# Critical Thinking and Learning Interest in Academic Achievement: The Mediating Role of ChatGPT

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**Abstract:** This study aims to analyze the influence of critical thinking skills and learning interest on students' academic achievement in Surakarta, with ChatGPT serving as a mediating variable. The research employed a quantitative, explanatory survey method. Data were collected from 140 university students who had used ChatGPT in their academic activities, selected through purposive sampling. The research instrument consisted of a questionnaire with a four-point Likert scale that had been tested for validity and reliability. The results revealed that critical thinking skills and learning interest significantly affect academic achievement, both directly and indirectly through ChatGPT's mediating role. The research model demonstrated strong explanatory power with an $R^2$ value of 0.719. These findings highlight that integrating artificial intelligence-based technologies, such as ChatGPT, can enhance learning outcomes when combined with the development of critical thinking skills. Therefore, this study emphasizes the importance of implementing adaptive educational strategies that integrate technological use with cognitive skill development to prepare students for the challenges of the digital era.

**Abstrak**: Penelitian ini bertujuan untuk menganalisis pengaruh kemampuan berpikir kritis dan minat belajar terhadap prestasi akademik mahasiswa di Surakarta dengan ChatGPT sebagai variabel mediasi. Pendekatan penelitian yang digunakan adalah kuantitatif dengan metode survei eksplanatif. Data dikumpulkan dari 140 mahasiswa yang telah menggunakan ChatGPT dalam kegiatan akademik melalui teknik *purposive sampling*. Instrumen penelitian berupa kuesioner dengan skala Likert empat poin yang telah melalui uji validitas dan reliabilitas. Hasil penelitian menunjukkan bahwa kemampuan berpikir kritis dan minat belajar berpengaruh signifikan terhadap prestasi akademik, baik secara langsung maupun tidak langsung melalui peran mediasi ChatGPT. Model penelitian memiliki daya jelas yang kuat dengan nilai $R^2$ = 0,719. Temuan ini menegaskan bahwa integrasi teknologi berbasis kecerdasan buatan, seperti ChatGPT, dapat meningkatkan hasil belajar apabila diintegrasikan dengan pengembangan kemampuan berpikir kritis. Oleh karena itu, penelitian ini menekankan pentingnya penerapan strategi pendidikan adaptif yang mengombinasikan pemanfaatan teknologi dengan penguatan keterampilan kognitif guna mempersiapkan mahasiswa menghadapi tantangan era digital.

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## A. Introduction

The rapid advancement of technology in the era of the Fourth Industrial Revolution demands that the education sector continuously innovate and adapt its learning processes. The shift from traditional to digital learning systems has had a significant impact on academic activities in higher education. One of the main objectives of higher education is to prepare students to achieve academic success and adapt to ongoing developments. Academic achievement serves as an essential indicator for assessing the effectiveness of the learning process (Rahmah et al., 2024). Therefore, it is necessary to examine the various factors influencing students' academic achievement.

According to Simamora et al (2020), academic achievement is influenced by both internal and external factors. Two crucial internal factors are critical thinking skills and learning interest. Previous studies have shown that critical thinking skills significantly affect academic achievement (Nurfitriyanti et al., 2020; Orhan, 2022; Putri et al., 2023; Millaty et al., 2025). Critical thinking is a key skill for addressing global challenges, as it involves evaluating, analysing, and making decisions based on diverse information and perspectives (Riasty & Sari, 2024). Students with strong critical thinking skills tend to solve problems more effectively, which positively impacts their academic performance.

In addition, learning interest plays an essential role in encouraging students to actively participate in learning activities, enabling them to achieve optimal academic results. Previous research has shown a positive correlation between learning interest and academic achievement (Ginting et al., 2021; Mappadang et al., 2022; Ilzana & Adelaidey, 2024; Safitri & Jaryanto, 2025). Learning interest fosters perseverance, diligence, and motivation to seek new knowledge and complete academic tasks effectively (Majidah & Susilo, 2024; Lestari, 2021).

However, many students still face difficulties in developing critical thinking skills and maintaining learning interest, which leads to lower academic achievement. This challenge becomes more complex as schools transition to digital learning models that require students to be more independent and adaptive in using technology (Sulistyowati & Asriati, 2024). One of the technological innovations widely utilised in education today is Artificial Intelligence (AI), particularly ChatGPT (Pontjowulan, 2023). ChatGPT is an AI-based language model capable of generating interactive responses, answering questions, and assisting students in understanding course materials more effectively (Ouyang et al., 2022).

Several previous studies (Kasneci et al., 2023; Sari & Yudhanto, 2025) have shown that using ChatGPT in learning helps students comprehend materials, complete academic tasks, find references, and enhance critical thinking skills through constructive interactions. Nevertheless, the effectiveness of ChatGPT as a learning medium remains debated, especially regarding its role as a mediating variable between critical thinking skills, learning interest and academic achievement.

In an increasingly competitive workforce, high levels of critical thinking and learning interest serve as essential assets for university graduates to compete globally. The

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industrial world demands graduates who not only master theoretical knowledge but also possess critical, creative, and adaptive thinking skills in response to technological developments (World Economic Forum, 2022). Based on these considerations, critical thinking skills and learning interest have been shown to influence academic achievement; however, most previous studies have examined these variables separately.

The novelty of this study lies in the inclusion of ChatGPT as a mediating variable, which has not been extensively explored in higher education. This research aims to analyse the influence of critical thinking skills and learning interest on students' academic achievement, with ChatGPT serving as the mediating variable.

The results of this study are expected to provide valuable insights for universities, educators, students, and policymakers in designing effective learning strategies to enhance academic performance. These strategies include strengthening critical thinking skills, increasing learning interest, and implementing artificial intelligence wisely and ethically in the educational process. Thus, the findings of this study serve as a reference in formulating policies that support the improvement of higher education quality in the digital era.

## B. Method

This study employed a quantitative, explanatory survey method (De Matteis & Borgonovi, 2021). The primary objective was to examine the causal relationships among variables empirically. This approach measured and explained the influence of critical thinking skills and learning interest on students' academic achievement, using ChatGPT as a mediating variable, based on empirical data from a representative sample.

The research data were derived from primary sources collected directly from students who had used ChatGPT in their academic activities during the even semester of the 2024/2025 academic year. Data collection was conducted through an online questionnaire using a four-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree (Narmada et al., 2024).

The selection of a four-point scale was based on two methodological considerations. First, an even-point scale without a neutral option encourages respondents to provide definitive judgments for each statement, thereby reducing central tendency bias commonly found in five- or seven-point scales (Tanujaya et al., 2022). Second, the four-point scale is considered suitable for student respondents because it is simple, easy to understand, and efficient for online surveys involving a relatively large number of items. Thus, this scale is expected to yield consistent responses that more accurately reflect the respondents' perceptions.

The study was conducted in Surakarta from April to May 2025. The research population included all active students during the even semester of the academic year. Since the total population was unknown, the sample size was determined following Sarstedt et al (2019), who recommend a minimum of five to ten times the number of indicators in the study. With 14 indicators, the sample size was calculated as follows:

$$N = (5 - 10) \times K) \quad \text{.....(1)}$$

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$$N = 10 \times 14 = 140 \quad \text{…….(2)}$$

Based on this calculation, the study included 140 respondents. The sampling technique used was non-probability purposive sampling. The respondents were active university students who had used ChatGPT in their academic activities. The research instrument was developed based on theoretical indicators for each variable, as presented in Table 1.

**Table 1.** Research Variable Indicators

| Variable | Indicators | Source |
|---|---|---|
| Critical Thinking Skills | Basic classification, basis for decision-making, conclusion, advanced identification, inference, and integration. | Ain et al (2024) |
| Learning Interest | Curiosity, active engagement, and learning persistence. | Fikri (2025) |
| ChatGPT Usage | Relevance, effectiveness, and achievement, | Nasution et al (2025) |
| Academic Achievement | Cognitive, affective, and psychomotor aspects | Hamidah et al (2025) |

Construct validity testing was conducted using convergent validity, which indicates the degree of internal consistency among indicators within a construct. Reliability testing was performed by assessing outer loading values, Average Variance Extracted (AVE), and Cronbach's Alpha to ensure that each indicator contributed significantly to the construct.

Data analysis was carried out using Partial Least Squares Structural Equation Modelling (PLS-SEM), as it can effectively test models involving mediating variables and complex latent constructs (Hair et al., 2019). The analysis consisted of two interrelated stages.

The first stage was the evaluation of the measurement model (outer model), which aimed to assess convergent validity, discriminant validity, and construct reliability. Convergent validity was evaluated using factor loadings and AVEs, while construct reliability was assessed using composite reliability and Cronbach's Alpha.

The second stage was the evaluation of the structural model (inner model), which focused on testing causal relationships among latent variables, including both direct and indirect effects. At this stage, mediation testing was also performed to assess the mediating role of ChatGPT usage in the relationship between critical thinking skills, learning interest, and academic achievement.

The mediation test was conducted using the bootstrap method with 5,000 bootstrap samples at the 5 per cent significance level. The testing criteria included a t-statistic greater than 1.96 and a p-value less than 0.01 to determine the significance of the relationships among variables. The relationships among the tested variables are illustrated in Figure 1. The data analysis procedure was systematically designed to address the research hypotheses as follows:

$H_1$ : Critical thinking skills have a positive effect on students' academic achievement.

$H_2$ : Learning interest positively affects students' academic achievement.

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$H_3$ : Critical thinking skills have a positive effect on ChatGPT usage.
$H_4$ : Learning interest has a positive effect on ChatGPT usage.
$H_5$ : ChatGPT usage has a positive effect on students' academic achievement.
$H_6$ : ChatGPT usage mediates the effect of critical thinking skills on students' academic achievement.
$H_7$ : ChatGPT usage mediates the effect of learning interest on students' academic achievement.

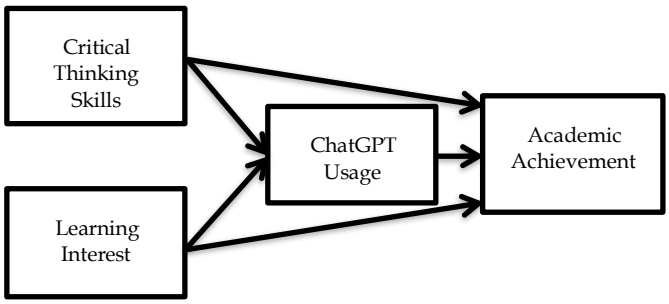


**Figure 1.** Research Flow

Figure 1. Research Flow illustrates the conceptual framework of the study, depicting the causal relationships among the research variables. Critical Thinking Skills and Learning Interest function as independent variables that influence Academic Achievement both directly and indirectly through ChatGPT Usage as a mediating variable. This research flow emphasizes that academic achievement is shaped not only by cognitive and motivational factors but is also strengthened by the effective use of artificial intelligence–based technology in the learning process.

## C. Result

Construct validity in this study was assessed using convergent validity, which indicates the degree of internal consistency among indicators within a construct. An indicator is considered valid if it has a loading factor (or outer loading) value greater than 0.70 and an Average Variance Extracted (AVE) value greater than 0.50. Based on Table 2, all indicators for the variables Critical Thinking Skills (7 items), Learning Interest (8 items), ChatGPT Usage (8 items), and Students' Academic Achievement (8 items) had outer loading values above 0.70, ranging from 0.743 to 0.867. These results demonstrate that all indicators within each variable meet the criteria for convergent validity and are valid representations of their respective constructs.

**Table 2.** Convergent Validity Results – Outer Loading (OL)

| Variable | Item | Outer Loading (OL) | Validity |
|---|---|---|---|
| Critical Thinking Skills | X1.1 | 0.771 | Valid |
| | X1.2 | 0.796 | Valid |
| | X1.3 | 0.867 | Valid |

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| Variable | Item | Outer Loading (OL) | Validity |
|---|---|---|---|
| | X1.4 | 0.791 | Valid |
| | X1.5 | 0.807 | Valid |
| | X1.6 | 0.814 | Valid |
| | X1.7 | 0.770 | Valid |
| Learning Interest | X2.1 | 0.771 | Valid |
| | X2.2 | 0.819 | Valid |
| | X2.3 | 0.762 | Valid |
| | X2.4 | 0.801 | Valid |
| | X2.5 | 0.808 | Valid |
| | X2.6 | 0.783 | Valid |
| | X2.7 | 0.769 | Valid |
| | X2.8 | 0.799 | Valid |
| ChatGPT Usage | Z1.1 | 0.867 | Valid |
| | Z1.2 | 0.817 | Valid |
| | Z1.3 | 0.762 | Valid |
| | Z1.4 | 0.756 | Valid |
| | Z1.5 | 0.743 | Valid |
| | Z1.6 | 0.771 | Valid |
| | Z1.7 | 0.839 | Valid |
| | Z1.8 | 0.813 | Valid |
| Academic Achievement | Y1.1 | 0.787 | Valid |
| | Y1.2 | 0.804 | Valid |
| | Y1.3 | 0.765 | Valid |
| | Y1.4 | 0.783 | Valid |
| | Y1.5 | 0.789 | Valid |
| | Y1.6 | 0.794 | Valid |
| | Y1.7 | 0.813 | Valid |
| | Y1.8 | 0.808 | Valid |

Source: Questionnaire, processed by the author using SmartPLS 4 (2025)

**Table 3.** Convergent Validity Results – Average Variance Extracted (AVE)

| Variable | Average Variance Extracted (AVE) | Validity |
|---|---|---|
| Critical Thinking Skills | 0.645 | Valid |
| Learning Interest | 0.623 | Valid |
| ChatGPT Usage | 0.628 | Valid |
| Academic Achievement | 0.635 | Valid |

Source: Questionnaire, processed by the author using SmartPLS 4 (2025)

The AVE analysis in Table 3 shows that all variables had AVE values above the minimum threshold of 0.50. The AVE values were 0.645 for Critical Thinking Skills, 0.623 for Learning Interest, 0.628 for ChatGPT Usage, and 0.635 for Students' Academic Achievement. All of these values exceed the recommended threshold suggested by Hair et al (2019) and Dash & Paul (2021). Therefore, all constructs in the model meet the criteria for convergent validity.

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**Table 4.** Reliability Results – Cronbach's Alpha (CR)

| Variable | Cronbach's Alpha (CR) | Reliability |
|---|---|---|
| Critical Thinking Skills | 0.908 | Reliable |
| Learning Interest | 0.914 | Reliable |
| ChatGPT Usage | 0.917 | Reliable |
| Academic Achievement | 0.916 | Reliable |

Source: Questionnaire, processed by the author using SmartPLS 4 (2025)

Construct reliability was tested using Cronbach's Alpha, as shown in Table 4. This test evaluates the internal consistency among items within each construct. According to Sarstedt et al (2019), a construct is considered reliable if the Cronbach's Alpha value exceeds 0.70. The analysis results show that Critical Thinking Skills (0.908), Learning Interest (0.914), ChatGPT Usage (0.917), and Students' Academic Achievement (0.916) all had Cronbach's Alpha values above this threshold. Thus, all constructs were deemed reliable, indicating high internal consistency among indicators.

The outer model testing was conducted to evaluate the strength of the estimated relationships among the latent variables and to assess the overall adequacy of the proposed research model. One of the key indicators used in this evaluation was the coefficient of determination ($R^2$), which reflects the proportion of variance in an endogenous variable that can be explained by its exogenous predictors within the model. The $R^2$ value serves as an important measure of the model's explanatory power and its ability to represent empirical data accurately. According to Hair et al (2019), an $R^2$ value of 0.75 is categorised as strong, 0.50 as moderate, and 0.25 as weak.

The estimation results presented in Figure 1 indicate that the $R^2$ value for the ChatGPT Usage variable (Z) was 0.793. This result demonstrates that 79.3% of the variance in ChatGPT usage can be explained jointly by Critical Thinking Skills ($X_1$) and Learning Interest ($X_2$). Based on the classification proposed by Hair et al. (2019), this value falls within the strong category, suggesting that the two independent variables provide substantial explanatory power in predicting students' utilisation of ChatGPT in academic activities.

Furthermore, the $R^2$ value for Students' Academic Achievement (Y) was found to be 0.719, indicating that Critical Thinking Skills, Learning Interest, and ChatGPT Usage collectively explained 71.9% of the variance in students' academic achievement. This value also belongs to the strong category, implying that the proposed model is highly effective in explaining academic performance outcomes. The relatively high $R^2$ values for both endogenous variables confirm that the structural relationships specified in the model are robust and meaningful.

Overall, these findings suggest that the model structure is adequate and demonstrates a strong level of goodness of fit. More importantly, the results provide empirical evidence that ChatGPT Usage functions as a significant mediating variable that enhances the indirect effects of Critical Thinking Skills and Learning Interest on Students' Academic Achievement. This indicates that the integration of artificial intelligence–based

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learning tools, when combined with cognitive and motivational factors, contributes substantially to improving academic outcomes.

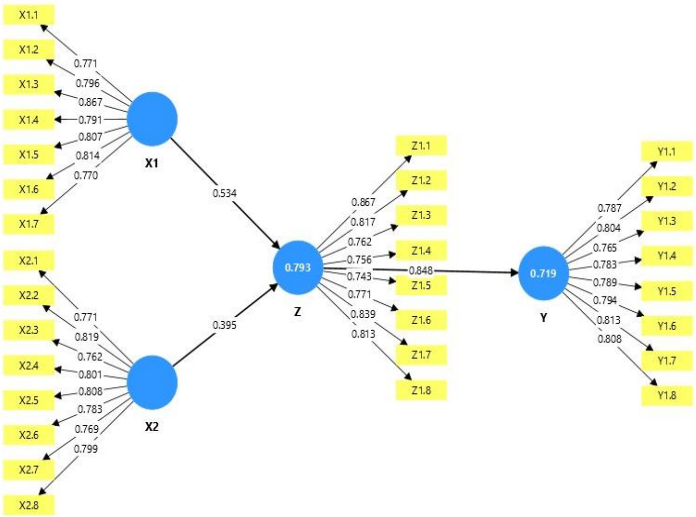


**Figure 2.** Outer Model

Figure 2. Outer Model presents the measurement model that illustrates the relationships between each latent construct and its observed indicators. The figure shows that all indicators for Critical Thinking Skills, Learning Interest, ChatGPT Usage, and Academic Achievement have strong factor loadings, indicating that each indicator reliably represents its respective construct. This outer model confirms the adequacy of convergent validity and reliability of the measurement instruments used in the study, supporting their suitability for further structural model analysis.

**Table 5.** Hypothesis Testing Results (Direct – Indirect)

| Hypothesis | T-Statistic | P-value | Interpretation |
|---|---|---|---|
| X1 → Y1 | 5.129 | 0.000* | $H_1$ accepted |
| X2 → Y1 | 3.834 | 0.000* | $H_2$ accepted |
| X1 → Z1 | 5.549 | 0.000* | $H_3$ accepted |
| X2 → Z1 | 3.892 | 0.000* | $H_4$ accepted |
| Z1 → Y1 | 19.896 | 0.000* | $H_5$ accepted |
| X1 → Z1 → Y1 | 5.129 | 0.000* | $H_6$ accepted |
| X2 → Z1 → Y1 | 3.834 | 0.000* | $H_7$ accepted |

Source: Questionnaire, processed by the author using SmartPLS 4 (2025).
Note: *significant at (α = 0.01).

Hypothesis testing was conducted by analysing the T-statistic and P-value to assess the significance of the relationships among variables. A hypothesis is considered significant if the P-value < 0.01 and the T-statistic > 1.96 at the 1% significance level. The tests were conducted for both direct effects and indirect effects through the mediating variable.

Based on Table 5, the first hypothesis ($H_1$), which posits that Critical Thinking Skills affect Students' Academic Achievement, shows a T-statistic value of 5.129 and a P-value of 0.000 < 0.01. Therefore, $H_1$ is accepted, indicating that Critical Thinking Skills have a positive

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and significant effect on Students' Academic Achievement. The second hypothesis ($H_2$), concerning the effect of Learning Interest on Students' Academic Achievement, was also significant, with a T-statistic of 3.834 and a P-value of 0.000 < 0.01. Hence, $H_2$ is accepted, suggesting that higher Learning Interest is associated with higher Academic Achievement.

The third hypothesis ($H_3$), which tested the effect of Critical Thinking Skills on ChatGPT Usage, showed a T-statistic value of 5.549 and a P-value of 0.000 < 0.01. Therefore, $H_3$ is accepted. This result indicates that students with higher critical thinking skills tend to be more active and effective in using ChatGPT as a learning tool. The fourth hypothesis ($H_4$) was also significant, with a T-statistic of 3.892 and a P-value of 0.000 < 0.01, indicating that higher Learning Interest enhances ChatGPT Usage in academic activities.

The fifth hypothesis ($H_5$), which examined the effect of ChatGPT Usage on Students' Academic Achievement, yielded a T-statistic value of 19.896 and a P-value of 0.000 < 0.01. Thus, $H_5$ is accepted, showing that ChatGPT Usage has a positive and significant effect on Students' Academic Achievement. The sixth hypothesis ($H_6$), which tested the indirect effect of Critical Thinking Skills on Students' Academic Achievement through ChatGPT Usage as a mediating variable, was also accepted, with a T-statistic of 5.129 and a P-value of 0.000 < 0.01. This result indicates that ChatGPT Usage significantly mediates the relationship between Critical Thinking Skills and Students' Academic Achievement.

The seventh hypothesis ($H_7$), which tested the mediating role of ChatGPT Usage in the relationship between Learning Interest and Students' Academic Achievement, showed a T-statistic of 3.834 and a P-value of 0.000 < 0.01. Therefore, $H_7$ is accepted. This result indicates that ChatGPT Usage also significantly mediates the effect of Learning Interest on Students' Academic Achievement.

All hypotheses in this study were statistically supported, and the proposed theoretical model is supported. These findings strengthen empirical evidence that Critical Thinking Skills and Learning Interest not only have direct effects on Students' Academic Achievement but also indirect effects through ChatGPT Usage as a mediating variable.

## D. Discussion

This study demonstrates that all proposed hypotheses ($H_1$–$H_7$) were supported by the data. These findings indicate that critical thinking ability and learning interest have both direct and significant positive effects on students' academic achievement, as well as indirect effects mediated by ChatGPT use. The results reinforce the theoretical foundation that academic success is not solely determined by cognitive capacity but also by intrinsic motivation and adaptability to AI-based learning technologies (Peng & Kievit, 2020; Yan & Li, 2023).

The direct influence of critical thinking on academic achievement, as reflected in the high T-statistic, confirms that students with the ability to analyse, evaluate, and construct logical arguments are better prepared to face academic challenges (Demetriou et al., 2020; Shi & Qu, 2022). Critical thinking not only reflects academic competence but also demonstrates intellectual maturity in responding to the complexity of materials and the

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dynamics of modern learning. This finding aligns with Rivas et al (2023), who emphasise that critical thinking is a key skill for 21st-century students.

Learning interest was also found to have a positive and significant effect on academic achievement. Students with strong internal motivation tend to perform better academically. Learning interest functions as a psychological energy that drives persistence and consistency in study activities, even when facing difficulties. This finding is consistent with Laine et al (2020) and Wu et al (2024), who argue that learning interest, as an intrinsic motivation, enhances the quality and intensity of students' engagement in academic activities.

An interesting aspect of this study is the significant mediating role of ChatGPT in the relationship between critical thinking ability, learning interest, and academic achievement. Students with high levels of critical thinking and learning interest tend to use ChatGPT more effectively to support comprehension of the material (Guo & Lee, 2023; Youssef et al., 2024; Dahri et al., 2025). This utilisation reflects both technological proficiency and metacognitive awareness in selecting and managing information sources. Reflective thinkers use ChatGPT selectively, verifying its responses for accuracy and integrating the information into their critical thinking framework (Romero-Rodríguez et al., 2023).

The significant effect of ChatGPT use on improving academic achievement suggests that AI technology functions as a cognitive catalyst, accelerating conceptual understanding and supporting the development of reflective thinking. However, the role of ChatGPT is not to replace the learning process but to broaden insights and enrich students' learning experiences, provided it is used in accordance with academic ethics and with adequate digital literacy (Memarian & Doleck, 2023). This perspective is consistent with Kasneci et al (2023), Lee (2024), and Rawas (2024), who assert that ChatGPT can serve as an effective learning partner when used under academic supervision and with users' reflective thinking skills.

Although the results reveal positive effects, several critical notes should be addressed. Some studies report that excessive use of ChatGPT may reduce originality of thought and learning independence (Farrokhnia et al., 2024; Memarian & Doleck, 2023). Dependence on instant AI responses can hinder deep thinking processes and reduce students' ability to develop original ideas. In the context of higher education in Indonesia, this risk may be more pronounced due to the persistent digital literacy gap among students, particularly in distinguishing between using ChatGPT as a learning aid and as a substitute for critical thinking processes.

The limited digital literacy among Indonesian students may also create new challenges, such as difficulties assessing the credibility of AI-generated information and a tendency to copy content without critical reflection. This condition underscores the crucial role of lecturers in guiding students to use ChatGPT ethically and productively. Integrating digital literacy and AI ethics training into the accounting education curriculum could be an effective strategy to help students use technology optimally while supporting the development of higher-order thinking skills.

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Thus, this study emphasises that critical thinking ability, learning interest, and the use of AI-based technology such as ChatGPT constitute a strategic combination that can significantly enhance students' academic achievement. These three factors should be developed synergistically through a holistic educational approach that adapts to the digital transformation and aligns with students' levels of digital literacy readiness in Indonesia.

## E. Implication

Theoretically, this study reinforces the perspective that students' academic success in the digital era is shaped by more than innate cognitive abilities or internal motivation alone. The findings demonstrate that critical thinking skills and learning interest interact dynamically with artificial intelligence–based learning technologies, particularly ChatGPT, to influence academic achievement both directly and indirectly. By positioning ChatGPT as a mediating variable, this study extends contemporary learning models and contributes a novel conceptual insight into how artificial intelligence functions as a cognitive and motivational catalyst in higher education. This perspective enriches existing theories of academic achievement by integrating technological mediation into the relationship between cognitive skills, affective factors, and learning outcomes.

From a practical standpoint, the findings provide meaningful guidance for key stakeholders in higher education. For lecturers, the results highlight the importance of designing instructional strategies that simultaneously cultivate critical thinking skills and learning interest while embedding the reflective and ethical use of artificial intelligence tools such as ChatGPT into academic activities. Rather than treating AI as a supplementary feature, educators are encouraged to integrate it intentionally into learning tasks that promote analysis, evaluation, and independent reasoning.

For students, this study underscores the need to perceive artificial intelligence as a supportive learning tool that enhances understanding and strengthens critical thinking, rather than as a substitute for analytical effort. Responsible use of ChatGPT can broaden perspectives and facilitate learning efficiency; however, overreliance may undermine originality and intellectual independence. Therefore, students must be guided to engage with AI critically and metacognitively to maximise its educational benefits.

At the institutional level, higher education institutions are encouraged to foster collaborative learning environments that support innovation while remaining grounded in academic integrity. Developing an adaptive digital learning ecosystem requires synergy between lecturers and students, supported by clear guidelines that promote ethical AI usage, critical engagement, and academic honesty.

At the policy level, this study highlights the urgency of incorporating artificial intelligence literacy and ethical frameworks into higher education curricula. Policymakers and accreditation bodies should consider strategies that enhance digital competencies among lecturers and students through structured training on responsible ChatGPT use, mechanisms for evaluating academic originality in AI-assisted work, and the formulation of ethical standards governing artificial intelligence in academic contexts. Such initiatives are

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essential for preparing graduates who are not only academically competent but also ethically responsible and globally competitive.

Finally, this study opens avenues for future research to explore the mediating mechanisms of ChatGPT across different academic disciplines, to compare its effectiveness with other artificial intelligence platforms, and to examine additional influencing factors such as digital literacy and academic ethics regulation. Employing mixed-method approaches and expanding research contexts across diverse regions in Indonesia would further deepen understanding of the complex interplay between critical thinking, learning interest, and artificial intelligence in enhancing the quality of higher education in the digital era.

## F. Limitation and Suggestion for Further Research

This study demonstrates that critical thinking skills and learning interest significantly influence students' academic achievement, with ChatGPT serving as a mediating variable. However, several limitations should be noted.

First, the study was conducted at a single university, which limits the generalizability of the findings to other regions with different student characteristics, curricula, and levels of technological access. Second, potential respondent bias may arise from the use of self-reported, subjective measurement methods. Third, external variables such as teaching quality, academic pressure, and social support were not included in the research model, which may influence the relationships among the studied variables.

Given these limitations, future research is recommended to expand the sample to multiple universities and to include moderating variables and other relevant external factors. In addition, subsequent studies should explore in greater depth the mechanisms of ChatGPT use, including the ethical aspects of artificial intelligence and its impact on students' learning independence and higher-order thinking skills. These efforts are expected to deepen understanding of the role of artificial intelligence in learning processes and ensure its continued support for the fundamental goals of education.

## G. Conclusion

This study demonstrates that critical thinking skills and learning interest significantly influence students' academic achievement, with ChatGPT use serving as a mediating variable. The hypothesis testing results ($H_1$–$H_7$) confirm that both variables exert a positive effect on academic performance. Students with higher levels of critical thinking and learning interest tend to utilise ChatGPT more effectively, resulting in improved academic achievement. Furthermore, ChatGPT has been proven to act as a mediator in the relationship between critical thinking skills and academic achievement, as well as between learning interest and academic achievement.

These findings affirm that academic success in the digital era is not solely determined by cognitive ability and learning motivation, but also by the capacity to use technology effectively and responsibly. Therefore, higher education institutions should prioritise the

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development of critical thinking skills, the enhancement of learning interest, and the cultivation of literacy and ethical use of artificial intelligence (AI) within learning activities.

This study underscores the importance of integrating artificial intelligence (AI) ethically and strategically in higher education to foster an adaptive, competitive, and intellectually independent learning environment.

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