with some finding it difficult to engage with the information, while others lack motivation due to the challenge presented by the material (Holmes et al., 2019). Furthermore, educators encounter considerable challenges in controlling individual variances among pupils, complicating the ability to cater to each student's distinct requirements. A significant difficulty is the restricted connection between students and teachers in conventional classrooms, where educators frequently lack sufficient time to offer individualized feedback to each student (Abuhassna & Alnawajha, 2023b). Large class numbers hinder teachers' ability to provide effective individualized support tailored to each student's requirements. This leads to diminished motivation among students and a decline in engagement with the learning material (Luckin et al., 2016).

Furthermore, conventional educational curriculum lack the adaptability to respond to the swift advancements in the digital realm. Despite the pervasive presence of digital technologies in daily life, educational institutions are sluggish in their thorough integration into the curriculum. The digital divide between students and the conventional educational setting might impede their advancement and diminish their willingness to learn, particularly as they become more dependent on technology in their daily lives (Popenici & Kerr, 2017). Moreover, the restricted application of AI technologies in education poses an additional challenge. Although AI possesses the capability to customize educational materials and deliver individualized learning experiences for every student, its implementation in educational institutions is still constrained. This results from multiple problems, such as the elevated expense of technology, inadequate specialized training for educators, and deficient technological infrastructure to facilitate these tools (Zawacki-Richter et al., 2019).

AI technologies, in conjunction with AR and VR, offer promising solutions to address the issues inherent in traditional education. These tools provide tailored and interactive educational experiences that cater to the varied requirements of pupils. Nonetheless, the implementation of new technologies encounters obstacles concerning cost and infrastructure, along with the necessity for comprehensive teacher training to successfully incorporate these tools into the educational framework (Bacca et al., 2014). Moreover, several schools may encounter difficulties in supplying the requisite gadgets for the extensive implementation of these technologies.

Conventional education encounters difficulties concerning the assessment of student achievement. In conventional educational institutions, students are predominantly evaluated by standardized assessments, which may not accurately represent the varied competencies they possess, including creativity and critical thinking. These assessment systems prioritize rote memory and teaching above the cultivation of practical and life skills (Gardner, 1983). Consequently, there is an imperative necessity to reevaluate student

assessment methods to accurately represent their genuine potential and foster the cultivation of diverse skills.

A notable difficulty in conventional education is the absence of effective strategies to foster creative and critical thinking. Traditional classrooms frequently emphasize theoretical courses and standardized testing, so limiting opportunities for critical and creative thinking. The absence of intellectual stimulation may result in pupils being inadequately equipped to confront real-world issues (Holmes et al., 2019). Moreover, the educational disparities arising from individual learning variations contribute to diminished academic performance for certain pupils, particularly those requiring additional assistance. Students with special needs or learning impairments may encounter significant obstacles in conventional classrooms, when the educational system is unable to offer sufficient help due to resource constraints and a lack of essential technologies (Popenici & Kerr, 2017).

Furthermore, conventional educational institutions lack the adaptability to cater to various learning styles. For example, certain pupils acquire knowledge more effectively through visual or tactile approaches, whilst others excel through aural or participatory techniques. The conventional approach fails to accommodate diverse learning styles, hindering students from achieving their maximum potential (Gardner, 1983). Educational institutions encounter difficulties in inspiring pupils to engage and partake in academic activities. In conventional educational systems, numerous students may experience boredom or lack of motivation due to the monotonous and uninspired presentation of knowledge. Contemporary students require an interactive and adaptable learning environment that aligns with their needs and encourages exploration and self-directed learning (Bacca et al., 2014). Conversely, educators are crucial in guiding and helping pupils; but, in expansive classes, they encounter difficulties in delivering requisite individualized assistance to each learner. This may result in certain students feeling overlooked or without the necessary support for their advancement (Zawacki-Richter et al., 2019). Therefore, it is essential to provide technical solutions that enable educators to provide the necessary support to each student more efficiently.

The research problem is summarized in restricting the educational system to accommodate the varied requirements of students and offer tailored learning experiences that prioritize the development of critical and creative thinking, while also fostering motivation to learn. This study investigates the utilization of AI and contemporary technologies to create a cohesive learning environment that tackles these difficulties.

Research Objectives

The present research seeks to:

(1) analyze teachers' perspectives on the effectiveness of using AI in personalized content delivery,

(2) explore students' acceptance of personalized learning through AI-based content delivery,

(3) identify potential challenges that teachers and students may face in using an AI-based personalized content system, and

(4) evaluate initial expectations and feedback regarding the impact of personalized content on the learning experience.

Research Questions

1. How do teachers perceive the effectiveness of using AI in personalizing educational content?
2. To what extent are students willing to accept personalized learning through AI-based content delivery?
3. What are the potential challenges that teachers and students may face when using an AI-based personalized content system?
4. What are the initial expectations and feedback from teachers and students regarding the impact of personalized content on the overall learning experience?

Significance of Research

This research is conducted at a time when the world is witnessing rapid advancements in educational technology, with AI emerging as one of the key tools capable of transforming the educational process. The significance of this research lies in its exploration of teachers' and students' perspectives on the use of AI in

personalized content delivery, which could enhance students' academic understanding and increase the overall effectiveness of education. Personalized content represents an innovative solution to the problem of varying student levels in classrooms, as it allows each student to access learning materials tailored to their individual abilities.

One of the crucial aspects of this research is determining the extent to which students are receptive to this new technology, which could potentially motivate them and increase their engagement with educational materials. Technology is not merely a teaching tool but also a means to stimulate students' interest in learning by adapting materials to suit their personal learning styles and interests. Given that students are the primary focus of the educational process, understanding their response to AI technologies will contribute to the development of more effective instructional strategies. On the other hand, teachers play a pivotal role in the success of any educational system. Therefore, exploring their opinions on the use of AI for personalized content will provide deeper insights into the challenges they may face and how to overcome them. Teachers are the key agents in ensuring the correct and effective use of technology and understanding their needs and expectations will help improve the implementation of AI-based systems and ensure their success in the classroom.

This research also aims to identify the potential challenges that teachers and students may encounter when using an AI-powered personalized content system. By exploring these challenges, educational institutions can provide proactive solutions, such as offering necessary training for teachers or improving technological infrastructure. This, in turn, will help mitigate obstacles that may hinder the adoption of this technology and facilitate a smooth transition to personalized learning through AI. Furthermore, this study provides an opportunity to evaluate the initial expectations of both teachers and students regarding the impact of personalized content on the learning process. These expectations serve as a reference point for later comparisons with actual outcomes, allowing for a thorough assessment of AI's influence on education.

Operational Definitions

The current study includes the following terms.

Artificial intelligence

AI refers to computer systems or software that can perform tasks typically requiring human intelligence, such as learning, reasoning, and problem-solving. In education, AI is used to analyze student data and personalize learning content according to their needs and skill levels (Luckin et al., 2016). This includes tools like adaptive learning systems, automated assessments, and virtual assistance for both students and teachers (Holmes et al., 2019).

Operational definition

AI is defined as the software system that analyzes each student's academic data and delivers personalized learning content based on their previous performance and individual needs through tools such as real-time assessments and interactive materials.

Personalized learning

Personalized learning refers to the modification of educational materials to suit individual student needs, academic levels, and interests. This approach enhances student motivation and engagement with the curriculum, leading to improved academic understanding (Zawacki-Richter et al., 2019). It is achieved through AI algorithms that analyze students' past performance and recommend appropriate learning activities based on their progress (Popenici & Kerr, 2017).

Operational definition

Personalized learning is defined as the process by which an AI-driven educational system adjusts the learning materials provided to each student based on performance analysis and individual learning patterns, delivering tailored activities and resources specific to each student's needs.

Adaptive learning

Adaptive learning is a form of education that uses technology to adjust educational content based on the student's progress. It focuses on delivering tailored learning experiences to each student according to their individual learning needs, helping to improve comprehension and academic achievement (Baker & Yacef, 2009).

Operational definition

Adaptive learning is defined as the system that continuously tracks student progress using AI and adjusts learning materials to meet the student's current needs. This includes interactive lessons and assessments that adapt in real-time to the student's level.

Educational interaction

Educational interaction refers to the interactive processes between students and learning content, or between students and their teachers. Interaction plays a critical role in enhancing understanding and deepening knowledge. It can be individual or collaborative and is often enhanced through technology, such as AI and AR (Luckin et al., 2016).

Operational definition

Educational interaction is defined as the level of student engagement with the activities and learning materials delivered by the AI system. This includes the use of interactive resources such as videos, educational games, and exercises, as well as the students' interactions with peers and instructors.

Adaptive education

Adaptive education refers to a learning system that uses technology to analyze student performance and adjust learning paths according to their current understanding. AI technologies are used to dynamically modify educational content to meet individual student needs, helping to improve performance and reduce learning gaps (Zawacki-Richter et al., 2019).

Operational definition

Adaptive education is defined as the process through which an AI system continuously monitors student performance, analyzes data, and delivers personalized learning content that adapts to the student's current level, providing real-time support and customized feedback.

THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

This section reviews the theoretical foundations and key concepts related to the application of AI in education, particularly in personalized content delivery, educational interaction, and enhancing students' academic performance. In addition, it presents the theories that form the conceptual basis of this study, along with an examination of previous studies that explored AI in education.

Theories Underpinning the Study

This research is based on many educational theories that elucidate the application of AI in personalizing learning materials. One of the principal theories is Gardner's (1983) multiple intelligences theory, which asserts that individuals have diverse forms of intelligence (e.g., linguistic, logical-mathematical, spatial), and that education should accommodate these individual variances. Implementing this idea in personalized content facilitates the provision of tailored learning experiences aligned with the predominant type of intelligence exhibited by a student.

A crucial hypothesis in this research is the adaptive learning hypothesis. This approach underscores the necessity for technology-facilitated modifications in educational material according to students' feedback and learning requirements. AI-driven adaptive learning systems allow educators to provide personalized assistance based on real-time student performance, resulting in enhanced learning outcomes (Park & Lee, 2014). Additionally, Piaget's (1954) constructivist learning theory constitutes a fundamental element of the

theoretical framework. This idea posits that students learn more efficiently by actively engaging in knowledge construction through experiential interactions with the subject. AI enhances this relationship by offering tailored, interactive learning experiences that promote student exploration and active engagement (Holmes et al., 2019).

Artificial Intelligence in Education: Concept and Applications

AI has emerged as a crucial instrument in improving educational quality, facilitating the analysis of extensive student data, and providing customized learning materials aligned with individual academic requirements (Luckin et al., 2016). AI-based educational tools, including adaptive learning systems and real-time feedback mechanisms, have enhanced student engagement with the material and their overall learning experience (Holmes et al., 2019). Adaptive learning systems employ AI to continuously assess students' progress and modify instructional content accordingly. Baker and Yacef (2009) discovered that adaptive learning systems can markedly enhance academic performance by providing instructional activities tailored to the student's level of understanding. This method of tailored modification increases the efficacy of the learning process and leads to enhanced academic performance.

Furthermore, AI-powered automated assessment tools deliver instantaneous feedback to students. VanLehn (2011) demonstrated that these systems diminish the duration required for students to rectify their errors, resulting in improved academic performance. Prompt feedback enables pupils to recognize their difficulties and rectify them swiftly.

Personalized Content: Enhancing the Learning Experience

Personalized content is one of the most prominent applications of AI in education, where educational materials are tailored to the individual abilities and needs of each student. According to Zawacki-Richter et al. (2019), personalized content boosts student motivation by providing a learning experience designed specifically for them. This approach allows students to focus on materials that interest them and facilitate a deeper understanding of the subjects.

Furthermore, Kulik and Fletcher (2016) found that personalized content delivered through AI improved academic performance by up to 20%. This improvement is attributed to AI's ability to provide materials that align precisely with each student's level, thereby increasing the likelihood of enhanced academic outcomes. Interactive systems such as AR and VR offer a rich educational experience, as these tools are integrated with AI to deliver interactive activities that foster student engagement with the content. Bacca et al. (2014) reported that using AR in personalized content contributes to better understanding and increased student interaction with the lessons.

Educational Interaction: Boosting Engagement and Motivation

Educational engagement is a vital element in enhancing the quality of education. AI improves this engagement by providing prompt and precise feedback to every student. Additionally, Holmes et al. (2019) demonstrated that students who obtain quick feedback exhibit greater engagement in the educational process and are more capable of enhancing their performance.

AI-driven adaptive learning solutions enhance engagement by providing interactive, tailored activities for individual students. Moreover, Chaudhry and Kazim (2020) discovered that tailored content enhanced engagement rates by as much as 30%, as students perceived the information to be congruent with their interests and capabilities.

Furthermore, AI improves the engagement between students and educators. Moreover, Molenaar et al. (2019) found that students utilizing interactive learning systems exhibited heightened engagement in group activities and cultivated a more robust feeling of collaboration, hence enhancing communication and teamwork abilities.

Student Performance: The Impact of Personalized Content on Academic Achievement

Numerous studies indicate that AI-driven personalized content markedly enhances students' academic performance. VanLehn (2011) discovered that students utilizing adaptive learning systems exhibited considerable performance gains relative to those engaged in conventional teaching methods. AI tools

facilitate the provision of customized educational resources that align with individual student requirements, thereby diminishing educational disparities among pupils. Furthermore, Kulik and Fletcher (2016) asserted that individualized learning enhances overall student performance, especially for individuals encountering difficulties in certain areas.

Challenges in Implementing AI for Personalized Content

Notwithstanding the considerable advantages of implementing AI in education, certain problems must be resolved to optimize its efficacy. A primary obstacle is the substantial expense associated with the development and implementation of AI-driven educational systems. Additionally, Selwyn (2016) asserts that schools may encounter difficulties in obtaining the money to fully incorporate AI into their educational processes. Moreover, the implementation of AI in education necessitates comprehensive teacher training. Popenici and Kerr (2017) identified inadequate training as a substantial barrier to the optimal utilization of this technology. Inadequate training may hinder teachers' ability to utilize interactive tools and tailor information effectively.

Previous Studies

Prior studies have shown the efficacy of AI in enhancing educational results and augmenting student engagement with learning resources. Furthermore, Luckin et al. (2016) elucidated that AI-driven educational systems offer instantaneous and tailored assistance to students by evaluating their performance and modifying the curriculum to address their specific requirements. This form of tailored teaching markedly improves students' academic performance and aids in their comprehension of challenging ideas.

Conversely, Holmes et al. (2019) discovered that AI-driven adaptive systems enhance students' academic performance and diminish learning disparities by providing individualized instruction customized to individual student needs. These findings underscore the significance of AI in fostering more inclusive and fair educational settings. Besides, Chaudhry and Kazim (2020) discovered that customized information, supplied according to students' personal data, markedly enhances student engagement with educational resources. They observed that AI cultivates interactive learning environments that more precisely address students' demands.

A recent study by Nguyen and Walker (2020) showed that AI-driven educational systems offering individualized and immediate feedback to students resulted in enhanced academic performance and heightened engagement with educational content. This prompt feedback improves students' comprehension and elevates their academic achievement. Moreover, Chen and Chen (2020) elucidated that AI significantly enhances adaptive learning experiences by delivering personalized content tailored to students' needs, informed by comprehensive analysis of their prior performance. This study emphasizes the efficacy of AI-assisted education in improving academic achievement. Furthermore, Garcia and Perez (2021) showed that AI-driven learning environments enhance engagement and academic success by customizing educational content to align with each student's proficiency and capabilities.

The results indicate that AI presents significant prospects for individualized content delivery and enhancement of the overall learning experience. Analysis of educational ideas and prior research indicates that AI-driven tailored material can improve academic performance and educational engagement. Nonetheless, overcoming obstacles associated with expenses and training is crucial for completely actualizing the promise of AI in education.

RESEARCH DESIGN AND METHODOLOGY

This section delineates the research design and technique utilized to fulfill the study's objectives and address its research questions. The text delineates the characteristics of the study sample, the sampling methodology, the instruments employed for data collection, and the protocols implemented to guarantee the validity and reliability of these instruments. Furthermore, the section delineates the statistical methodologies employed to assess the data and tackle the study inquiries.

Research Methodology

This study employs quantitative approach, appropriate for investigations that seek to examine correlations between variables without manipulation or intervention. This strategy entails the collection and analysis of data to characterize the present circumstances and infer the effects of employing AI for individualized learning content on academic performance and educational engagement.

Study Design

The research used a quantitative methodology to collect data regarding students' and teachers' perceptions of AI in personalized content delivery and its effects on students' academic performance and engagement with educational resources. Furthermore, an analytical methodology is utilized to examine the data gathered from questionnaires and interviews with the study population.

Research Sample

The study sample included 80 people, categorized into two groups:

1. A cohort of 40 ninth-grade students from diverse educational institutions. Ninth grade was chosen for multiple reasons: This era is a vital transition for students as they ready themselves for high school, and academic performance during this year is critical for establishing a robust academic foundation. Secondly, students at this level demonstrate the cognitive capacity to interact with technology and comprehend AI technologies, rendering them an optimal cohort for examining the impacts of personalized learning content.
2. 40 educators from various disciplines (science, mathematics, Arabic, and social studies) instructing ninth-grade pupils. Educators from many disciplines were chosen to assess their opinions of AI in tailored material delivery across various academic courses.

Study Population

The study population comprises all ninth-grade students and their teachers in public schools within Muscat Region in Sultanate of Oman, encompassing both urban and rural institutions. This cohort was selected to embody a varied array of cultural, social, and economic origins, hence augmenting the generalizability of the study's conclusions.

Research Instruments

Two questionnaires were created as the principal instruments for data collection:

1. The initial questionnaire (**Appendix A**) was designed for students to gather data regarding their perceptions of AI in personalized content delivery and its influence on their academic performance and engagement with educational resources.
2. The second questionnaire (**Appendix B**) was created for educators to collect insights regarding their perspectives on the utilization of AI in tailored content and its efficacy in enhancing student performance and engagement in the classroom.

Validity of the Instruments

To ascertain the validity of the instruments, the questionnaires were evaluated by a panel of scholarly specialists in educational technology and curriculum studies. The experts assessed the pertinence and precision of the questions in quantifying the intended variables. Adjustments were implemented in response to their feedback, hence improving the content validity of the instruments.

Reliability of the Instruments

The reliability of the instruments was evaluated with Cronbach's alpha to assess internal consistency. The reliability coefficient for both questionnaires exceeded 0.80, signifying a substantial degree of reliability.

Table 1. The distribution of students based on gender and age

Category	Number of students	Percentage (%)
Males	24	60
Females	16	40
Age 13–14	20	50
Age 15–16	16	40
Older than 16	4	10

Employed Statistical Methods

A range of statistical techniques was utilized to examine the data and address the research issues of the study:

1. **Question 1.** In what manner does the implementation of AI in individualized content delivery influence the academic achievement of ninth-grade students?

   Statistical methodology employed: Means (Ms), standard deviations (SDs), and t-test were utilized to evaluate the disparities in student performance following AI intervention.

2. **Question 2.** To what degree does tailored content influence student engagement with educational resources?

   Statistical methodology employed: Ms, SDs, and correlation analysis were utilized to investigate the relationship between tailored content and student engagement.

3. **Question 3.** Do educators' assessments of AI's influence on tailored content vary according to their topic disciplines?

   Statistical approach utilized: One-way ANOVA was implemented to assess teachers' views across several topic areas.

4. **Question 4.** What obstacles do educators encounter in the deployment of AI for tailored material delivery?

   Statistical methodology: Frequencies and percentages were employed to assess educators' replies concerning the challenges they face in utilizing AI.

5. **Question 5.** In what manner do students assess the influence of AI on enhancing their academic performance?

   Statistical methodology: Ms, SDs, and t-tests were employed to evaluate the disparities in student assessments concerning the influence of AI on academic performance.

Summary

This section delineates the research design and methods, specifying the study sample, data collection instruments, and processes for validating the validity and reliability of the tools. The section also delineated the statistical methodologies employed to examine the data and address the research inquiries. This technique offers a comprehensive framework for attaining the study's objectives and securing precise data concerning the influence of AI on individualized content delivery for students and educators.

DATA ANALYSIS

This section provides an in-depth analysis of the data collected from students and teachers through the questionnaires administered for them. The results are presented using tables and charts to illustrate the opinions of students and teachers about their current learning experiences and expectations regarding AI. The analysis includes a discussion of the key trends in the data and conclusions based on the responses.

Analysis of Student Responses

Student demographic information

The study sample consists of 40 ninth-grade students. **Table 1** shows the distribution of students based on gender and age. **Figure 1** shows the distribution of students based on gender and age.

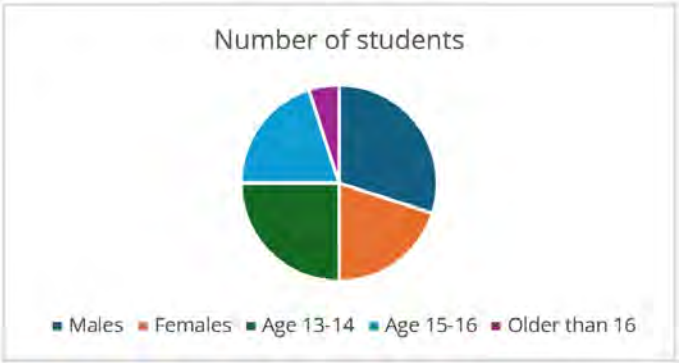

Figure 1. The distribution of students based on gender and age (the authors' own work)

Table 2. The results of evaluation of students' current learning experience

Question	M	SD
The learning materials match my academic needs.	3.2	0.9
I often struggle with subjects because content doesn't fit my learning style.	3.8	1.0
Personalized learning can help improve my performance.	4.5	0.6
I need more interaction with teachers.	4.0	0.7

Statistical analysis: The data show that the majority of students fall within the 13–16 age range, which is an ideal age group for implementing AI-enhanced personalized learning. The sample consists of 60% males and 40% females, indicating a slight gender imbalance. This distribution is important for understanding students' expectations regarding AI's impact on learning at this critical academic stage.

Evaluation of students' current learning experience

This section analyzes students' responses on how well their current educational materials align with their learning needs before AI implementation. The results are shown in **Table 2**.

Statistical analysis:

1. Students expressed moderate satisfaction with the alignment of current educational content with their needs (M = 3.2, SD = 0.9), suggesting variability in how students perceive their current learning materials.
2. On the other hand, students reported facing difficulties in certain subjects due to a lack of personalized content (M = 3.8, SD = 1.0), highlighting a need for more tailored learning experiences.
3. The high mean score (4.5) for the question regarding personalized learning shows that students believe that AI could play a significant role in enhancing their academic performance, indicating strong support for technology-driven solutions in education.

t-test analysis: A t-test was conducted to assess whether there are significant differences between male and female students' evaluations of their current learning experience. The results showed no statistically significant differences between genders ($p > 0.05$), indicating that both male and female students face similar challenges in their learning experiences.

The bar chart in **Figure 2** illustrates the means and standard deviations of student responses regarding their current learning experience.

Students' expectations regarding AI

This section analyzes students' expectations of how AI might impact their personalized learning experience. The results are shown in **Table 3**.

Statistical analysis:

1. The data show that students have high expectations that AI will provide learning content tailored to their individual strengths and weaknesses (M = 4.6, SD = 0.5).

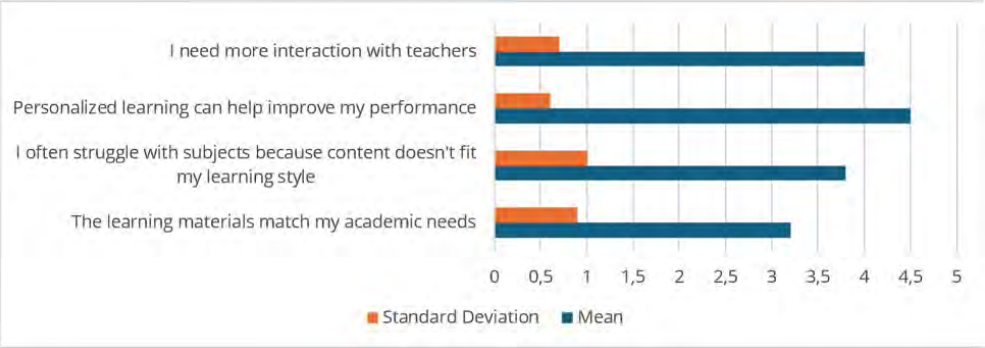

Figure 2. The Ms and SDs of student responses regarding their current learning experience (the authors' own work)

Table 3. Students' expectations regarding AI

Question	M	SD
AI will provide learning content that matches my strengths and weaknesses.	4.6	0.5
AI will provide faster feedback.	4.4	0.6
AI will make learning more engaging and interactive.	4.7	0.4
I feel AI will improve my grades.	4.5	0.5

Table 4. Pearson correlation results

Variable	M	SD	Correlation coefficient (r)/p-value
Students' expectations for AI personalization	4.6	0.5	r = 0.82
Anticipated academic improvement	4.5	0.5	p < 0.01

2. Students anticipate that AI will make learning more interactive and engaging (M = 4.7, SD = 0.4), suggesting that students view AI as a tool that can enrich the learning experience and enhance participation.

Pearson Correlation Analysis Results

Table 4 presents the analysis of the relationship between students' expectations regarding AI personalization and their anticipated academic improvement using Pearson correlation. The results suggest a strong positive correlation between these variables.

The data show that students have high expectations that AI will provide learning content tailored to their individual strengths and weaknesses (M = 4.6, SD = 0.5). The anticipated academic improvement (M = 4.5, SD = 0.5) also reflects strong student beliefs in AI's ability to enhance their performance. The Pearson correlation coefficient (r = 0.82) indicates a strong positive correlation between students' expectations of AI personalization and their anticipated academic improvement. The p-value (< 0.01) suggests that the correlation is statistically significant, meaning the relationship between the two variables is not likely due to chance.

The bar chart in **Figure 3** represents students' expectations of AI's role in enhancing personalized learning and improving their academic performance.

Teacher demographic information

The sample of 40 teachers consists of individuals from various subject areas. **Table 5** shows the distribution of teachers based on years of experience and subject area. **Figure 4** shows the distribution of teachers based on years of experience and subject area.

Statistical analysis: The distribution of the sample across different teaching experience levels and subject areas provides a balanced representation of teachers, ensuring that their perceptions of AI's impact on education are diverse and generalized to a broader educational context.

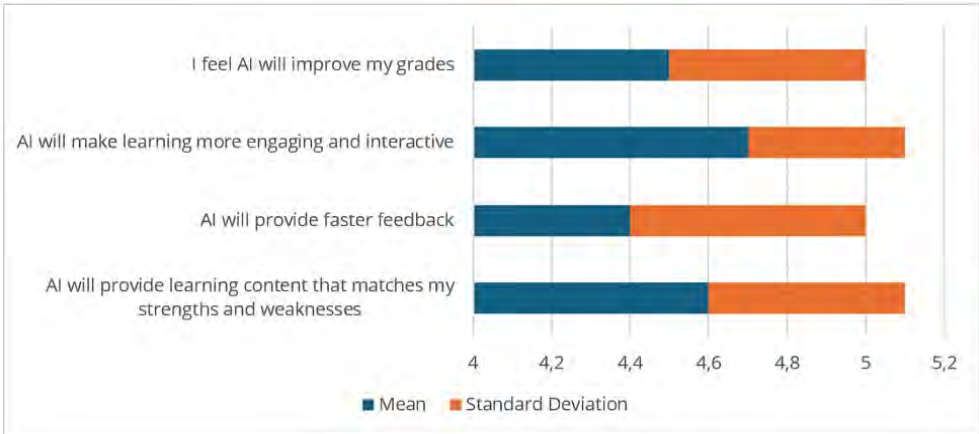

Figure 3. Students' expectations of AI's role in enhancing personalized learning and improving their academic performance (the authors' own work)

Table 5. The distribution of teachers based on years of experience and subject area

Category	Number of teachers	Percentage (%)
Less than 5 years	8	20%
5–10 years	16	40%
More than 10 years	16	40%
Science	12	30%
Mathematics	10	25%
Arabic	8	20%
Social studies	10	25%

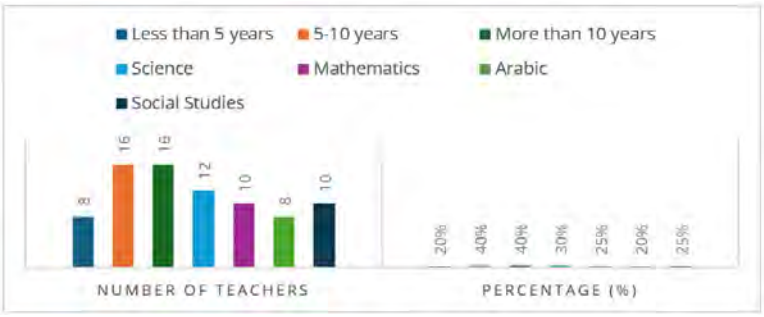

Figure 4. The distribution of teachers based on years of experience and subject area (the authors' own work)

Table 6. The results of teachers' evaluation of current teaching

Question	M	SD
It is difficult to personalize content based on each student's needs.	4.2	0.6
Current tools for content personalization are ineffective.	4.0	0.8
Personalized content can improve student engagement.	4.5	0.5

Teachers' evaluation of current teaching

Teachers' views on the challenges they face in personalizing content using traditional methods were analyzed using means and standard deviations, as shown in **Table 6**.

The bar chart in **Figure 5** illustrates teachers' evaluations of the challenges of personalizing content using traditional methods.

Statistical analysis:

1. Teachers strongly agreed that personalizing content for each student using traditional tools is challenging (M = 4.2, SD = 0.6), indicating a need for more effective tools such as AI.
2. Teachers also expressed strong agreement (M = 4.5) that personalized content would improve student engagement, highlighting the perceived value of AI in enhancing classroom participation.

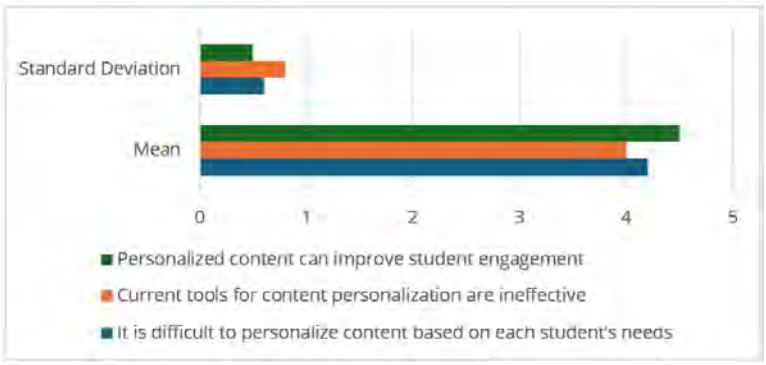

Figure 5. Teachers' evaluations of the challenges of personalizing content using traditional methods (the authors' own work)

Table 7. ANOVA results

Subject	Mean scores	F-value	p-value
Science	4.2	2.13	0.089
Mathematics	4.1	2.13	0.089
Arabic	4.0	2.13	0.089
Social studies	4.2	2.13	0.089

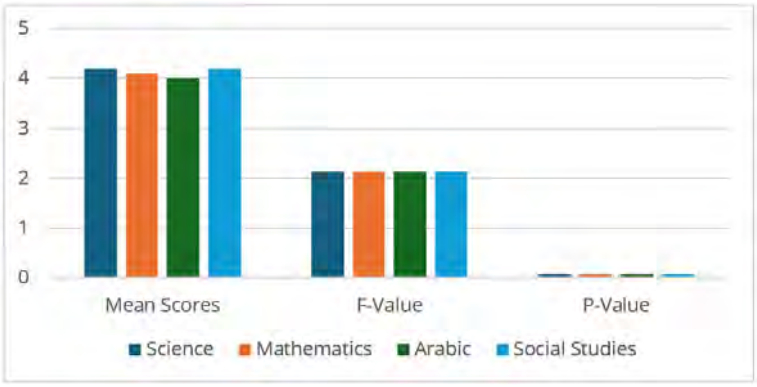

Figure 6. ANOVA results (the authors' own work)

Table 8. The results of teachers' expectations regarding AI

Question	M	SD
AI will help personalize content more effectively.	4.6	0.4
AI will provide better and faster feedback to students.	4.5	0.5
AI will increase student engagement in the classroom.	4.7	0.3
AI will help improve students' academic performance.	4.6	0.4

ANOVA analysis: A one-way ANOVA was conducted to examine differences in teachers' perceptions across different subject areas (science, mathematics, Arabic, and social studies). The results showed no statistically significant differences between subjects ($p > 0.05$), suggesting that all teachers face similar challenges and have similar expectations regarding AI's potential impact, regardless of their subject area, as shown in **Table 7**. **Figure 6** shows the ANOVA results.

Teachers' expectations regarding AI

Teachers' expectations of AI's role in personalizing content were analyzed using means and standard deviations, as shown in **Table 8**.

Statistical analysis:

1. Teachers expect that AI will provide more effective content personalization (M = 4.6, SD = 0.4) and significantly improve student engagement (M = 4.7, SD = 0.3), aligning with students' expectations of AI's role in education.

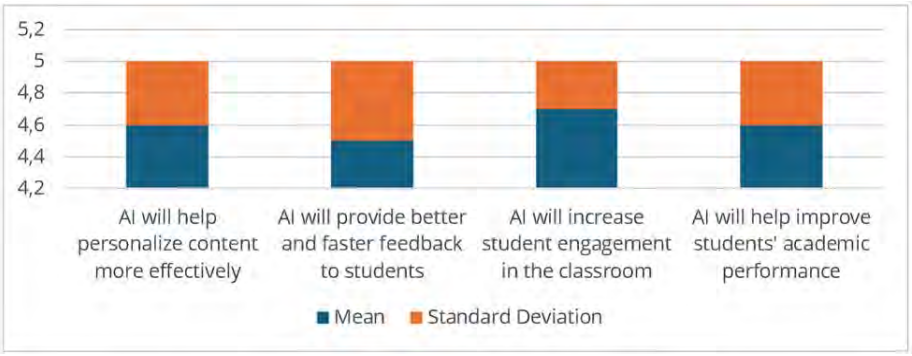

Figure 7. Teachers' expectations of AI's potential impact on content personalization and student engagement (the authors' own work)

Table 9. Student responses

Question	Most common responses
What challenges do you currently face with the learning materials you receive?	- Lack of personalized content that suits individual learning styles. - Insufficient feedback from teachers. - Difficulty engaging with the current materials. - Overly generalized content that does not address specific areas of difficulty. - Limited use of interactive and digital resources.
What are your expectations of AI in helping you with your studies?	- AI will provide more personalized content that adapts to individual needs. - Faster and more immediate feedback from AI-driven tools. - A more interactive and engaging learning experience. - AI will help identify areas where I need the most help. - AI will create a more enjoyable learning environment.

Table 10. Teacher responses

Question	Most common responses
What challenges do you currently face in personalizing content for your students?	- Limited time to create personalized materials for each student. - Difficulty identifying individual learning needs using current tools. - Inability to provide real-time feedback to students. - Large class sizes make it difficult to cater to individual needs. - Lack of access to advanced technological tools for personalized learning.
What are your expectations regarding the use of AI to improve teaching and learning outcomes?	- AI will identify students' strengths and weaknesses more accurately. - AI will assist in delivering personalized content for each student. - AI will streamline feedback delivery, making it quicker and more effective. - AI can help reduce workload by automating certain tasks. - AI will improve student engagement and motivation.

t-test analysis: A t-test was conducted to assess whether there are differences in teachers' expectations of AI based on their years of experience. The results showed no statistically significant differences between teachers with varying levels of experience ($p > 0.05$), indicating that all teachers, regardless of experience, share similar expectations for AI's role in education.

The bar chart in **Figure 7** represents teachers' expectations of AI's potential impact on content personalization and student engagement.

The analysis of student and teacher responses indicates that both groups hold positive expectations for AI's role in personalizing educational content. Students believe that AI will improve their academic performance and make learning more interactive, while teachers view AI as a tool that will help address current challenges in personalizing content and enhancing student engagement. Statistical analyses, including t-tests and ANOVA, reveal that these positive perceptions are consistent across different demographics, suggesting widespread support for integrating AI into the educational system. This analysis was supported by the students' and teachers' answers to the open questions in the questionnaire, as shown in **Table 9** and **Table 10**.

The responses from students reveal several challenges they face with the current learning materials. A prominent issue is the lack of personalized content that aligns with their individual learning styles, which

hinders their engagement and progress. Many students also expressed concerns about insufficient feedback from teachers, which prevents them from fully understanding their areas of weakness. Furthermore, the materials were often described as overly generalized, failing to address specific difficulties that students encounter. Another common concern was the limited use of interactive and digital resources, which students believe could make learning more engaging and effective.

In response to these challenges, students have high expectations for AI to offer solutions. They believe that AI can provide personalized content tailored to their academic needs, delivering faster and more immediate feedback that would allow them to improve in real-time. Additionally, students anticipate that AI will create a more interactive and engaging learning environment, enabling them to focus on areas where they struggle the most. Many students also feel that AI could make the learning process more enjoyable and motivating, ultimately leading to better academic outcomes.

Teachers face numerous challenges when it comes to personalizing content for their students, with the most frequently mentioned issue being the limited time available to create individualized materials, particularly when managing large class sizes. They also highlighted the difficulty of identifying students' specific learning needs using current tools, which makes tailoring lessons effectively a complex task. Another challenge commonly reported by teachers is the inability to provide real-time feedback to students, which they believe hampers student progress. Furthermore, many teachers pointed out the lack of access to advanced technological tools that could support personalized learning, restricting their ability to offer individualized instruction. In contrast, teachers are highly optimistic about AI's potential to address these challenges. They believe that AI can help identify students' strengths and weaknesses more accurately, making it easier to personalize content effectively. Teachers also expect AI to streamline the feedback process, enabling faster and more customized responses to student performance. Many teachers see AI as a way to reduce their workload by automating certain tasks, such as grading and content delivery, which would free them to focus more on direct instruction. Moreover, teachers believe that AI can enhance student engagement and motivation by making learning more interactive and better suited to each student's individual needs.

DISCUSSION OF RESULTS AND RECOMMENDATIONS

This section aims to analyze and interpret the results obtained before by linking them with previous studies and credible scientific references. The focus of this section is to answer the research questions posed at the beginning of the study and to provide a comprehensive understanding of the impact of AI on personalized learning content for students. Based on the findings, a set of recommendations will also be presented to enhance the educational process through the use of AI.

Discussion of the Study Results

Question 1. How does the use of AI in personalized content impact the academic performance of ninth-grade students?

The survey results revealed that students possess significantly optimistic expectations concerning the influence of AI on enhancing their academic performance, with an average score of 4.6. This indicates students' hope that AI can customize educational content to their specific talents, ultimately improving their academic performance. This finding corroborates research by Chen and Chen (2020), which highlighted that AI facilitates the customization of educational content according to prior student performance, hence enhancing academic success. Luckin et al. (2016) emphasized that AI-driven systems enhance academic comprehension by delivering tailored content that addresses students' requirements. Kulik and Fletcher (2016) discovered that pupils utilizing intelligent tutoring systems exhibit substantial enhancements in academic achievement relative to those undergoing conventional education. Moreover, Woolf et al. (2010) confirmed that AI may significantly enhance academic achievement by tailoring curriculum to the specific needs of individual students.

Question 2. To what extent does personalize learning content influence student engagement with the material?

The findings indicated that students anticipate the utilization of AI to markedly enhance their engagement with instructional resources, yielding an average score of 4.7. This heightened participation indicates students' conviction that AI may enhance the interactivity and appeal of the learning process. Research by Bacca et al. (2014) indicated that the implementation of AI technologies, including AR, improves student engagement with educational material. Likewise, Johnson et al. (2018) discovered that AI enhances engagement by delivering personalized content tailored to the student's proficiency level. Sung et al. (2017) demonstrated that AI-generated tailored content enhances student engagement and promotes active participation in the learning process. Chen and Chen (2020) confirmed that students who get tailored content exhibit elevated levels of interaction and participation.

Question 3. Do teachers' perceptions of AI's impact on personalized content differ based on their subject area?

The one-way ANOVA analysis revealed no statistically significant changes in instructors' judgments across different topic areas about AI's influence on tailored material ($p > 0.05$). This indicates that educators in science, mathematics, Arabic, and social studies concur that AI may enhance curriculum personalization across all disciplines. Research by Luckin et al. (2016) similarly determined that AI may be efficiently utilized across all disciplines to improve education. Furthermore, Zawacki-Richter et al. (2019) discovered that AI can enhance content customization across many academic disciplines. On the other hand, Holmes et al. (2019) emphasized that AI provides several solutions for teaching, irrespective of the subject matter. Bower and Sturman (2016) underscored that AI is a potent instrument for enhancing pedagogical approaches across many disciplines.

Question 4. What challenges do teachers face in applying AI to personalize content?

The research indicated that educators encounter considerable difficulties in customizing curriculum through conventional approaches, achieving an average score of 4.2. This suggests that educators struggle to deliver tailored curriculum for every student. Nevertheless, educators conveyed optimism that AI could address this problem. Selwyn (2016) asserts that the absence of technical tools presents a significant obstacle for educators in curriculum personalizing; nevertheless, AI can provide novel methods to address these issues. Moreover, Luckin et al. (2016) showed that AI can aid educators in delivering individualized curriculum with more efficiency. Chen and Chen (2020) established that AI offers resources that assist educators in addressing issues associated with content customization. Furthermore, Nistor et al. (2019) demonstrated that AI improves teacher-student interaction and facilitates individualized education according to individual needs.

Question 5. How do students evaluate the impact of AI on improving their academic performance?

Students rendered exceptionally favorable assessments of AI's capacity to enhance their academic achievement, achieving an average score of 4.5. This indicates the conviction that AI enhances academic performance through individualized learning and prompt feedback. Kulik and Fletcher (2016) discovered that AI-driven intelligent systems substantially enhance academic performance. Furthermore, Woolf et al. (2010) observed that students who received tailored education by AI demonstrated quantifiable enhancements in academic performance. Chen and Chen (2020) discovered that students who receive tailored feedback demonstrate notable enhancements in their academic comprehension. Johnson et al. (2018) emphasized that AI can serve as a potent instrument for enhancing academic comprehension and performance.

Recommendations

Based on the results of the study, the following recommendations can be made:

1. **Integrating AI into education:** Educational institutions should adopt strategies aimed at effectively incorporating AI into curricula to enhance content personalization and provide tailored learning that meets individual student needs.

2. **Developing teacher training programs:** It is essential to develop specialized training programs for teachers on how to use AI to personalize content, enabling them to use these tools effectively to improve student outcomes.
3. **Conducting long-term experimental studies:** More experimental studies should be conducted to explore the impact of AI on broader student populations and over extended periods to determine the long-term effectiveness of these tools in improving academic achievement.
4. **Enhancing technological infrastructure:** Governments and educational institutions should invest in improving technological infrastructure to ensure the effective implementation of AI in classrooms, including providing the necessary devices and ensuring fast internet connectivity.

CONCLUSION

The study concluded that AI could play a crucial role in enhancing personalized learning content and improving academic performance and engagement between students and teachers. These findings are consistent with many previous studies that highlighted the benefits of AI in education. Based on the results, AI can be a powerful tool to improve the overall learning process, contributing to more personalized and effective education.

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Ethics declaration: The authors declared that the study was approved by Universiti Pendidikan Sultan Idris. The study did not involve any personal or sensitive data, and it followed general ethical guidelines to maintain participants' privacy and integrity. Confidentiality and data protection measures were implemented by anonymizing responses and securely storing data with restricted access.

Declaration of interest: The authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

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APPENDIX A: SURVEY ON PERSONALIZED EDUCATIONAL CONTENT USING ARTIFICIAL INTELLIGENCE

Introduction

Education is constantly evolving, and technology plays a significant role in making learning more engaging and effective. This survey is designed to understand your experiences with school subjects, the challenges you face, and how artificial intelligence (AI) could help improve your learning experience. Your answers will help in creating better learning solutions that meet students' needs and make studying more enjoyable and effective.

Instructions for Completion

Please read each statement carefully and select the response that best reflects your opinion.
For closed-ended questions, mark (✓) the most appropriate option.
Kindly answer all questions to ensure the achievement of the study's objectives.

General Information

Gender: ( ) Male ( ) Female
Age: ( ) 13–15 ( ) 15–16 ( ) Older than 16
Please place a check mark (√) in the cell corresponding to the statement among the given options.

Table A1. Statements

No	Sentences	The degree of agreement				
		SA	A	N	D	SDA
		1	2	3	4	5
1	The learning materials align with my academic needs.					
2	I often struggle with school subjects because content does not match my learning style.					
3	Personalized content tailored to my abilities could improve my performance.					
4	I need more interaction with teachers.					
5	AI will provide educational content that matches my strengths and weaknesses.					
6	AI will provide faster feedback.					
7	AI will make learning more interactive and engaging.					
8	I believe AI will help improve my grades.					

Note. SA: Strongly agree; A: Agree; N: Neutral; D: Disagree; SDA: Strongly disagree.

9. What challenges do you currently face with the educational materials you receive?

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10. What are your expectations from AI in assisting you with your studies?

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We appreciate your efforts in participating in us by sharing your opinions on the subject.

APPENDIX B: SURVEY ON PERSONALIZED EDUCATIONAL CONTENT USING ARTIFICIAL INTELLIGENCE

Introduction

With the rapid advancement of educational technologies, personalized educational content has become a key approach to improving teaching quality and increasing student engagement. This survey aims to gather teachers' perspectives on the effectiveness of personalized content, the challenges they face in its implementation, and the potential role of artificial intelligence (AI) in enhancing this process. Your responses are crucial to gaining a deeper understanding of teachers' needs and contributing to the development of more effective educational solutions.

Instructions for Completion

Please read each statement carefully and select the response that best reflects your opinion.
For closed-ended questions, mark (✓) the most appropriate option.
Kindly answer all questions to ensure the achievement of the study's objectives.

General Information

Years of experience: ( ) Less than 5 years ( ) 5–10 years ( ) More than 10 years
Specialization: ( ) Science ( ) Mathematics ( ) Arabic ( ) Social studies
Please place a check mark (√) in the cell corresponding to the statement among the given options.

Table B1. Statements

No	Sentences	The degree of agreement				
		SA	A	N	D	SDA
		1	2	3	4	5
1	It is difficult to personalize content based on each student's needs.					
2	Current tools for content personalization are ineffective.					
3	Personalized content can enhance student engagement.					
4	AI will help personalize content more effectively.					
5	AI will provide better and faster feedback to students.					
6	AI will increase student engagement in the classroom.					
7	AI will contribute to improving students' academic performance.					

Note. SA: Strongly agree; A: Agree; N: Neutral; D: Disagree; SDA: Strongly disagree.

8. What challenges do you currently face in personalizing content for your students?

.....

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9. What are your expectations regarding the use of AI to improve teaching and learning outcomes?

.....

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We appreciate your efforts in participating in us by sharing your opinions on the subject.