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Synthesizing Evidence on AI Integration in Education and Its Effects on Academic Performance: A Scoping Review

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ABSTRACT
This scoping review examines how Artificial Intelligence (AI) is utilized to enhance academic performance in higher education. Despite growing student reliance on AI, comprehensive mapping of its applications and effectiveness remains limited. Using the PCC framework, empirical studies published in Scopus (2021–2025) were analyzed to identify forms of AI use, system types, research trends, and factors influencing implementation outcomes. Findings show that AI—especially Generative AI based on Large Language Models—improves academic performance by strengthening learning engagement and motivation. The review highlights a research shift from exploring AI's potential to empirically evaluating its impact and emphasizes the need for an integrated conceptual model incorporating cognitive, motivational, and technology acceptance dimensions in AI-based learning.

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INTRODUCTION

Academic performance is an important indicator in assessing the success of the learning process in higher education. Academic performance not only reflects students' cognitive achievements, but also the effectiveness of learning strategies, the quality of pedagogical interactions, and the support of the available learning environment. In the context of modern education, the use of digital technology is one of the key factors in creating adaptive, efficient, and student-oriented learning (Wang, 2024). Improving academic performance is the main focus of various educational studies, especially in efforts to optimize learning strategies, learning motivation, and relevant technological support. Along with technological developments in modern education (digital technology), artificial intelligence (AI) is increasingly being integrated into higher education practices. Artificial Intelligence/AI is defined as the ability of a computing system to perform functions that generally require human intelligence, such as learning, decision making, and processing.

A number of studies show that the integration of Artificial Intelligence/AI has the potential to increase learning effectiveness and support student academic achievement (Garzón, 2025; Vieriu & Petrea, 2025). The trend of AI adoption in higher education and online learning has shown significant growth in recent years. The integration of AI in education has also shown a significant upward trend over the past five years (Wang, 2024; Bond et al., 2024). A global survey conducted by the Digital Education Council (2024) reported that the majority of students have used Artificial Intelligence/AI in academic activities, with generative AI such as ChatGPT being the most dominant tool at 66%, followed by Grammarly and Microsoft Copilot. The survey results indicate that 86% of students worldwide have reportedly used AI in academic activities, with 54% of them using AI weekly and 24% using it daily.

Similar findings were reported by Vieriu and Petrea (2025) at the National University of Science and Technology POLITEHNICA Bucharest, Romania, showing that most students (95.6%) believe that Artificial Intelligence/AI contributes positively to learning efficiency and academic performance. A systematic review study shows that AI can significantly improve productivity and the quality of academic writing. AI assists in almost all stages of research, such as brainstorming ideas, writing, reviewing literature, analyzing data, editing, and matters related to academic ethics. The review also reported that ChatGPT is a domain tool that shows great potential in research ideas, concept explanations, and text composition. The application of AI technology has had a significant positive impact on student academic development. Approximately 80% of students believe that AI helps improve their learning experience. Meanwhile, 82.4% of students think that the use of AI contributes to improving.

A number of recent empirical studies show that the use of artificial intelligence in higher education is influenced by students' academic and psychological factors. A quantitative study by Acosta-Enriquez et al. (2025) of prospective teachers in Peru found that academic workload directly influences increased use of AI, with academic stress and performance expectations acting as mediators that explain the complex relationship between learning pressure and

technology adoption. Meanwhile, Aslam et al (2024), through a machine learning approach, confirmed that student personality factors contribute to predicting academic performance, while emphasizing the importance of developing human-centered, transparent, and ethical educational AI systems. Cross-country findings by Dahri et al. (2024) also show that performance expectations, ease of use, information accuracy, and pedagogical suitability of AI-based chatbots significantly encourage AI adoption and positively impact student learning satisfaction and academic performance, particularly in developing countries.

LITERATURE REVIEW

In Indonesia, research shows a similar pattern. Nugroho et al. (2025); Hendra et al. (2025) found that students use AI in various academic activities, especially writing, research, analysis, reference management, chatbots, text summarization, paraphrasing, translation, and grammar. The majority of students have been using artificial intelligence (AI) applications for 6–12 months with varying frequencies. These findings indicate that AI applications play an important role in helping students complete academic tasks and supporting student engagement and adaptability. Theoretically, the use of AI in higher education can be explained through several conceptual frameworks. One theory that explains the role of AI in higher education is Cognitive Load Theory (Sweller, 1988). This theory emphasizes that human working memory capacity is limited, so learning will occur optimally when extraneous cognitive load can be minimized. In this context, AI has the potential to play a role in providing adaptive learning materials, appropriate learning recommendations, and automated evaluation systems, so that students can focus their cognitive resources on germane load that supports deep conceptual understanding.

A number of recent studies show that AI-based learning systems are able to adjust the level of difficulty of the material according to the cognitive profile of students, which ultimately increases the efficiency and effectiveness of learning (Listiana et al., 2025). In addition to the aspect of cognitive load management, the use of AI in higher education is also closely related to students' ability to manage their learning process independently. Furthermore, Self-Regulated Learning Theory (Zimmerman, 2000) provides a conceptual framework for understanding how AI supports the development of students' self-regulation skills. Self-Regulated Learning highlights the role of AI as a scaffolding tool that can support the ability to set plans, learning goals, monitor progress, and reflect on the strategies used. AI technologies, such as learning analytics and chatbots, can help students develop these skills. Research shows that students who utilize AI systems to monitor their learning progress tend to have better time management skills, higher learning motivation, and more optimal academic achievement (Ashari & Napitupulu, 2024).

Research in Indonesia shows that positive perceptions of AI correlate with increased student engagement in online learning (Jafar et al., 2024). Based on the Sociocultural Theory perspective (Vygotsky, 1978), which emphasizes the role of mediation tools in the zone of proximal development (ZPD), AI can function as a mediator that enables students to achieve higher academic achievements

through interaction with adaptive intelligent systems. Meanwhile, from a technology acceptance perspective, the Technology Acceptance Model (TAM) (Davis, 1989) explains that students' attitudes toward AI are influenced by perceived usefulness and perceived ease of use. If students consider AI to be a useful and easy-to-use tool, then the level of acceptance and effectiveness in improving academic performance will be higher.

Although the potential of AI in higher education is increasingly recognized, there are a number of knowledge gaps that need to be addressed. First, most research still focuses on the short-term impact of AI use on academic outcomes, while longitudinal evidence on knowledge retention and critical thinking skills is still limited. Studies in Indonesia show that the use of AI does improve learning efficiency, but there is no strong evidence yet regarding its long-term impact on students' analytical skills (Wijaya et al., 2023). Second, research has emphasized quantitative learning outcomes, while psychological variables such as intrinsic motivation, engagement, and intellectual humility have not been widely integrated. In fact, these psychological variables are very important for explaining how students interact with technology and how AI can influence academic character development. Studies emphasize that even though AI improves academic performance, aspects of student motivation and engagement are still not comprehensively measured (Kautsar et al. 2024; Jebasingh, et al. 2025). In addition, challenges remain, such as the ethical and transparent use of AI and the continued reliance on human assessment (Khalifa & Albadawy, 2024). Third, the cultural context and educational infrastructure in developing countries, including Indonesia, have been under-explored. Most studies have been conducted in developed countries with strong digital infrastructure, so the results may not be relevant to the local context. Research by Ashari & Napitupulu (2024) shows that the application of AI in Indonesia faces challenges in the form of limited access to technology, lecturer readiness, and cultural resistance to the use of automated systems. Furthermore, the use of AI also faces challenges related to understanding academic ethics, digital literacy, and the limits of responsible use (Nugroho et al., 2025). This shows that the use of AI is not always synonymous with improved learning quality, but rather depends on how and in what context it is used. Efforts to improve students' understanding so that the use of AI remains in line with academic ethics principles need to be made.

Based on the above explanation, a scoping review is needed to systematically map the literature on the use of Artificial Intelligence in improving student academic performance. This study aims to identify the forms of AI application in the context of learning and academic assessment, examine the reported empirical findings, map the trends and research methods used, and identify research gaps that can serve as a basis for further studies and higher education policy development. In line with these objectives, this scoping review seeks to answer the following key research questions: First, how is artificial intelligence technology utilized in the context of higher education as reported in the academic literature, including the types of applications, models, and AI approaches used in learning and academic assessment? Second, to what extent

does the use of AI contribute to improving student academic performance according to previous studies, particularly those related to learning outcome indicators, academic engagement, self-regulation in learning, and material retention. Third, what dimensions of student academic performance are most frequently examined in the use of AI in previous studies, whether from cognitive, affective, or learning behavior aspects. Fourth, what research methods and designs have been predominantly used in studies on the use of AI to improve student academic performance, and how have these methodological approaches trended over the past decade? Fifth, what challenges, limitations, and opportunities have been identified in the literature?.

METHODOLOGY

This study uses a scoping review approach to comprehensively map scientific literature discussing the use of artificial intelligence (AI) technology in improving student academic performance in higher education. The scoping review approach was used because it is exploratory in nature, allowing for a comprehensive mapping of concepts, trends, and research gaps in the field of AI-based education. This approach also provides flexibility in reviewing literature from various methodologies without limiting it to a specific empirical design (Arksey & O'Malley, 2005). This study follows the framework developed by Arksey and O'Malley (2005), which consists of five main stages: (1) identification of research questions, (2) identification of relevant studies, (3) selection of studies, (4) mapping and data extraction (charting the data), and (5) summarization and reporting of results. All stages were conducted iteratively and reflectively, allowing for adjustments to the strategy during the process. To ensure transparency and methodological repeatability, the reporting process followed the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines (Tricco et al., 2018). The literature identification stage was conducted using the Scopus database as the sole primary source, as Scopus covers highly reputable international scientific journals and has a consistent metadata system. The literature search was conducted in November 2025, with publication years restricted to 2021–2025 to represent the period of rapid development of generative AI and ChatGPT in the context of higher education.

The article selection process was conducted in three stages: (1) initial screening (title and abstract) to eliminate irrelevant studies, (2) full-text review to ensure relevance to the study focus, and (3) final selection of articles for analysis. Duplicate articles were removed using Mendeley software. The selection process and number of articles at each stage were reported using a PRISMA-ScR flow diagram to ensure transparency and traceability of decisions.

Inclusion and exclusion criteria were established to ensure the relevance and credibility of the literature considered. These criteria are shown in Table 1 below.

Table 1. Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Types of Publications	Scopus-indexed peer-reviewed journal articles	Proceedings, technical reports, editorials, or grey literature
Language	English	Languages other than English
Research Context	Higher education (university, college, or polytechnic)	Primary and secondary education
Study Focus	The application of AI, machine learning, ChatGPT, or generative AI related to academic performance, learning, academic efficacy, AI literacy, AI dependence, or student academic integrity.	Technical AI studies without learning context or academic performance
Publication Period	2021–2025	Before 2021
Document Availability	The article is available in full text.	The article cannot be accessed in full.

Studies that met the inclusion criteria were then included in the data mapping and extraction process using a Table of Evidence to document important information such as: author, year, title, research method, research subject, and main results related to student academic performance.

The analysis was conducted descriptively and thematically. Descriptive analysis aimed to identify the temporal, geographical, and methodological distribution of the studies reviewed. Meanwhile, thematic analysis was used to reveal conceptual patterns and major trends in the use of AI, including dimensions such as AI literacy, academic self-efficacy, and academic integrity. Thematic analysis was conducted through a process of open coding and repeated categorization to produce a comprehensive and actionable synthesis of findings.

The entire research process was designed to be transparent, systematic, and replicable, in line with the principles of evidence-based research. Thus, the results of this scoping review are expected to provide a conceptual and empirical mapping of the role of AI technology in improving student academic performance, as well as offering directions for further research in the context of technology-based higher education.

Population

To ensure that the literature selection process is systematic and focused on truly relevant research, this study established eligibility criteria using the PI/EMS framework. The accepted population was higher education students, both undergraduate and graduate. Data on the prevalence of the student population is also supported by research by Balabdaoui et al. (2024), which found that the student population are early adopters of AI technology, as well as a generation that will enter a world of work that is heavily influenced by AI. In addition, the prevalence of the student population is also explained in the study by Wang & Li (2024), which found that the student population was chosen in this study because they are the group most affected by the development of artificial intelligence in the context of learning. The presence of AI has changed the way

students obtain data, personalizes the learning process, and encourages increased learning independence.

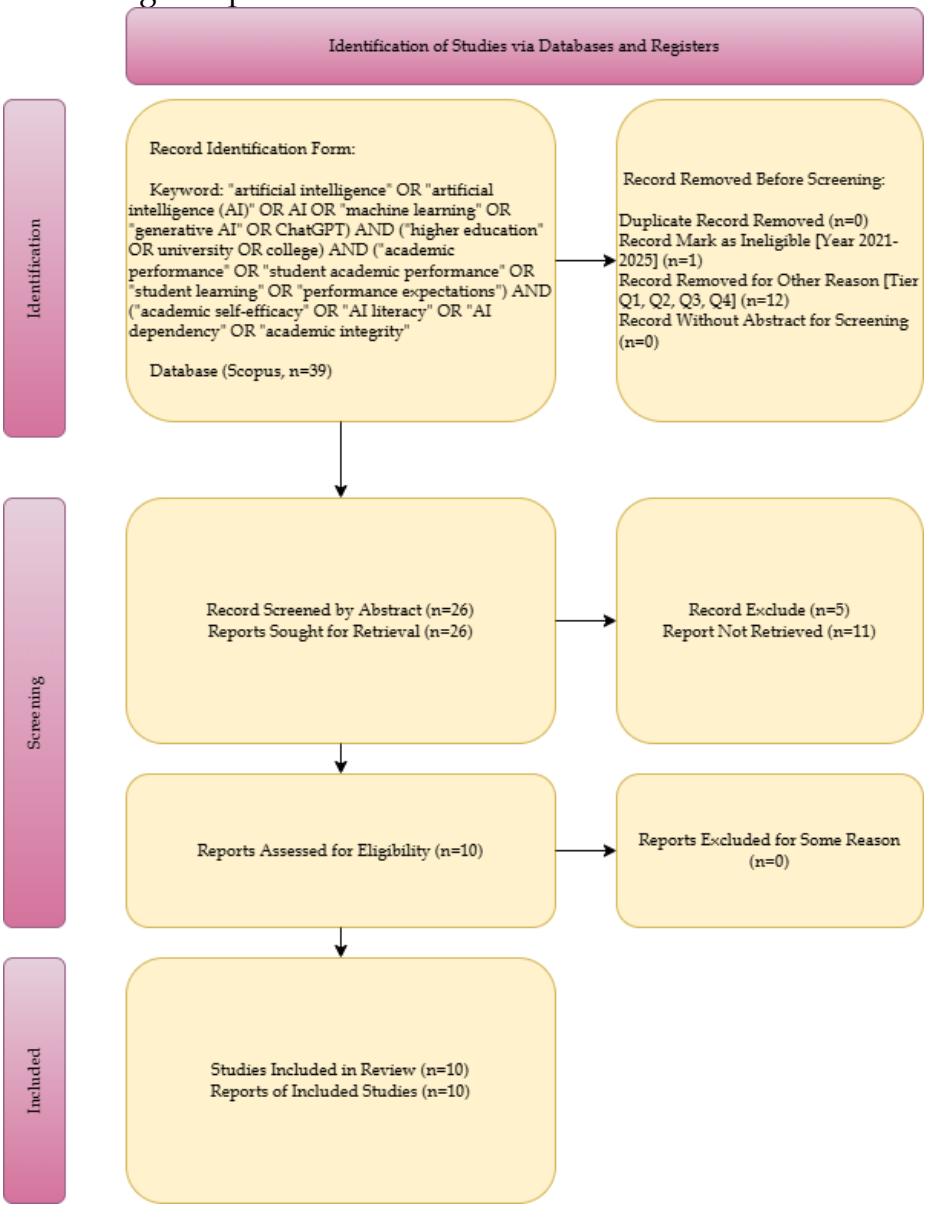

Figure 1. Flowchart illustrating the literature search process for scoping reviews in accordance with the PRISMA-ScR guidelines.

RESEARCH RESULTS

Ten quantitative studies were found to be used in this review. These studies originated from Indonesia, Malaysia, India, Pakistan, Peru, Jordan, China, and South Africa. The results of the review show that there is a significant correlation between the use of AI technology and improved academic performance in the ten studies found. Overall, the ten studies show that the use of AI in higher education contributes positively to student academic performance through increased engagement, self-regulation, adaptability, and learning efficiency. However, this impact is highly dependent on user perceptions and characteristics. individual, serta konteks pedagogis. Therefore, AI should be

positioned as a human-centered learning support tool, not as a substitute for students' cognitive and reflective processes.

The integration of artificial intelligence (AI) technology in higher education is increasingly seen as a strategic response to the complexity of academic demands in the digital age. A number of studies show that the use of AI has great potential to improve student academic performance, but its effectiveness is largely determined by psychological, pedagogical, and contextual factors surrounding its use.

In general, studies show that AI contributes to improved academic performance by strengthening student engagement. Olaitan et al. (2025) confirm that students who perceive generative AI as a useful technology that is relevant to their academic needs tend to show higher levels of engagement, which in turn has a positive impact on academic performance. This finding is in line with Dahri et al. (2025), who show that the use of AI-powered chatbots such as ChatGPT increases learning interaction, attention to academic tasks, and student learning continuity.

In addition to engagement, AI also plays an important role in supporting students' self-regulation abilities. Jebasingh et al. (2005) revealed that AI tools help students reduce academic procrastination by providing learning structures, reminders, and cognitive support that accelerate task completion. In this context, AI functions as a self-regulatory scaffold that enables students to manage their time and academic workload more effectively, thereby positively impacting learning outcomes.

The affective and adaptive dimensions of students are also important mechanisms in the relationship between AI and academic performance. Imran et al. (2025) show that the application of AI based on advanced machine learning can improve students' adaptability and sentiment in ICT learning environments. This adaptability allows students to adjust their learning strategies to dynamic academic demands, while more positive affective aspects strengthen perseverance and learning motivation. Hendra et al. (2025) reinforce these findings by emphasizing that technological readiness and AI literacy are latent factors that determine academic success in the era of AI-based learning.

From a technology acceptance perspective, a number of studies confirm that students' perceptions of AI are a major determinant of its academic impact. Dahri et al. (2025) and Abu-Taieh et al. (2025) found that perceived usefulness, ease of use, and performance expectancy consistently predict the continued use of AI and contribute to improved academic performance. This shows that AI does not work neutrally, but is mediated by the subjective meaning that students construct around the technology.

This aspect of subjectivity is discussed in depth by Cui et al. (2025), who researched the use of AI writing assistants in academic writing. Their research findings indicate that writing quality improves when students maintain cognitive control and autonomy in the writing process. Conversely, over-reliance on AI has the potential to weaken students' cognitive and reflective engagement. These findings emphasize that AI should be positioned as a supportive tool, not a substitute for the process.

Furthermore, the effectiveness of AI is also influenced by the individual characteristics of students. Aslam et al. (2024) showed that personality factors play an important role in predicting AI-based academic performance, indicating that the benefits of AI are individualized. Meanwhile, Acosta-Enriquez et al. (2025) found that academic pressure and work stress encourage students to use AI as a coping strategy, with performance expectations acting as a mediator. In this context, AI not only functions as a learning tool, but also as a source of psychological support in dealing with academic burdens.

Table 2. Table of Evidence

No	Author's Name & Year of Publication	Tittle	Research Methods & Design	Research Subject	Respondent Demographic Variables	Variable Research	Research Objectives	Research Results
1	Hendra, R., et al. (2025)	Academic performance in AI Era:salient factors in higher education	Quantitative, survey. Analisis: Partial Least Squares – Structural Equation Modeling (PLS-SEM) Analisis: Partial Least Squares – Structural Equation Modeling (PLS-SEM)	380 lecturers from 3 universities in one province in Indonesia.	Women: 68.42% Male: 31.58% Last Education: Master S2: 80, 53% Doctor S3: 19,4% demographic variables not analyzed as a moderator variable in the research model.	IV: Teacher AI competence (TAC) Mediation variables: Student Learning Ability (SLA), Student Engagement (SE) DV: Student Academic Performance (SAP)	The relationship between Teacher AI Competence (TAC), Student Learning Ability (SLA), Student Engagement (SE), and Student Academic Performance (SAP) in higher education in the AI era.	The AI competency of lecturers has no direct influence; the most powerful factor affecting academic achievement is student engagement. AI is effective if it supports learning strategies that encourage adaptability and active student engagement.
2	Imran, A., et al. (2025).	AI-driven educational transformation in ICT: Improving adaptability, sentiment, and academic performance with advanced machine learning	Data-driven research methods (Quantitative). Machine Learning /deep learning: CNN, RCNN, Decision Tree, Random Forest, XGBoost, Stacking Ensemble	Dataset containing 1,205 student data from Kaggle (student adaptability)level in online education)	Age, gender, education level, type of institution, IT student status, region of residence, economic status, type of device, location, duration of online classes	IV: -Demographic factors (age, gender, education, economic status) -Technological factors (devices, internet, LMS) -Environmental factors (location, electricity) DV: -Adaptivity level (low, medium, high) -Student sentiment (positive/negative) -Academic performance	How machine learning (ML) and deep learning (DL) can be used to predict student adaptability in learning online, improving academic performance in the context of ICT (information and communication technology) dalam pendidikan	The ensemble and boosting approaches are most effective for predicting student adaptability and academic performance.
3	Dahri, NA., et al. (2024)	Investigating AI-based academic support acceptance and its impact on students' performan	Quantitative, with a survey research design. Analysis: SPSS, PLS-SEM	305 respondents, 203 students from QUEST University Pakistan,	-Age: 20-30 years old Gender: -Male: 81% -Women: 19%	IV: -Performance expectancy -facilitating conditions -Student engagement -Assessment effectiveness	-Identifying factors that influence the acceptance and use of AI tools for academic support	-Research results indicate that the acceptance and use of AI as academic support are influenced by perceived benefits, accuracy of

		ce in Malaysian and Pakistani higher education institutions		102 students from UT Malaysia.	Education: Bachelor's degree, Master's degree, Doctorate degree Frequency of AI use, duration, and satisfaction level	-student interaction -information accuracy -personal innovativeness -pedagogical fit DV: Improvement of Student's Academic Performance Mediation variables: -Behavioral Intention -AI tools Use -Student statisfaction	-Analyzing the impact of AI tools on student satisfaction and academic performance	information, pedagogical suitability, and student interaction. -The use of AI tools has a positive impact on student satisfaction and improved academic performance. However, student engagement and personal innovation do not significantly affect the use of AI tools.
4	Abu-Taieh, E., et al. (2025)	Evaluating Generative AI Tool Adoption and Its Effects on Academic Performance	Quantitative, online questionnaire. Analysis: Structural Equation Modeling with AMOS, Machine Learning Analysis	398 students using Generative AI (GenAI) in Jordan	Age: 18-28 years old Gender Level of education: Bachelor's degree The most frequently used GenAI	IV: -Perceived Risk -Ease of Use -Compatibility -Subjective Norm -Self-Efficacy -Facilitating Conditions Mediation Variables: -Attitude, Perceived Behavioral Control, Behavioral Intention DV: Academic Achievement	Analyzing factors that influence students' intention to use Generative AI (GenAI) -Testing the impact of GenAI use on student academic performance	-Research results show that the use of Generative AI contributes positively to students' academic achievement. - Ease of use and technological suitability improve students' attitudes toward Generative AI, while supporting conditions significantly influence perceptions of behavioral control. Attitudes, subjective norms, and perceived behavioral control significantly increase students' intention to use Generative AI. -The intention to use AI has been proven to have a positive effect on pencapaian akademik. Namun, persepsi risiko dan efikasi diri tidak shows a significant effect in this research model.
5	Olaitan, O., & Ajao, I. O. (2025).	Generative AI in Higher Education: Investigati	Quantitative, using questionnaires based on	208 students from 4 higher	Usia: 18-24 years old: 55.8%	IV: Frequency of Use, Perceived Usefulness	Researching the impact of GenerativeAI use on student engagement,	Generative AI has great potential to improve the quality of

		ng How Perceived Usefulness and Usage Patterns Influence Student Engagement and Academic Performance	two validated instruments Analysis: Descriptive statistics, inferential statistics, PLS-SEM	education institutions	25-30 years old: 42.3% Gender: Male: 61.5% Women: 38.5% Level of education: Bachelor's degree and Diploma/ certificate Residence, Familiarity with AI, AI Training	DV: Academic Performance Outcome and mediator: Cognitive Engagement, Engament with study materials, Interest and Curiosity, Self-efficacy	interest and curiosity, cognitive development, and academic performance	learning, particularly learning engagement, interest and motivation, and academic efficiency.
6	Jebasingh, D. R., et al. (2025).	Perceived Impact of Procrastination on Academic Performance Among Students and the Role of AI Tools	Quantitative, with descriptive and analytical (survey) designs Analysis: Descriptive and inferential statistics	202 students from St. Joseph's College of Commerce (Autonomous), Bengaluru.	-Gender: Women: 63.9% Male: 36.1% -Age: Mostly 18-21 years old -Academic Year	IV: -Academic procrastination (also as mediation) -Use and effectiveness of AI tools DV: -Academic Performance	This study aims to examine the level and factors causing academic procrastination among students and its impact on academic performance. In addition, This study analyzes perceptions of the effectiveness of artificial intelligence (AI)-based tools and AI features that play the most significant role in reducing academic procrastination.	-The results showed that 84.2% of students experienced procrastination, with assignments (58.9%) and research/reading activities (53%) being the most frequently postponed activities. -The existence of AI tools and the use of AI are perceived as effective in reducing procrastination through distraction reduction and task completion improvement, with a significant difference based on age ($p = 0.041$).
7	Cui, Y., et al. (2025).	The Impact of AI Writing Assistants on Academic Writing Performance: From the Perspective of Subjectivity	Quantitative (with qualitative data support; student reflection quotes)	44 undergraduate students	-Students have participated in academic writing training for 4 weeks. - controlled environment	IV: -Writing conditions -AI readiness DV: -Academic writing performance Psychological Variables: -self-determination -self-regulated learnin	Investigating the effect of using AI writing assistants on students' academic writing performance and subjectivity	AI effectively improves the quality of academic writing, but it does not automatically strengthen students' subjectivity.
8	Acosta-Enriquez, B. G., et al. (2025).	The mediating role of work stress and the performan	Quantitative, cross-sectional design Analysis:		Gender: -women: 56.96% Male: 43.04%	IV: Worklooad DV: Use of AI Models	-Analyzing the effect of academic workload on the use of AI models	-The results show that academic workload has a positive and significant effect

		ce expectations in the effect of academic overload on the use of AI models among preservice teachers: a cross-sectional study	PLS-SEM and CFA	876 students prospective teachers (semesters IX and X) from 12 universities in Peru.	Age: 20 to 26 years old Type of University and Field of Study	Mediator: Work stress, performance expectations	-Testing the mediating role of work stress -Testing the mediating role of work stress and performance expectations in the relationship between academic workload and AI use.	on the use of AI models (β = 0.354; p 0.001). -Work stress acts as a significant mediator in the relationship between academic workload and AI use (β = 0.084; p = 0.008). - The use of AI is a response to academic pressure.
9	Aslam, M. A., et al. (2024).	A Human-Centered Approach to Academic Performance Prediction Using Personality Factors in Educational AI	Quantitative approach based on machine learning and data mining Analysis: - Regression (CGPA prediction)	494 students	Age: 18-25 years old Gender: Male and female Family background, personal circumstances, and study program	IV: Personality factors (Big Five) DV: Cumulative Grade Point Average	-Generating accurate and explainable AI models -comparing the accuracy of prediction models, without personality factors, and with factors personality (Big Five) on academic performance	-Integration of personality factors (Big Five) significantly improves the accuracy of predicting student academic performance, with the Gradient Boosting model achieving an R^2 value of up to 0.83.
10	Dahri, N. A., et. al. (2025)	Enhancing Mobile Learning with AI-Powered Chatbots: Investigating ChatGPT's Impact on Student Engagement and Academic Performance	Quasi-experimental design with pre-test and post-test (quantitative) Analysis: Independent sample t-tesT, ANCOVA	32 respondents: - prospective educators, Faculty of Education, Universiti Teknologi Malaysia	experimental group: 16 students (6 males, 10 females) control group: 16 students in the control group (8 males, 8 females)	IV: -Use of mobile-based Chat GPT DV: Academic performance	Investigating the effect of mobile-based ChatGPT usage on student academic achievement, cognitive load, perceived learning value, trust, and learning motivation	The use of mobile-based ChatGPT has been proven effective in improving learning outcomes, supporting flexible learning, and providing quick and personalized feedback.

DISCUSSION

How is the Use of Artificial Intelligence (AI) Technology in the Context of Higher Education Reported in Academic Literature?

The use of artificial intelligence technology in higher education currently includes the use of Generative AI tools adopted by students to assist in content creation, text summarization, and research assistance (Abu-Taieh et al., 2025). In addition, AI-powered writing assistants are specifically utilized to improve the quality of scientific papers through grammar correction and linguistic precision (Cui et al., 2025). In the context of mobile learning, AI-powered chatbots such as ChatGPT are used as tools to help students review material independently after class hours (Dahri et al., 2025).

AI-based academic support tools are also being implemented to provide learning assistance that can be accessed at any time to overcome the limitations of traditional guidance (Dahri et al., 2024). Machine learning models are now being used to predict student academic performance by considering personality factors such as Big Five traits (Aslam et al., 2024). AI technology is also being

implemented in the form of platforms that can automatically tailor learning materials based on individual students' competency levels and interests (Hendra et al., 2025).

In the field of information technology, AI is used to drive educational transformation by improving students' adaptability through advanced analytics (Imran et al., 2025). Other AI models include the use of automated grading systems that help institutions evaluate student assignments more efficiently (Acosta-Enriquez et al., 2025). Finally, AI tools such as Grammarly and ChatGPT are utilized as strategic instruments to break down complex research tasks into more manageable parts (Jebasingh et al., 2025).

To What Extent Does the Use of AI Contribute to Improving Student Academic Performance According to Published Research Results?

The use of AI writing assistants contributes significantly to improving the quality of students' academic writing, particularly in terms of logical structure and citation accuracy (Cui et al., 2025). The use of Generative AI has been shown to increase students' cognitive engagement, as evidenced by their increased intellectual curiosity about course material (Olaitan & Ajao, 2025). The presence of AI technology in the learning process contributes to strengthening learning agility or students' agility in learning new topics (Hendra et al., 2025). Effective integration of AI tools can reduce academic procrastination because it helps students manage their time better when completing assignments (Jebasingh et al., 2025). The use of AI chatbots in mobile learning strategies has a positive impact on mastery of subject matter by providing immediate support (Dahri et al., 2025).

AI-based analytics also contribute to an increase in positive student sentiment, which has an impact on learning outcomes (Imran et al., 2025). The intensive adoption of generative AI tools is reported to have a significant influence on higher academic achievement among students (Abu-Taieh et al., 2025). In addition, student satisfaction in using AI-based academic support tools is an important factor that drives overall academic performance improvement (Dahri et al., 2024).

What are the Dimensions of Student Academic Performance Most Often Associated with the Use of AI in Previous Studies?

Previous studies have shown that the use of AI is most often associated with the dimensions of motivation, student engagement, learning satisfaction, and academic learning outcomes. Dahri et al. (2023) stated that increased use of AI has improved learning satisfaction levels and significantly influenced student learning outcomes, as well as being directly related to student engagement and academic performance (Dahri, et. al., 2023). In line with this, Aslam (2024) explained that AI contributes to quantitative learning outcomes, such as grades and CGPA. Another prominent dimension is cognitive learning strategies and academic outcome quality, particularly in academic writing. Cui et al. (2025) found that the use of AI writing assistants significantly improves writing quality, particularly in linguistic accuracy, critical recognition, and structure and logic,

reflecting improvements in students' cognitive strategies and academic outcome quality.

In addition, several studies have also linked AI with learning adaptability and students' affective conditions, with Imran et al. (2025) asserting that AI-based educational transformation improves adaptability, sentiment, and academic performance in the context of ICT-based education.

What Research Methods and Designs are Most Commonly Used in Studies on the Use of AI to Improve Student Academic Performance?

The selection of research methods and designs used varies. Dahri et al. (2024) used a survey research design and Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the acceptance and impact of AI on student academic performance. Meanwhile, Acosta-Enriquez et al. (2025) applied a cross-sectional design with PLS-SEM analysis to explain the relationship between academic workload, work stress, and AI use. Meanwhile, Cui et al. (2025) used a within-subjects pre–post design to assess the impact of AI on students' academic writing performance. Many studies also adopted machine learning and predictive analysis approaches to measure and predict students' academic performance. Aslam et al. (2024) emphasized that regression and classification algorithm models were used to predict academic performance, particularly based on academic grade indicators and cumulative GPA.

What Challenges, Limitations, and Opportunities are Reported in the Literature Regarding the Application of AI in Higher Education?

Challenges in the application of AI arise from excessive academic burdens that can trigger work-related stress among students and affect the effectiveness of using this technology (Acosta-Enriquez et al., 2025). There are limitations related to the risk of a decline in student autonomy and critical thinking if dependence on AI is not managed with good self-regulation (Cui et al., 2025). The effectiveness of AI integration in higher education environments is highly dependent on the level of AI competency possessed by teaching staff (Hendra et al., 2025). Issues of availability and technical barriers remain major challenges in the acceptance of AI-based academic support in several countries (Dahri et al., 2024). A major opportunity for the future lies in the development of more human-centered performance prediction systems that integrate psychological factors (Aslam et al., 2024). Institutional policies and a global regulatory framework are needed to manage the transformation of AI-based education in an ethical manner (Imran et al., 2025).

AI also offers opportunities to create a more inclusive educational environment, especially for students with special needs through material adaptation (Hendra et al., 2025). In addition, there are opportunities to optimize AI features in helping prioritize tasks to overcome students' extraordinary workloads (Jebasingh et al., 2025).

CONCLUSION AND RECOMMENDATION

This scoping review study shows that the use of artificial intelligence (AI) technology in higher education is consistently associated with improved student academic performance. Based on the empirical studies analyzed, AI, specifically generative AI based on Large Language Models such as ChatGPT, functions as a learning support tool that helps improve learning engagement, self-regulation, adaptability, and the efficiency and quality of academic outcomes. These findings reflect a shift in the direction of current research (2023–2025) from conceptual exploration to empirical evaluation of the impact of AI on student academic achievement in various higher education contexts (Dahri et al., 2025; Olaitan & Ajao, 2025; Abu-Taieh et al., 2025).

However, the positive impact of AI on academic performance is not universal and is greatly influenced by psychological, pedagogical, and contextual factors. Variables such as learning engagement, AI literacy, performance expectations, self-regulation, and perceptions of technology usefulness play an important role in determining the effectiveness of AI utilization. In addition, the literature emphasizes the need for human-centered and academically ethical AI implementation to prevent excessive dependence and a decline in student learning autonomy (Cui et al., 2025; Hendra et al., 2025). Therefore, further research should focus on longitudinal studies and exploration of local cultural contexts to gain a deeper understanding of the long-term impact of AI on academic performance in higher education.

ADVANCED RESEARCH

This scoping review concludes that artificial intelligence (AI), particularly generative AI based on Large Language Models such as ChatGPT, significantly enhances student academic performance by improving engagement, self-regulation, adaptability, and learning efficiency. However, its effectiveness is contingent upon psychological readiness, AI literacy, pedagogical design, and ethical implementation. Therefore, future research should prioritize longitudinal and cross-cultural studies while promoting human-centered and responsible AI governance to ensure sustainable and context-sensitive impacts on higher education outcomes.

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