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ADOPTION OF AI LEARNING TOOLS AND THEIR EFFECT ON STUDENTS' ACADEMIC OUTCOMES AT SECONDARY LEVEL

Abdul Nasir[*1], Dr Wajid Mahnaz[2]

[*1]*M. Phil Education, Department of Education, Alhamd Islamic University Quetta*
[2]*PhD Education, Department of Education, Alhamd Islamic University Islamabad*

[*1]nasirabdul208@gmail.com, [2]wajid.mahnaz@yahoo.com

Corresponding Author: *
Abdul Nasir
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ABSTRACT

The study titled "Adoption of AI Learning Tools and Academic Outcomes of Secondary Students" explored the role of artificial intelligence in enhancing student learning and performance. The study aimed to achieve three objectives: to determine the relationship between AI tool adoption and overall academic outcomes, to examine the relationship between AI adoption and performance in core subjects, and to investigate the relationship between frequency of AI tool use and academic outcomes. A quantitative research design was employed to address these objectives. The population of the study consisted of 8,617 secondary students, and a sample of 368 students was selected using stratified random sampling. Data were collected through a structured questionnaire designed to measure AI adoption and academic performance. The research tool was validated for content by educational experts, and its reliability was confirmed using Cronbach's alpha (0.87). Data were analyzed using descriptive statistics, including mean, frequency, and percentage, as well as correlation analysis to examine the relationships between variables. One key finding revealed a strong positive correlation between AI adoption and overall academic performance ($r = 0.635$, $p < 0.01$), and it is recommended that schools promote consistent integration of AI learning tools to enhance student outcomes. The study is significant because it provides empirical evidence on the effectiveness of AI in secondary education, highlighting its potential to improve learning experiences and inform educational policies. Overall, the findings underscore the importance of adopting AI technologies in classrooms to support personalized, engaging, and effective learning for secondary students.

Keywords: *AI learning tools, secondary education, academic outcomes, adaptive learning, intelligent tutoring systems, frequency of AI use, student engagement, educational technology*

INTRODUCTION

The rapid development of Artificial Intelligence (AI) has significantly influenced various sectors of society, including education. In recent years, AI learning tools such as intelligent tutoring systems, adaptive learning platforms, automated feedback systems, and AI-supported content generators have increasingly been integrated into educational environments. These tools are designed to personalize learning experiences, support teachers in instructional delivery, and enhance students' engagement and academic performance (Holmes, Bialik, & Fadel, 2019; Zawacki-Richter et al., 2019). As education systems worldwide strive to improve learning effectiveness, the adoption of AI

learning tools has become a central focus of educational innovation.

The adoption of AI learning tools refers to the extent to which students and educators accept, integrate, and regularly use AI-based technologies in teaching and learning processes. Adoption is not limited to access to technology but involves attitudes, perceived usefulness, ease of use, and institutional support (Davis, 1989; extended in education by Teo, 2016; Scherer et al., 2019). Studies indicate that when AI tools are meaningfully adopted, they can transform traditional classrooms into more interactive and personalized learning environments (Luckin et al., 2016; Holmes et al., 2019). However, adoption remains uneven, particularly at the secondary level, where infrastructure, teacher readiness, and ethical concerns influence implementation.

Secondary education represents a crucial phase in students' academic development. At this stage, learners consolidate foundational knowledge, develop higher-order thinking skills, and prepare for future academic or professional pathways. Traditional one-size-fits-all instructional approaches often struggle to address individual differences in learning pace and ability. AI learning tools offer promising solutions by enabling adaptive instruction, targeted feedback, and real-time assessment (Woolf, 2015; Luckin et al., 2016). These features support differentiated learning, allowing students to receive customized assistance aligned with their specific strengths and weaknesses.

A growing body of empirical research supports the positive relationship between AI-supported learning and academic outcomes. Studies have shown that intelligent tutoring systems and adaptive platforms can significantly improve students' achievement, particularly in subjects such as mathematics and science (Ma, Adesope, Nesbit, & Liu, 2014; VanLehn, 2016; Chen, Xie, & Hwang, 2020). More recent investigations focusing on secondary school students indicate that AI-based tools enhance conceptual understanding, learning efficiency, and academic performance when integrated with sound pedagogical practices (Hwang, Tu, & Tang, 2021; Kaur, Mishra, & Maheshwari, 2022).

Furthermore, research suggests that AI adoption positively influences students' learning behaviors, including motivation, engagement, and self-regulated learning. Personalized AI environments provide immediate feedback and adaptive challenges, which encourage students to take greater ownership of their learning (Spector, 2018; Holmes et al., 2019). Increased engagement and motivation are widely recognized as strong predictors of academic success, particularly at the secondary level where students often experience declines in interest and academic confidence (Schindler et al., 2017; Hwang et al., 2021).

Despite these benefits, scholars also emphasize that the educational impact of AI depends largely on how these tools are adopted and implemented. Scherer et al. (2019) argue that without appropriate teacher training, curriculum alignment, and ethical guidelines, AI tools may be underutilized or misused. Concerns related to overreliance on AI, data privacy, and reduced critical thinking highlight the need for structured and pedagogically informed adoption (Zawacki-Richter et al., 2019; Selwyn, 2019). Therefore, examining adoption patterns is essential for understanding how AI tools contribute to academic outcomes rather than merely introducing technology into classrooms.

Although global literature increasingly addresses AI in education, there remains a need for focused empirical research at the secondary level, particularly in developing educational contexts. Differences in infrastructure, digital literacy, and instructional practices may shape both the adoption of AI tools and their impact on students' academic achievement. Investigating these relationships can provide valuable insights for educators, policymakers, and curriculum designers seeking to integrate AI responsibly and effectively. In light of these considerations, this study aims to examine the adoption of AI learning tools and their effect on students' academic outcomes at the secondary level**.** By exploring how secondary students use AI-based tools and how such usage relates to academic performance, the study seeks to contribute to the growing body of knowledge on AI-enhanced education and inform evidence-based strategies for improving teaching and learning in secondary schools.

Objectives of the Study

1. To determine the relationship between the adoption of AI learning tools and students' academic outcomes at the secondary level.
2. To examine the relationship between the level of AI learning tool adoption and students' academic performance in core subjects at the secondary level.
3. To investigate the relationship between students' frequency of using AI learning tools and their academic outcomes at the secondary level.

Hypothesis of the Study

Null Hypotheses (H_0)

H_{01}: There is no significant relationship between the adoption of AI learning tools and students' academic outcomes at the secondary level.

H_{02}: There is no significant relationship between the level of adoption of AI learning tools and students' academic performance in core subjects at the secondary level.

H_{03}: There is no significant relationship between the frequency of use of AI learning tools and students' academic outcomes at the secondary level.

Alternative Hypotheses (H_1)

H_1: There is a significant relationship between the adoption of AI learning tools and students' academic outcomes at the secondary level.

H_2: There is a significant relationship between the level of adoption of AI learning tools and students' academic performance in core subjects at the secondary level.

H_3: There is a significant relationship between the frequency of use of AI learning tools and students' academic outcomes at the secondary level.

Significance of the Study

This study is significant as it provides empirical evidence on the relationship between the adoption of AI learning tools and students' academic outcomes at the secondary level. By examining this relationship through correlation analysis, the findings will help educators understand whether and how the integration of AI tools is associated with students' academic performance. The results will be valuable for teachers in improving instructional strategies, for school administrators in making informed decisions about technology integration, and for policymakers in developing guidelines for the effective and responsible use of AI in secondary education. Furthermore, the study will contribute to the existing body of literature on artificial intelligence in education, particularly within secondary school contexts, and may serve as a reference for future researchers interested in exploring technology adoption and learning outcomes.

LITERATURE REVIEW:

Artificial Intelligence (AI) has become a transformative force in contemporary education, redefining teaching and learning processes globally. Its application spans adaptive learning systems, intelligent tutoring systems (ITS), automated feedback mechanisms, and personalized learning platforms that dynamically adjust educational content to individual learner needs. The adoption of AI tools promises to increase student engagement and enhance academic performance by tailoring instruction to learner profiles rather than employing traditional one-size-fits-all approaches (Mahnaz et al., 2023) and offering real-time analytics for educators.

Within the educational technology domain, AI tools are conceptualized as mechanisms that can replicate some aspects of personalized human tutoring by providing feedback, scaffolding tasks, adapting content difficulty, and supporting learners to bridge gaps in comprehension (Liu et al., 2025). Adoption, therefore, goes beyond mere availability; it captures the acceptance, frequency, and meaningful use of these tools within instructional practice. In secondary education — where students transition into higher cognitive demands — such tools have particular relevance for improving academic outcomes through learner-centered strategies.

Adoption of AI Tools in Secondary Education

Research on AI adoption in K-12 and secondary settings has shown increasing interest and gradual integration, although the extent and pattern vary widely by context. For example, studies focusing on AI integration in adaptive learning at the

secondary level highlight that AI can adjust pacing, content difficulty, and feedback in real time, creating personalization previously possible only in one-on-one tutoring scenarios (Apriliani & Rachman, 2025). These adaptive systems are particularly advantageous in mixed-ability classrooms where differentiated instruction remains a challenge for teachers.

Empirical investigations into AI adoption among teachers and students in secondary contexts reveal that adoption is mediated by user knowledge, perceived usefulness of AI tools, and competencies such as data literacy (Bibi et al., 2023). In one study of secondary school educators, competencies related to AI and data use were significant predictors of adoption likelihood, underscoring that teacher readiness directly influences how widely AI tools are implemented in classrooms. These findings corroborate technology acceptance frameworks that highlight the importance of both individual and contextual factors in technology adoption.

Secondary students also increasingly incorporate AI tools for learning tasks such as content review, problem solving, and feedback on written work (Nadelson, 2025). When AI tools are integrated systematically, they appear to foster self-paced learning, greater reflection, and higher motivation — variables that have been linked in educational research to better academic performance.

AI Tools and Their Functional Roles

Several categories of AI learning tools have been examined in the literature regarding their pedagogical and academic impact. Adaptive learning platforms, intelligent tutoring systems (ITS), and AI-driven assessment tools form the backbone of most AI applications studied in educational contexts.

Adaptive Learning Platforms

Adaptive learning platforms leverage machine learning algorithms to customize instruction based on learner data such as responses to formative assessments, pace of learning, and patterns of errors. These platforms have demonstrated improvements in student outcomes by guiding learners through tailored pathways rather than standardized sequences. Research synthesizing findings across multiple contexts indicates that adaptive systems often outperform traditional instructional approaches, contributing to moderate to substantial gains in academic outcomes — particularly in mathematics and science learning (Kwak, 2025). These systems provide automated scaffolding and progressive feedback — features associated with improved student comprehension and retention.

Intelligent Tutoring Systems (ITS)

Intelligent tutoring systems are designed to mimic aspects of human tutors by diagnosing learner knowledge states and responding with targeted interventions. Extensive reviews of ITS research suggest that these systems significantly enhance learner achievement compared to non-adaptive instructional methods. ITS implementations have been found to support performance gains, increased engagement, and knowledge retention by modeling student comprehension levels and adjusting instructional paths accordingly. For example, systematic analyses of tutoring systems highlight that personalized feedback and guidance from ITS significantly improve understanding of core concepts and lead to higher test performance (Mehmood et al., 2022). Such personalized interventions are especially effective for learners who need additional support beyond the core classroom instruction.

Automated Feedback and AI Assessment Tools

Another class of AI tools involves automated feedback and assessment mechanisms that use natural language processing and machine learning to evaluate student responses. These tools allow educators to monitor student work efficiently and provide instantaneous feedback, which is known to reinforce learning by highlighting errors and suggesting corrections. Automated feedback tools have been shown to help students refine their problem-solving skills and writing proficiency when integrated into regular coursework

AI Adoption and Academic Outcomes

The central research focus of many empirical studies has been on the relationship between AI adoption and student academic outcomes. These outcomes typically include test scores, class

performance indicators, engagement measures, and qualitative improvements in learning processes.

Positive Correlations with Academic Performance

Several quantitative studies demonstrate that higher levels of AI tool use correlate with better academic performance outcomes. A recent survey of secondary students in Pakistan found a medium positive correlation between AI tool application and learning performance, with reported association values aligning with moderate effect sizes (Wafa Muhammad et al., 2025). Furthermore, correlations were observed between AI usage and increased motivation ($r = 0.37$) and participation ($r = 0.39$), both of which are recognized as predictors of academic achievement. Quantitative meta-analytical research corroborates these findings, emphasizing that adaptive and intelligent AI systems improve both engagement and learning outcomes across a wide range of studies. For instance, synthesis studies that compile empirical evidence over multiple settings report academic gains from AI usage ranging from 15% to 35% when compared with traditional instructional methods, indicating statistically significant improvements in student performance when AI is integrated effectively (Mehnaz et al., 2025).

Influence on Engagement, Motivation, and Learning Behaviors

AI adoption does not solely influence cognitive outcomes; it also affects motivational and behavioral variables that mediate academic success. Research shows that AI tools enhance student engagement by offering interactive and personalized learning experiences. For example, ITS fosters student motivation by providing challenges that are closely aligned with student abilities, which can help maintain engagement and reduce frustration.

Secondary learners exposed to AI environments often demonstrate higher levels of active participation in learning tasks and increased confidence in tackling difficult concepts. These behavioral improvements are significant because they contribute to a student's willingness to persist with challenging academic work, thereby indirectly influencing performance outcomes.

Benefits of AI Adoption in Education

AI adoption in secondary schools is associated with several pedagogical and academic benefits. First, personalized instruction enables students to work at their own pace with targeted support where needed. Second, immediate feedback mechanisms help learners address misconceptions promptly, reducing the time between error and correction, which is a key factor in effective learning. Third, AI tools provide educators with data-driven insights that can inform instructional strategies and help identify learners at risk of underperformance.

Research has also indicated that AI tools can support diverse learning styles by providing multiple modes of content presentation — from visual aids to interactive problem solving — catering to individual preferences.

Challenges and Limitations in AI Adoption

Despite the benefits, AI adoption in secondary education faces substantial challenges. One major issue is infrastructure disparity between schools, especially in rural versus urban settings, which affects equitable access to AI tools and their sustained use. Another barrier is teacher readiness; without adequate training and professional development, educators often lack the confidence or skills to integrate AI tools meaningfully into instruction. This is consistent with research showing that teacher competencies in data use and AI understanding significantly influence adoption likelihood (Costa, 2025).

Ethical concerns also arise, particularly regarding data privacy and the responsible use of AI tools by students. Without policies and guidelines, students may misuse AI for shortcut answers rather than deep learning, potentially undermining academic integrity.

Synthesis and Research Gap

Existing literature largely supports the positive relationship between AI adoption and improved academic outcomes, but there remains a significant gap in context-specific research at the secondary level, especially within developing

education systems. Many studies either focus on higher education or combine K-12 settings without isolating secondary student populations. Moreover, few studies explore longitudinal effects of sustained AI use over extended periods, leaving a gap in understanding long-term impacts on academic trajectories.

Additionally, while adaptive learning and ITS show promise, there is limited research on the role of newer generative AI tools (e.g., large language models) in structured academic outcomes among secondary learners specifically. These newer forms of AI require deeper examination due to their distinct functionalities and potential to influence study habits, engagement patterns, and academic performance in novel ways.

The literature indicates a broad and growing interest in the adoption of AI learning tools across educational levels, with several empirical studies demonstrating positive correlations between AI use and academic outcomes. Secondary education, in particular, stands to benefit from personalized learning, adaptive feedback, and engagement enhancements afforded by AI tools. However, significant challenges — including infrastructure gaps, teacher readiness, and ethical concerns — must be addressed to ensure equitable and effective adoption. Further research focusing on context-specific adoption patterns, longitudinal academic effects, and the evolving role of generative AI tools will deepen understanding and guide evidence-based educational policy and practice.

RESEARCH METHODOLOGY:

Research Design

This study employed a quantitative research design to examine the relationship between the selected variables. The design was descriptive and correlation in nature, as it aims to describe characteristics of the population and analyze the strength and direction of relationships among variables. This approach is appropriate because it allows for objective measurement and statistical analysis of the collected data.

Population

The population of this study comprises all students enrolled in the institution under investigation. According to the latest records, the total number of students is 8,617. This population includes students across all programs and academic levels, providing a comprehensive representation of the target group.

Sample Size

To determine the sample size, the Cochran formula was applied, which is commonly recommended for large populations: by using this formula, the final sample size for this study is 368 students, ensuring accuracy and representativeness.

Sampling Technique

A stratified random sampling technique was employed to ensure proportional representation of students across different programs and academic levels. The population was divided into strata based on department and year of study, and students were randomly selected from each stratum. This method minimizes sampling bias and enhances the generalizability of the study findings.

Research Tool

The data was collected using a structured questionnaire developed by the researcher. The questionnaire consisted of multiple sections, including demographic information and items related to the variables under study. A Likert scale was used to measure attitudes and perceptions, providing quantitative data suitable for statistical analysis. The tool was pre-tested on a small sample to ensure validity and reliability.

Validity and Reliability of the Research Tool

To ensure the accuracy and appropriateness of the research instrument, the questionnaire was evaluated for content validity. This was carried out by a panel of educational research experts, who reviewed the items to confirm that they adequately measured the variables under study. The experts provided feedback on clarity, relevance, and comprehensiveness, ensuring that each item aligned with the study objectives and effectively captured the intended constructs. Based on their suggestions, minor revisions were made to enhance clarity and remove ambiguities.

The reliability of the research tool was determined using Cronbach's alpha to assess internal consistency. A pilot test was conducted on a small sample of students similar to the study population, and the responses were analyzed. The results indicated a Cronbach's alpha value of 0.87, which exceeds the generally accepted threshold of 0.70, demonstrating that the questionnaire is highly reliable and consistent for measuring the intended variables.

Data Collection Procedure

Data was collected after obtaining ethical permission from the relevant authorities. The questionnaires were distributed to the selected students in both online and offline formats. Participants were informed about the purpose of the study, and their consent was obtained before participation. Data collection was completed over a period of two weeks, ensuring maximum participation.

Data Analysis Method

The collected data was analyzed using IBM SPSS 25. Descriptive statistics, including mean, frequency, and percentage, were calculated to summarize the demographic information. Inferential statistics, such as correlation analysis and regression analysis, were conducted to examine the relationships between the study variables. The results were presented in tables and charts for clarity and interpretation.

DATA ANALYSIS:

Table 1: Demographic Characteristics of the Participants (n = 368)

Demographic Variable	Category	Frequency	Percentage (%)	Mean
Gender	Male	190	51.6	
	Female	178	48.4	
Age (years)	14–15	150	40.8	15.2
	16	218	59.2	15.2
Program of Study	Science	200	54.3	
	Arts	168	45.7	

Table 1 presents the demographic characteristics of the 368 participants. The sample includes 190 male students (51.6%) and 178 female students (48.4%) enrolled in 10th grade. The ages of participants range from 14 to 16 years, with a mean age of 15.2 years. Regarding the program of study, 200 students (54.3%) are in Science and 168 students (45.7%) are in Arts. These statistics provide an overview of the sample composition for the study.

Table 2: Correlation between AI Learning Tool Adoption and Academic Outcomes

		AI_Adoption	Academic_Achievement
AI_Adoption	1	.635**
	Sig. (2-tailed)	.000
	N	368
Academic_Achievement	.635**	1
	Sig. (2-tailed)	.000
	N	368

Correlation is significant at the 0.01 level (2-tailed).

Table 2 presents the correlation between AI learning tool adoption and students' academic outcomes. The results show a strong positive relationship ($r = 0.635$, $p < 0.01$), indicating that students who adopt AI tools more extensively tend to achieve higher academic performance. This

finding suggests that AI tools, when integrated effectively into learning activities, can enhance understanding and retention of concepts. The correlation also reflects that technology-mediated learning may complement traditional classroom instruction. Overall, this demonstrates the potential of AI adoption to positively influence student outcomes at the secondary level.

Table 3: Correlation between AI Learning Tool Adoption and Academic Performance in Core Subjects

	AI_Adoption	Core_Subject_Performance
AI_Adoption	1	.598**
	Sig. (2-tailed)	.000
	N	368
Core_Subject_Performance	.598**	1
	Sig. (2-tailed)	.000
	N	368

Correlation is significant at the 0.01 level (2-tailed).

Table 3 shows the relationship between AI learning tool adoption and students' performance in core subjects. The results indicate a moderate positive correlation ($r = 0.598$, $p < 0.01$), suggesting that higher adoption of AI tools is associated with improved achievement in essential subjects such as Mathematics, Science, and Language Arts. This implies that AI tools can support differentiated learning by adapting to student needs and reinforcing difficult concepts. The findings also highlight the importance of consistent use of AI resources to achieve better subject-specific outcomes. Therefore, AI adoption appears to be a valuable strategy for enhancing academic performance in core areas.

Table 4: Correlation between Frequency of AI Tool Use and Academic Outcomes

	AI_Frequency	Academic_Achievement
AI_Frequency	1	.621**
	Sig. (2-tailed)	.000
	N	368
Academic_Achievement	.621**	1
	Sig. (2-tailed)	.000
	N	368

Correlation is significant at the 0.01 level (2-tailed).

Table 4 displays the correlation between the frequency of AI tool usage and students' academic outcomes. The results show a significant positive relationship ($r = 0.621$, $p < 0.01$), indicating that students who use AI tools more frequently tend to achieve higher academic performance. Frequent engagement with AI learning tools may enhance understanding, facilitate self-paced learning, and provide timely feedback on performance. These findings suggest that not only adoption but also consistent and repeated use of AI tools is important for improving learning outcomes. The results reinforce the notion that support better academic achievement among secondary students.

Discussion

Table 2 shows a strong positive correlation ($r = 0.635$, $p < 0.01$) between AI learning tool adoption and students' academic outcomes, suggesting that greater use of AI tools is associated with improved overall academic performance. These findings align with previous research that highlights the benefits of AI integration in education. For example, Ogunleye et al. (2024) reported that AI tools enhance student engagement and understanding by providing adaptive learning paths and personalized feedback, which positively impacts learning outcomes. Similarly, Mahnaz and Kiran (2024a) found that intelligent tutoring

systems, as a form of AI tool, significantly improve student achievement by addressing individual learning gaps and offering scaffolded instruction. Nadelson (2025) also emphasized that consistent adoption of AI learning tools fosters self-paced learning and promotes higher retention of concepts, particularly in secondary education. Collectively, these studies support the present findings, demonstrating that technology-mediated learning can complement traditional instruction and enhance overall student performance.

Table 3 presents a moderate positive correlation ($r = 0.598$, $p < 0.01$) between AI learning tool adoption and performance in core subjects such as Mathematics, Science, and Language Arts. This result is consistent with research showing that AI tools can reinforce difficult concepts and support differentiated instruction. Apriliani and Rachman (2025) found that adaptive learning systems improve student achievement in mixed-ability classrooms by adjusting pacing and content difficulty in real time. Kwak (2025) demonstrated through a meta-analysis that adaptive and intelligent tutoring systems positively influence performance in STEM subjects by guiding learners through individualized learning pathways. Furthermore, Mahnaz and Kiran (2024b) reported that secondary students who engage with AI resources more consistently show higher scores in core subjects, highlighting the effectiveness of AI in subject-specific learning outcomes. These studies corroborate the current results, emphasizing that structured AI adoption in classrooms enhances academic performance across essential subjects.

Table 4 indicates a significant positive correlation ($r = 0.621$, $p < 0.01$) between the frequency of AI tool usage and students' academic outcomes. This finding reinforces the notion that not only adoption but also the consistent and frequent use of AI tools is critical for improving academic performance. Costa (2025) emphasized that teacher guidance and student familiarity with AI tools increase their effective usage, which in turn positively affects learning outcomes. Similarly, Mahnaz and Kiran (2024c) highlighted that frequent interaction with AI platforms supports self-paced learning, motivation, and engagement, leading to measurable improvements in academic performance. Ogunleye et al. (2024) also reported that repeated use of AI-driven feedback and assessment tools strengthens knowledge retention and reinforces skills, particularly for complex problem-solving tasks. Collectively, these studies confirm that frequent engagement with AI learning tools is a key factor in maximizing their impact on secondary students' academic achievement.

This study investigated the relationship between the adoption and frequency of AI learning tools and the academic outcomes of secondary students. The results reveal that the use of AI tools has a significant positive impact on both overall academic performance and performance in core subjects. Students who adopt and use AI tools frequently tend to achieve higher academic scores, highlighting the importance of consistent engagement with technology-mediated learning. The findings also suggest that AI tools provide personalized and adaptive learning experiences, which help students bridge knowledge gaps, reinforce difficult concepts, and enhance understanding and retention. Furthermore, the study shows that AI integration complements traditional classroom instruction by promoting self-paced learning, motivation, and active participation. These outcomes emphasize the potential of AI learning tools as an effective educational strategy in secondary schools. Based on the results, it is clear that AI adoption and frequent usage can serve as important predictors of academic success. This study contributes to the growing body of literature supporting technology-enhanced learning and offers practical implications for educators and policymakers.

Conclusion

This study investigated the relationship between the adoption and frequency of AI learning tools and the academic outcomes of secondary students. The results reveal that the use of AI tools has a significant positive impact on both overall academic performance and performance in core subjects. Students who adopt and use AI tools frequently tend to achieve higher academic scores, highlighting the importance of consistent engagement with technology-mediated learning. The findings also suggest that AI tools provide

personalized and adaptive learning experiences, which help students bridge knowledge gaps, reinforce difficult concepts, and enhance understanding and retention. Furthermore, the study shows that AI integration complements traditional classroom instruction by promoting self-paced learning, motivation, and active participation. These outcomes emphasize the potential of AI learning tools as an effective educational strategy in secondary schools. Based on the results, it is clear that AI adoption and frequent usage can serve as important predictors of academic success. This study contributes to the growing body of literature supporting technology-enhanced learning and offers practical implications for educators and policymakers.

Findings

1. Higher adoption of AI learning tools is strongly associated with improved overall academic performance.
2. AI adoption shows a moderate positive correlation with performance in core subjects such as Mathematics, Science, and Language Arts.
3. Frequent use of AI tools significantly enhances students' academic outcomes.
4. AI tools support personalized and adaptive learning experiences that help address individual learning needs.
5. Technology-mediated learning through AI complements traditional instruction by promoting self-paced learning and engagement.

Recommendations

1. Schools should promote the integration and consistent use of AI learning tools in classrooms.
2. Teachers should receive training to effectively implement AI tools into teaching practices.
3. Students should be encouraged to engage frequently with AI tools to maximize academic benefits.
4. Educational institutions should provide adequate infrastructure and resources to ensure equitable access to AI learning technologies.
5. Policymakers and educators should consider integrating AI tools in curriculum planning to support personalized learning and improved student outcomes.

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