

Artificial Intelligence Use Among Generation Z Students and Its Impact on Academic Performance and Learning Behavior

Penggunaan Kecerdasan Buatan di Kalangan Mahasiswa Generasi Z dan Dampaknya terhadap Kinerja Akademik serta Perilaku Belajar

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Abstract: *Artificial Intelligence (AI) has become a widely used tool among Generation Z students for completing academic tasks and exploring learning materials in the digital era. However, the responsible use of AI in producing academic work remains a subject of debate, particularly regarding its impact on students' thinking processes and learning quality. This study aims to identify and classify patterns of AI use among Generation Z students and to examine the relationship between AI utilization and academic performance. The research employed a descriptive exploratory design using a mixed-methods approach. The participants were Generation Z students at Institut Teknologi Sepuluh Nopember (ITS), selected through stratified random sampling. The findings indicate that AI contributes significantly to improving assignment performance, academic productivity, and students' confidence in participating in learning activities. Nevertheless, intensive AI use is also associated with shifts in learning behavior and motivation, from intrinsic curiosity toward performance-oriented and instrumental goals. These findings suggest that while AI enhances accessibility to information and learning efficiency, its use may reduce students' engagement in reflective thinking, critical thinking, and collaborative learning processes. Therefore, ethical and pedagogical strategies for AI integration are needed to ensure that this technology supports academic competence development without diminishing the quality of student learning experiences.*

Keywords: *artificial intelligence; Generation Z students; academic performance; learning behavior*

Abstrak: *Artificial Intelligence (AI) telah menjadi salah satu teknologi yang banyak dimanfaatkan oleh generasi Z dalam menyelesaikan tugas dan mengeksplorasi materi pembelajaran pada era digital. Namun, penggunaan AI secara bijak dalam menghasilkan karya akademik masih menjadi perdebatan, terutama terkait dampaknya terhadap kualitas berpikir dan proses belajar mahasiswa. Penelitian ini bertujuan untuk mengidentifikasi dan mengklasifikasikan pola penggunaan AI oleh mahasiswa generasi Z serta mengevaluasi hubungan antara penggunaan AI dan kinerja akademik. Penelitian ini menggunakan desain eksploratif deskriptif dengan pendekatan metode campuran (mixed methods). Objek penelitian adalah*

mahasiswa generasi Z dari Institut Teknologi Sepuluh Nopember (ITS) yang dipilih menggunakan teknik stratified random sampling. Hasil penelitian menunjukkan bahwa AI berkontribusi secara signifikan terhadap peningkatan kualitas penyelesaian tugas, produktivitas akademik, dan kepercayaan diri mahasiswa dalam mengikuti proses pembelajaran. Namun, intensitas penggunaan AI juga berkaitan dengan perubahan perilaku belajar dan motivasi dari yang semula didorong oleh rasa ingin tahu intrinsik menjadi lebih berorientasi pada pencapaian hasil dan efisiensi kerja. Temuan ini menunjukkan bahwa meskipun AI mampu meningkatkan aksesibilitas informasi dan efisiensi pembelajaran, penggunaannya berpotensi mengurangi keterlibatan mahasiswa dalam proses refleksi, berpikir kritis, dan pembelajaran kolaboratif. Oleh karena itu, diperlukan strategi pemanfaatan AI yang etis dan pedagogis agar teknologi ini dapat mendukung pengembangan kompetensi akademik tanpa mengurangi kualitas proses belajar mahasiswa.

Kata kunci: *artificial intelligence; Mahasiswa Generasi Z; kinerja akademik; perilaku belajar*

INRODUCTION

Artificial Intelligence (AI) has come a long way in recent decades and is increasingly adopted in education. According to the Digital Education Council's (2024-2025) report, around 86% of college students worldwide use AI to support their academic activities, with 54% using it weekly and 24% daily. In addition to helping with essay and report writing, AI tools like ChatGPT, Grammarly, and Notion AI improve grammar accuracy, condense scholarly texts, and make difficult ideas easier to understand.

In Indonesia, this trend has accelerated since the Covid-19 pandemic, due to the country's increasingly digital education system. According to Microsoft's Work Trend Index 2023, approximately 75% of respondents reported using AI in their daily tasks and work, placing Indonesia eighth among Asia-Pacific countries with the highest predicted AI user growth (Ali et al., 2023). This trend reflects the rapid and widespread adoption of AI tools across professional and educational contexts. AI tools such as ChatGPT assist users in drafting, organizing, and summarizing documents, while Grammarly supports structural and grammatical accuracy in written communication. Beyond individual productivity, these tools have also been adopted for bilingual communication tasks, particularly in professional contexts that require alternating between Bahasa Indonesia and English, reflecting the growing role of AI in meeting the linguistic demands of modern administrative and academic work (Sarbani & Hadisoebroto, 2025).

The development of AI in higher education has progressed from simple automation tools with feedback systems and assessment practices to tools that offer measurable gains in learning efficiency and student engagement (Luo et al., 2025). This shift is particularly relevant to Generation Z — individuals born between 1997 and 2012 — who represent the first cohort to grow up entirely within a digital environment. They

are characterized by constant connectivity, digital fluency, and an expectation of immediate access to information (Chan & Lee, 2023). These characteristics make Generation Z highly receptive to AI-powered tools. However, their deep integration with technology simultaneously raises concerns about over-reliance on digital shortcuts at the expense of independent reasoning and intrinsic motivation (Maxwell et al., 2025).

In terms of learning behavior, AI has been shown to strengthen instrumental motivation, improve organizational learning strategies, and produce divergent outcomes depending on individual levels of metacognitive awareness and self-regulation (Martín-Núñez et al., 2023). These patterns suggest that the educational impact of AI on Generation Z is not uniform, underscoring the need for clear pedagogical frameworks to ensure AI supports, rather than undermines, deep and meaningful learning (Lan & Zhou, 2025).

The use of AI is increasingly reshaping students' learning styles and academic performance in complex and often paradoxical ways. While Zhang et al. (2025) found that frequent AI use improves students' organizational learning strategies, critical thinking capacity declines significantly as a consequence. A global survey reported that 40% of students are concerned that reliance on AI may disrupt learning autonomy, while others maintain that AI enhances productivity (World Economic Forum, 2025). McKinsey (2025) similarly affirmed that AI improves effectiveness and efficiency in learning. Nevertheless, excessive application of AI lowers analytical skills and suppresses creativity. These issues are reflected in academic performance outcomes. A meta-analysis by Wang and Fan (2025) demonstrated a large positive effect of generative AI on learning performance ($g = 0.867$), but its effect on higher-order thinking skills was only moderate ($g = 0.457$), suggesting that performance gains remain concentrated at the surface level. This gap between output quality and conceptual depth is often described as the "illusion of competence", a condition in which students produce superior academic work with AI assistance without a corresponding increase in actual understanding (Sejdiu & Sejdiu, 2025). Reinforcing this concern, Ishaque et al. (2026) found that excessive AI use correlated significantly with superficial learning ($r = 0.56$, $p < 0.05$), underscoring the importance of distinguishing between academic performance and academic competence in the era of AI-assisted learning.

In an effort to increase digital literacy among students, various universities in Asia, including those in Indonesia, have begun to integrate AI into their curricula. Sewandono et al. (2023) found that e-learning adoption in Indonesian state universities is significantly shaped by information quality, learning collaboration, and performance expectancy. In line with these developments, Universitas Indonesia (UI) and Institut Teknologi Sepuluh Nopember (ITS) have incorporated AI into courses on ethics, law, and social consequences (Kompas, 2025). Nevertheless, AI adoption in Indonesia remains uneven and largely driven by individuals rather than institutionally guided. Limited trust

in AI accuracy, linguistic limitations in Bahasa Indonesia outputs, and the absence of clear governance frameworks (Sarbani & Hadisoebroto, 2025) underscore the urgency of developing structured AI literacy programs and academic policies that govern ethical and responsible AI use in Indonesian higher education.

Despite the growing body of literature on AI in education, most existing studies have examined AI adoption broadly across diverse populations or focused primarily on Western and East Asian contexts, leaving a significant gap in empirical understanding of how AI specifically influences the learning behavior and academic performance of Generation Z students in Indonesian higher education. Generation Z constitutes the dominant student population in Indonesian universities today, yet their patterns of AI use, motivational shifts, and cognitive outcomes remain insufficiently documented in peer-reviewed literature. Prior studies have largely focused on either attitudinal acceptance of AI or general performance outcomes, without simultaneously examining the interplay between AI use, learning behavior (motivation, learning strategies, and cognitive engagement), and academic performance within a single empirical framework.

This research, therefore, addresses the following questions: (1) What are the patterns of AI use among Generation Z students in Indonesian universities? (2) How does AI use influence changes in students' learning behavior, including motivation, learning strategies, and cognitive engagement? and (3) What are the implications of AI use on students' academic performance? Accordingly, this study aims to provide comprehensive empirical evidence on the impact of AI on the learning behavior and academic performance of Generation Z students in Indonesian higher education. The ultimate goal is to inform institutional policies, pedagogical frameworks, and AI literacy programs that support responsible and effective AI integration in academic settings.

METHODS

This research is designed as a descriptive exploration using both quantitative and qualitative methods. This research aims to gain a comprehensive understanding of the patterns of AI use in students and its effects on academic behavior and performance. Data were obtained from semi-structured interviews, online surveys, and secondary data analysis. The study was conducted at Institut Teknologi Sepuluh Nopember, Indonesia, from November 2025 to February 2026. The sample consisted of undergraduate and postgraduate students who were selected using stratified random sampling based on educational level and study program. The sample totaled 319 respondents, determined using the Slovin formula with a 5% margin of error. The inclusion criteria required students to have a history of using AI for academic purposes.

Data collection was carried out in two stages. First, the online survey was distributed through Google Form during the period of research. The survey instrument measured students' perceived academic achievement, learning motivation, learning strategies,

cognitive engagement, and AI use habits using a five-point Likert scale (1–5). Instrument validity was established through expert judgment and exploratory factor analysis, while reliability was confirmed using Cronbach’s Alpha with a threshold value of >0.7. Second, semi-structured interviews were conducted with 10 selected participants during February, with each interview lasting approximately 30 minutes. The interviews explored learning experiences, behavioral shifts, perceptions of dependency, and expectations regarding AI use. All interviews were conducted with recorded, transcribed verbatim, and verified for accuracy.

Quantitative data were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation) and inferential statistics, including Pearson correlation, linear regression, and t-tests or ANOVA to compare groups. Qualitative interview data were analyzed using content analysis to identify key themes and patterns related to students’ perceptions and experiences of AI in learning.

RESULTS AND DISCUSSION

Characteristics of Respondents

Table 1. Characteristics of Respondents

Variable	N	%
Agency		
Institut Teknologi Sepuluh Nopember	308	96.6
Sekolah Luar Bisa Negeri (SLBN) Gedangan	7	2.1
Unesco	3	0.9
Universitas Muhammadiyah Malang	1	0.3
Active students		
Yes	312	97.8
Not	7	2.2
Generation Z		
Yes	306	95.9
Not	13	4.1
Gender		
Man	136	42.6
Woman	183	57.4
Age		
17	8	2.5
18	55	17.2
19	80	25.1
20	67	21
21	81	25.4
22	18	5.6
23	3	0.9
30	1	0.3
37	1	0.3
50	1	0.3
55	2	0.6
56	2	0.6

Semester		
1-2	73	22.9
3-4	74	23.2
5-6	62	19.4
>7	110	34.5
College Type		
Country	316	99.1
Private	3	0.9
The Main Tools of Learning		
Laptop/PC	236	74
Smartphone	63	19.7
Tablets	20	6.3
Average internet duration per day (hours)		
	5	1.6
<2	37	11.6
2-4	159	49.8
4-8	118	37
>8		
Formal AI training experience		
Yes	88	27.6
Not	231	72.4

As shown in Table 1, Most of the respondents came from the Institut Teknologi Sepuluh Nopember, as many as 308 people (96.6%). The appearance of respondents affiliated with UNESCO, Muhammadiyah University of Malang, and Public Special School of Gedangan in the dataset is not indicative of intentional sampling beyond the target population. Rather, these entries represent response anomalies that fall outside the defined inclusion criteria of the study, which was explicitly scoped to students enrolled at Institut Teknologi Sepuluh Nopember. The majority of respondents are active students (97.8%) and belong to Generation Z (95.9%). By gender, female respondents were more numerous (57.4%) than male respondents (42.6%). In terms of age, respondents were dominated by the age group of 21 years (25.4%), followed by 19 years (25.1%) and 20 years (21%). Most of the respondents were in semester 7 (34.5%), followed by semesters 3–4 (23.2%) and semesters 1–2 (22.9%). By university type, almost all respondents were from state universities (99.1%). Regarding the main devices used for studying, the majority use laptops or PCs (74%). Based on the average daily internet use duration, most respondents used the internet for 4–8 hours (49.8%). In addition, only 27.6% of respondents had formal training in artificial intelligence (AI), while the majority (72.4%) had never participated in such training.

Patterns of AI Use among Generation Z Students

As presented in Table 2, AI use among Generation Z students was widespread across various academic activities. The most frequent use was for understanding difficult concepts, with 57.4% of respondents reporting using AI very often for this purpose. Searching for information related to lecture material also ranked highly, with 43.6% of

Table 2. Descriptive Data of The Use Of AI In The Learning Process

Question	Never	Rarely	Sometimes	Often	Very Often
I use AI to search for information related to lecture material	2 (0.6)	7 (2.2)	42 (13.2)	129 (40.4)	139 (43.6)
I use AI to understand difficult concepts	2 (0.6)	3 (0.9)	29 (9.1)	102 (32)	183 (57.4)
I use AI to help with tasks (ideas, structures, examples)	1 (0.3)	11 (3.4)	71 (22.3)	120 (37.6)	116 (36.4)
I use AI for language editing/editing (grammar, paraphrasing, summary).	10 (3.1)	39 (12.2)	86 (27)	101 (31.7)	83 (26)
Question	Never	Rarely	Sometimes	Often	Very Often
I use AI for practice questions/quizzes	23 (7.2)	58 (18.2)	100 (31.3)	76 (23.8)	62 (19.4)
I use AI to prepare presentations/projects	15 (4.7)	40 (12.5)	90 (28.2)	97 (30.4)	77 (24.1)
My average duration of academic AI use is more than 5 hours per week.	27 (8.5)	58 (18.2)	103 (32.3)	75 (23.5)	56 (17.6)
I rely more on AI than asking lecturers/friends	29 (9.1)	47 (14.7)	113 (35.4)	95 (29.8)	35 (11)
I double-check the AI output before using it	5 (1.6)	9 (2.8)	32 (10)	100 (31.3)	173 (54.2)
I save a prompt or create a template for repeated use	76 (23.8)	70 (21.9)	70 (21.9)	63 (19.7)	40 (12.5)

Source: research data

respondents using AI very often. For task assistance such as generating ideas, structures, and examples, 37.6% reported using AI often and 36.4% very often. Language editing, including grammar correction and paraphrasing, was used often or very often by 57.7% of respondents combined. Meanwhile, AI used for practice questions (19.4% very often) and presentation preparation (24.1% very often) was relatively lower. Regarding critical use behavior, 54.2% of respondents reported very often double-checking AI output before using it, reflecting a degree of evaluative awareness. However, 40.8% admitted to relying more on AI than on consulting lecturers or peers, raising concerns about a potential shift away from human-centered academic interaction.

Interviews revealed that AI has become a primary and indispensable learning tool among Generation Z students in Indonesian universities. As one participant noted, "I rely on my laptop and ChatGPT for almost everything. Such as searching for references, fixing my English writing, even practicing conversation for my language class. It has become part of how I study every day" (Participant 07, personal communication, 2025). Students commonly use digital devices (laptops and smartphones) and AI platforms

such as ChatGPT, Gemini, and Perplexity to search for references, refine language, understand complex concepts, and practice foreign languages. Contextual and strategic platform selection reflects students' digital literacy and evaluative skills. For example, Perplexity is used when explicit references are needed, while ChatGPT is preferred for conceptual clarification.

The results suggest that a practical, useful approach to AI emphasizes task efficiency and access to information. Crucially, AI is a "cognitive partner" that influences students' thought processes rather than merely an additional tool, shifting the paradigm from human-centered learning to algorithm-assisted learning. This change is consistent with research that indicates AI improves autonomous and self-directed learning and encourages students' active participation in knowledge construction (Chan & Lee, 2023; Vieriu & Petrea, 2025).

Of the 319 respondents, the majority frequently used AI in information retrieval (43.6% very often), theory comprehension (57.4% very often), task completion (37.6% often), language skills improvement (31.7% often), and presentation creation (30.4% often). With an average AI usage score of 36.41 (SD = 6.34; range: 10–50), the distributions of low and high usage rates are similar. These results show that students interact with AI in various ways, suggesting that AI is undergoing a transformation from a passive source of information to an active instrument. However, the level of use classified as "often" could lead to functional dependence, thereby decreasing the capacity to think critically or reflectively. This concern has emerged in previous research (Maxwell et al., 2025; Alhur et al., 2025).

Students who use AI show adaptive and intentional abilities, primarily for task completion and concept clarification, particularly under time constraints. On the other hand, prolonged or daily engagement (>5 hours/week under certain conditions) may indicate a risk of dependence. Quantitative results indicating that some students consult AI more often than lecturers or classmates are consistent with qualitative results revealing relatively low procrastination and self-discipline. This behavior change reflects a shift towards asynchronous digital interactions, which can pose an obstacle to developing critical academic soft skills, including teamwork, communication, and discussion. In addition, previous research has shown that although AI increases productivity, it can also suppress engagement in social and collaborative learning (Luo et al., 2025; Bittle & El-Gayar, 2025). Although operational digital awareness levels are relatively high, many students are classified as lacking critical AI literacy and often use AI results without questioning or understanding algorithmic bias. Therefore, it is very important for higher education to promote AI literacy, namely the ability to understand, evaluate, and use AI content appropriately.

These results highlight the importance of clear pedagogical guidance from lecturers. Through reflection-based learning, lecturers play a crucial role in assisting students as

they become critical and reflective users by verifying AI outputs. Overall, the use of AI by Generation Z students could be categorized as an example of “adaptive efficiency”. To ensure AI truly enhances the quality of learning, higher education institutions should strengthen digital literacy programs, pedagogical guidance, and clear academic policies on the ethical use of AI. Most of the respondents came from Institut Teknologi Sepuluh Nopember, with 308 people (96.6%). Most respondents are active students (97.8%) and belong to Gen Z (95.9%). By gender, female respondents were more (57.4%) than male respondents (42.6%), and by age, respondents were dominated by the 21-year age group.

The Influence of AI Use on Changes in Student Learning Behavior

Table 3. Data Analysis of The Use of Changes in Student Learning Behavior, Including

Variable	B	t	Sig	Sig (ANOVA)
Constant	3,260	1,411	0,159	<0.001*
MOT	0,479	6,837	<0.001*	
SRL	0,087	1,904	0,058	
COG	0,150	1,918	0,056	
ETH	0,014	0,258	0,796	
FUT	0,031	0,423	0,672	
PERF	0,364	3,857	<0.001*	

Source: research data

As displayed in Table 3, the regression analysis revealed that the overall model was statistically significant ($p < 0.001$, ANOVA), with the independent variables collectively explaining 49.3% of the variance in AI use ($R^2 = 0.493$). Among all predictors, motivation (MOT) emerged as the strongest significant predictor ($B = 0.479$, $t = 6.837$, $p < 0.001$), followed by performance perception (PERF) ($B = 0.364$, $t = 3.857$, $p < 0.001$). In contrast, self-regulated learning strategies (SRL), cognitive engagement (COG), ethics and dependency (ETH), and future expectations (FUT) did not show statistically significant partial effects ($p > 0.05$). These findings suggest that students’ decision to use AI is primarily driven by motivational factors and their perception that AI can improve academic outcomes, rather than by strategic or ethical considerations.

The use of AI influences changes in Generation Z students’ learning behavior, including motivation, learning strategies, and cognitive engagement from a motivational point of view, producing a dual effect. AI could increase instrumental motivation (confidence, productivity, sense of being able to complete tasks), but potentially decrease intrinsic motivation due to a reduction in cognitive challenges and curiosity. Qualitatively, students feel more ‘motivated’ when AI makes tasks easier but are also worried about

missing out on the deep learning process. This is in line with research conducted by Zogheib and Zogheib (2024), who argue that the perception of the ease and usefulness of AI generates strong external (instrumental) motivations but can suppress intrinsic motivation based on exploration and intellectual curiosity.

Thus, AI modulates motivation not only in terms of the quantity of learning but also the quality and orientation of motivation (instrumental and intrinsic). These findings illustrate a paradigm shift in motivation among Generation Z students. AI functions as an external regulator that strengthens short-term achievement orientation. It also confirms that students who use AI show an increase in short-term performative motivation but a decrease in deep emotional engagement with the learning process. Learning motivation, previously driven by intellectual curiosity, has now partially shifted toward efficiency-based motivation, namely the desire to achieve maximum results with minimal effort. This phenomenon was also reported in previous studies, which found that AI strengthens an orientation toward efficiency and results but reduces learning autonomy and intrinsic student satisfaction. This phenomenon indicates that AI can enhance performance but also threaten the development of learning autonomy and intrinsic satisfaction in the learning process (Martín-Núñez et al., 2023; Fan et al., 2025; Mohamed et al., 2025).

The linear regression results show that independent variables include performance perception, ethics, dependency, learning strategies, future hopes, motivation, and cognitive engagement. The results indicate that 49.3% of the variance in the use of AI ($R^2 = 0.493$) is explained, and these variables have a significant effect on the use of AI ($p < 0.05$). However, only motivation and performance perception showed a significant influence ($p < 0.05$), while the variables of learning strategies, cognitive engagement, ethics/dependency, and future expectations were not partially significant ($p > 0.05$). The regression coefficients indicated that the greatest contributions came from motivation ($B = 0.479$) and performance perception ($B = 0.364$) in predicting the intensity of AI use. These results suggest that psychological factors such as motivation and performance perception play a central role in explaining AI usage behaviors, in line with research showing that perceptions of AI performance directly improve self-efficacy and the sustainability of learning motivation. Students use AI especially when they see that the technology can improve the efficiency and quality of their academic work. Thus, a positive perception of AI performance creates an effect Self-reinforcing cycle (Lin & Chen, 2024), in which success can be obtained through the help of AI, further strengthening the motivation to continue using it. This interpretation is consistent with Li et al (2025), who explain that the perception of success from the use of AI will encourage sustained motivation and increasingly strong dependent behavior on AI systems.

Students think that AI can directly increase the success of assignments and confidence in the quality of academic products. As one participant affirmed, *"When I use AI to check my writing, I feel more confident submitting it. The structure looks better, and the language is cleaner. It makes me trust my own work more"* (Participant 12, personal communication, 2025). This is evident, for example, in how AI assists in correcting writing structure and language use, so that instrumental motivation and performance perception serve as strong drivers to continue using AI. In contrast, quantitative measurements showing variable cognitive engagement and learning strategies to be partially insignificant may indicate that changes in strategy and cognitive engagement are heterogeneous among individuals. This shows that some students use AI in depth to develop understanding, while others use it superficially just to get instant answers. These findings are consistent with research showing that differences in AI literacy levels and Self-regulated learning (SRL) affect the depth of students' cognitive engagement when using AI for academic assignments (Shi et al., 2025). Students who demonstrate metacognitive awareness in the high category are more likely to use AI as a tool to explore, test answers, confirm concepts, and expand knowledge. On the other hand, students who are oriented towards quick results use AI as an academic shortcut. These different learning strategies in the context of AI often depend on the extent to which students can apply AI to their self-regulation and metacognitive monitoring. This variation in the use of AI provides explanations of learning strategies and cognitive engagement that do not appear to be significant in statistical analysis (Sabando-García et al., 2025).

The systematic review highlights that learning designs that foster cognitive reflection and elaboration are crucial to the successful use of AI in higher education. AI used in accordance with pedagogical guidelines can be an inhibitor of "depth of learning," although it can also increase "learning efficiency" (Lan & Zhou, 2025). Thus, lecturers and instructional designers play an important role in ensuring AI promotes critical thinking rather than being a time-saver. Promoting learning encourages cognitive elaboration and metacognitive reflection, which should be used as a goal of educational interventions. For example, assignments for students take the form of activities to validate, distinguish, or assess arguments generated by AI. The restoration of AI functions as a cognitive aid is a tactic for achieving a balance between instrumental and intrinsic motivation (Mohamed et al., 2025).

Thus, the influence of AI on the learning habits of Generation Z students reflects a phenomenon called "techno motivation", defined as a condition that shows technology has a usefulness as a tool for learning and a source of new learning techniques and motivational patterns. This suggests that, in the context of higher education, the phenomenon represents a generational shift, with Generation Z students assimilating AI as a component of the learning regulatory system. To optimize its positive impact,

educational institutions need to integrate AI literacy training that includes cognitive, ethical, and reflective aspects in the curriculum, so that students are not only able to use AI effectively, but also wisely and responsibly (Fan et al., 2025).

Implications of Using AI on Student Academic Performance

Table 4. Data Analysis about Implications of Using AI on Student Academic Performance

Kruskal-Wallis	Df	Sig
27,615	3	<0,001*

Source: research data

As presented in Table 4, the Kruskal-Wallis test results demonstrate a statistically significant difference in AI usage patterns across different student groups, indicated by a Chi-Square value of 27.615, degrees of freedom (df) of 3, and a highly significant p-value ($p < 0.001$). This statistical finding confirms that academic maturity, specifically the student's current semester, plays a critical role in shaping how AI is integrated into their learning process.

In terms of product output, the empirical data and interview insights present a paradoxical picture. On the one hand, the use of AI significantly improves the quality of academic artifacts, resulting in neater writing structures, enhanced academic language, and better-organized references, which ultimately translate into higher assignment scores. On the other hand, from both a procedural and cognitive standpoint, these elevated grades are not always accompanied by a genuine advancement in conceptual mastery. Several participants expressed notable difficulties when evaluated without AI assistance, highlighting the prevalence of the "illusion of competence." This condition represents a psychological misperception where students mistake the high-quality outputs generated with technological scaffolding for their own actual cognitive understanding.

This phenomenon shows that the role of AI in learning is twofold. On the one hand, AI contributes to strengthening academic performance (performance-oriented learning). On the other hand, students tend to be more focused on the result than the thinking process that underlies it. As one participant candidly admitted, "*Honestly, I sometimes just want to finish the assignment quickly. I ask AI for the answer, and then I edit it a little; I don't always think deeply about whether I really understand it or not*" (Participant 09, personal communication, 2025). This condition indicates a shift in learning orientation from process-based to outcome-based, which has the potential to reduce cognitive depth. Meta-analysis research shows that although the use of Wang & Fan's (2025) Chatbot or generative AI had a large positive effect on learning performance ($g = 0.867$), the effect on Higher-order thinking ($g = 0.457$) is only moderate and is affected by the context of use. Meanwhile, research has identified that

the advancement of AI in higher education brings new challenges related to students' critical and conceptual thinking (Sejdiu & Sejdiu, 2025). Deep cognitive engagement, however, remains contingent upon the degree to which students consciously resist outcome-oriented shortcuts and instead engage AI as a scaffold for genuine intellectual inquiry.

The results of statistical calculations reinforce these findings. The analysis of Table 4 showed that there was a variation in the use of AI based on semesters ($p < 0.001$), which indicates that the level of academic maturity also affects the patterns and results of AI use. Students in the early semester tend to use AI for conceptual understanding and knowledge exploration, while students in the advanced semester use it more to improve academic products. This shows that the higher the level of study, the more likely AI is to be used for the pragmatic purpose of speeding up task completion rather than deepening understanding of concepts.

This difference is important to consider when designing pedagogical interventions appropriate to the learning level. In addition, the regression results show that perception of performance improvement is a significant predictor of AI use. Thus, the relationship between AI and academic performance is circular and reflective: students use AI because they believe it can improve performance, and as the results seem to improve, that trust grows. This phenomenon is known as the self-fulfilling expectancy effect: a positive perception of technology leads to improved performance not solely because of improved cognitive ability, but also because of confidence in the tool's effectiveness. However, because this research is Cross-sectional, the interpretation of direct causality between AI use and performance improvement should be approached with caution. This relationship can be mediated by other variables such as early ability, digital literacy, or institutional support. Research by Younas et al. (2025) shows that the effect of AI on learning outcomes is generally positive, but individual variability is large. Therefore, factors such as students' academic level and their purpose for using AI play an important role in shaping learning outcomes.

Thus, the positive impact of AI on academic performance is real but limited to the performative realm, not the substantive one. AI makes it easier for students to produce academic work that meets formal standards, but it does not necessarily improve students' ability to analyze, synthesize, or evaluate, which are indicators of higher-order thinking skills. These findings confirm the importance of distinguishing between academic performance and academic competence. The integration of qualitative and quantitative results leads to the conclusion that the use of AI has positive short-term implications for academic output in both product and assignment assessment but risks creating a gap between quantitative performance and conceptual mastery. If educational institutions evaluate only the end results without considering the reasoning behind them, this risk will increase even further. Therefore, learning evaluation policies need to assess both

products and processes to ensure that AI-generated performance improvements truly reflect deep understanding.

To ensure that academic performance improvements are substantive, institutions need to implement assessment policies that evaluate both processes and products, for example, by combining AI-assisted proctored exams with process-based assignments that demand documentation of students' thinking steps. This practice is supported by evidence that process-oriented assessment more accurately captures higher-order thinking skills in AI-integrated learning environments (Luo et al., 2025). In addition, ethical and methodological literacy of AI use should be incorporated into the curriculum so that students understand the boundaries of legitimate and responsible AI engagement. The recommendation is consistent with systematic evidence showing that students who receive structured AI literacy training demonstrate significantly better critical evaluation of AI outputs and lower rates of academic integrity violations (Bittle & El-Gayar, 2025; Shi et al., 2025). This approach is in line with the constructive alignment paradigm, which emphasizes the coherence between learning objectives, learning activities, and learning outcome assessment (Lan & Zhou, 2025), and is further supported by research demonstrating that when AI integration is guided by explicit pedagogical design, it promotes deeper cognitive engagement rather than surface-level task completion (Wang & Fan, 2025).

The results of research on the use of artificial intelligence by Generation Z students at Institut Teknologi Sepuluh Nopember are like several previous studies that examined the relationship between AI, learning behavior, and students' academic performance. Research showed that the use of AI can increase students' academic productivity by accelerating the processes of writing and literature search, but also poses a risk of reducing critical thinking skills if students are passively dependent on the technology. This is in line with research showing that students use AI to understand difficult concepts, improve writing, and organize assignments faster, but, on the other hand, lower intrinsic motivation and reflective involvement in the learning process. Similarly, it found that overuse of AI can lead to decreased learning motivation and cognitive engagement, as reflected in interview data showing that students feel they complete assignments faster but lack understanding of the substance of the material being studied (Yeung et al., 2025; Widhanarto et al., 2024).

In addition, research on Generation Z shows that students tend to use AI in a multifunctional way, for both information search and academic production, with the main motivations being time efficiency and ease of access. However, this phenomenon also gives rise to instrumental dependence on AI, which can reduce reflective capacity. These results are consistent with quantitative data showing that most respondents use AI almost every day and rely on it more than on asking lecturers or friends questions directly. The research also supports the findings, stating that although AI improves

efficiency and productivity, its overuse can reduce social interaction and collaboration among students. This can be seen in interview results, which show that students often engage in dialogue with AI rather than discussing directly with their peers. In line with that, it emphasizes that AI can indeed speed up task processing and improve academic scores, but it risks creating an illusion of competence, a condition in which learning outcomes appear to be good quantitatively but are not followed by an increase in conceptual understanding in depth. (Maxwell et al., 2025; Luo et al., 2025; Fan et al., 2025).

Theoretically, these results can be explained through several approaches. First, according to Vygotsky's (1978) theory of social constructivism, AI functions as a scaffolding that helps students reach the proximal developmental zone (ZPD). However, if the assistance is too intensive, students lose the opportunity to build knowledge independently, so the internalization and reflection process decreases. Second, within the framework of Cognitive Load Theory (Sweller, 1988), AI helps reduce extraneous load by providing quick and structured answers, but excessive use actually inhibits the formation of germane load, which is the cognitive load necessary for deep and reflective thinking. Third, based on Self-Determination Theory (Deci & Ryan, 2000), the convenience offered by AI encourages an increase in extrinsic motivation because learning outcomes can be achieved quickly, but at the same time decreases intrinsic motivation that is rooted in curiosity and satisfaction in learning. Fourth, in the Technology Acceptance Model (Davis, 1989), students accept AI because of perceived usefulness and perceived ease of use, but the dominance of the convenience factor can turn AI from a learning aid into a thinking-substitution tool. Finally, according to Social Cognitive Theory (Bandura, 1986), changes in students' learning behavior result from interactions among personal, environmental, and behavioral factors. Although AI produces an effective digital learning environment, it may also diminish the social interactions that foster metacognition, reflection, and teamwork.

Therefore, a paradox in the academic application of AI is revealed by the results of this study and evidence from earlier research. AI shows potential to improve learning efficiency, productivity, and student outcomes, but it can also reduce social interaction, intrinsic motivation, and depth of thinking. This phenomenon emphasizes that the presence of AI as an intellectual partner is necessary to increase the capacity of students to have critical and reflective thinking, as opposed to being a substitute for the learning process. For AI integration in higher education to boost outcomes while supporting students' cognitive development and academic ethics, clear pedagogical policies and guidelines are needed.

CONCLUSION AND RECOMMENDATION

Conclusion

AI has evolved to become an important component of the learning environment for Generation Z students. AI significantly improves assignment performance, academic productivity, and students' confidence in handling their courses. However, the widespread use of AI has resulted in a shift in learning behavior and motivation from intrinsic curiosity to performance-oriented, instrumental ones. AI improves accessibility and efficiency and also plays a role in reducing opportunities for reflective engagement, critical thinking, and group learning. AI's contribution is primarily performance-based rather than conceptual to academic success.

The findings indicate that higher education institutions need to establish clear ethical and pedagogical frameworks governing the use of AI in academic activities. Given that motivation and perceived performance are the primary drivers of AI adoption among students, while cognitive engagement and learning strategies remain statistically insignificant predictors, institutions must design interventions that shift students from efficiency-oriented use toward reflective, critically engaged learning. This includes integrating AI literacy into the curriculum, redesigning assessments to evaluate both process and product, and strengthening collaborative learning activities to counterbalance the decline in social interaction and intrinsic motivation associated with excessive reliance on AI.

Recommendation

Universities should provide clear guidelines for the ethical and responsible use of AI in academic activities. AI literacy also needs to be integrated into learning so students can evaluate AI outputs critically, verify information, and avoid overdependence. Lecturers are encouraged to design assessments that measure both the final product and the learning process, such as reflection notes or explanations of AI use. In addition, collaborative learning through discussion, peer review, and presentations should be strengthened to maintain students' critical thinking, communication, and social learning skills. At the policy level, AI integration in higher education should be supported by ethical standards, lecturer training, and assessment reform.

REFERENCES

- Alhur, A. A., Khlaif, Z. N., Hamamra, B., & Hussein, E. (2025). Paradox of AI in higher education: Qualitative inquiry into AI dependency among educators in Palestine. *JMIR Medical Education, 11*, e74947–e74947. <https://doi.org/10.2196/74947>
- Ali, N., Hayati, M., Faiza, R., & Khaerah, A. (2023). Artificial intelligence (AI) dalam pendidikan Islam: Trends, persepsi, dan potensi pelanggaran akademik di kalangan mahasiswa. *Indonesian Journal of Islamic Religious Education, 1*(1), 51–66.

<https://doi.org/10.63243/1sgbam44>

- Bittle, K., & El-Gayar, O. (2025). Generative AI and academic integrity in higher education: A systematic review and research agenda. *Information, 16*(4), Article 296. <https://doi.org/10.3390/info16040296>
- Chan, C. K. Y., & Lee, K. K. W. (2023). The AI generation gap: Are Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers? *Smart Learning Environments, 10*(1), Article 60. <https://doi.org/10.1186/s40561-023-00269-3>
- Digital Education Council (2024). *What students want: Key results from DEC global AI student survey 2024*.
- Fan, G., Liu, D., Zhang, R., & Pan, L. (2025). The impact of AI-assisted pair programming on student motivation, programming anxiety, collaborative learning, and programming performance: A comparative study with traditional pair programming and individual approaches. *International Journal of STEM Education, 12*(1). <https://doi.org/10.1186/s40594-025-00537-3>
- Kompas. (2025). *Universitas Indonesia dan ITS integrasikan AI dalam kurikulum: Tantangan dan peluang*. <https://www.kompas.id/2025/04/ai-kurikulum>
- Lan, M., & Zhou, X. (2025). A qualitative systematic review on AI empowered self-regulated learning in higher education. *Npj Science of Learning, 10*(1), 21. <https://doi.org/10.1038/s41539-025-00319-0>
- Lin, H., & Chen, Q. (2024). Artificial intelligence (AI) -integrated educational applications and college students' creativity and academic emotions: students and teachers' perceptions and attitudes. *BMC Psychology, 12*(1), 487. <https://doi.org/10.1186/s40359-024-01979-0>
- Luo, J., Zheng, C., Yin, J., & Teo, H. H. (2025). Design and assessment of AI-based learning tools in higher education: A systematic review. *International Journal of Educational Technology in Higher Education, 22*(1), 42. <https://doi.org/10.1186/s41239-025-00540-2>
- Martín-Núñez, J. L., Ar, A. Y., Fernández, R. P., Abbas, A., & Radovanoviæ, D. (2023). Does intrinsic motivation mediate perceived artificial intelligence (AI) learning and computational thinking of students during the COVID-19 pandemic? *Computers and Education: Artificial Intelligence, 4*, 100128. <https://doi.org/10.1016/j.caeai.2023.100128>
- Maxwell, D., Oyarzun, B., Kim, S., & Bong, J. Y. (2025). Generative AI in higher education: Demographic differences in student perceived readiness, benefits, and challenges. *TechTrends*. <https://doi.org/10.1007/s11528-025-01109-6>

- McKinsey & Company. (2025). *The future of AI in education: Opportunities and challenges*. McKinsey Report. <https://www.mckinsey.com/education/aifuture>
- Mohamed, A. M., Shaaban, T. S., Bakry, S. H., Guillén-Gámez, F. D., & Strzelecki, A. (2025). Empowering the faculty of education students: Applying AI's potential for motivating and enhancing learning. *Innovative Higher Education*, 50(2), 587–609. <https://doi.org/10.1007/s10755-024-09747-z>
- Sejdiu, N, P., & Sejdiu, S. (2025). The quiet transformation of higher education in the AI era. *Open Research Europe*, 5, 249. <https://doi.org/10.12688/openreseurope.20715.1>
- Sabando-García, A. R., Olguín-Martínez, C. M., Benavides-Lara, R. M., Salazar-Echeagaray, T. I., Huerta-Mora, E. A., Bumbila-García, B. B., Cedeño-Barcia, L. A., & Moreira-Choez, J. S. (2025). Artificial intelligence for determining learning strategies in university students. *Frontiers in Education*, 10. <https://doi.org/10.3389/educ.2025.1611189>
- Sarbani, Y. A., & Hadisoebroto, A. E. (2025). Adoption of generative ai in secretarial practices: Insights from Indonesian administrative professionals. *Jurnal Administrasi dan Kesekretarian*, 10(2), 84-95. <https://doi.org/10.36914/nv3y1473>
- Sewandono, R. E., Thoyib, A., Hadiwidjojo, D., & Rofiq, A. (2023). Performance expectancy of E-learning on higher institutions of education under uncertain conditions: Indonesia context. *Education and Information Technologies*, 28(4), 4041-4068. <https://doi.org/10.1007/s10639-022-11074-9>
- Shi, J., Liu, W., & Hu, K. (2025). Exploring how AI literacy and self-regulated learning relate to student writing performance and well-being in generative AI-supported higher education. *Behavioral Sciences*, 15(5), Article 705. <https://doi.org/10.3390/bs15050705>
- Vieriu, A. M., & Petrea, G. (2025). The impact of artificial intelligence (AI) on students' academic development. *Education Sciences*, 15(3), 343. <https://doi.org/10.3390/educsci15030343>
- Wang, J., & Fan, W. (2025). The effect of ChatGPT on students' learning performance, learning perception, and higher-order thinking: Insights from a meta-analysis. *Humanities and Social Sciences Communications*, 12(1), 621. <https://doi.org/10.1057/s41599-025-04787-y>
- Widhanarto, G.P., Prihatin, T. & Kusumawardani, S. (2024). Social media learning strategies, teachers' digital competencies and online learning quality: A correlational study. *Jurnal Inovasi Teknologi Pendidikan*, 11(3), 299-310. <https://doi.org/10.21831/jitp.v11i3.73020>

- World Economic Forum. (2025). *AI and the future of work and education*. <https://www.weforum.org/ai-future>
- Yeung, R. S. K., Tian, R., Chiu, D. K. W., & Choi, S. P.-M. (2025). University students' perceptions on how generative artificial intelligence shapes learning and research practices: A case study in Hong Kong. *The Journal of Academic Librarianship*, 51(5), 103082. <https://doi.org/10.1016/j.acalib.2025.103082>
- Younas, M., Ismayil, I., El-Dakhs, D. A. S., & Anwar, B. (2025). Exploring the impact of artificial intelligence in advancing smart learning in education: A meta-analysis with statistical evidence. *Open Praxis*, 17(3), 594–610. <https://doi.org/10.55982/openpraxis.17.3.842>
- Zhang, Y., Chen, L., & Wong, T. (2025). Effects of AI on student learning strategies: A cross-cultural analysis. *International Journal of Educational Research*, 119, 101905. <https://doi.org/10.1016/j.ijer.2024.101905>
- Zogheib, S., & Zogheib, B. (2024). Understanding university students' adoption of ChatGPT: Insights from TAM, SDT, and beyond. *Journal of Information Technology Education: Research*, 23, Article 25. <https://doi.org/10.28945/5377>