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The Future of Science Education: Artificial Intelligence (AI) Integration and Student Achievement

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Abstract

Purpose: This study examined the impact of adopting Artificial Intelligence (AI) educational tools on the academic performance of science major students enrolled in the Bachelor of Secondary Education, major in Science during the second semester of the 2023–2024 academic year at Northern Iloilo State University – Ajuy Campus.

Methods: A descriptive–correlational research design was employed to determine the relationship between AI tool usage and students' academic performance. Data were collected using a validated researcher-developed questionnaire.

Results: Findings revealed that 94.8% of students actively used AI educational tools, with Quillbot, ChatGPT, and Grammarly being the most frequently accessed platforms. However, overall usage was described as occasional, and AI tools were found to have only a moderate effect on academic performance. No significant relationship was observed between AI tool utilization and academic achievement when students were grouped by sex, year level, or socio-economic status. These results indicate that although AI tools are widely accessed, their impact on learning outcomes remains limited in the absence of structured integration.

Application: The study concludes that while AI educational tools offer potential benefits for supporting academic performance, their use is currently sporadic and not fully optimized for enhancing learning. The findings highlight the need for systematic incorporation of AI tools into the curriculum, accompanied by teacher training, clear guidelines, and pedagogical support to ensure meaningful engagement. Furthermore, policymakers and curriculum developers are encouraged to promote responsible and pedagogically sound AI adoption in higher education to improve learning outcomes and foster digital competence among students.

Keywords: AI Educational Tools, Artificial Intelligence, Science Major, Academic Performance

1. Introduction

The integration of Artificial Intelligence (AI) in education has rapidly gained attention as schools and universities explore innovative strategies to enhance teaching and learning. AI-powered tools such as Quillbot, ChatGPT, and Grammarly are increasingly utilized by students for tasks including writing assistance, paraphrasing, editing, and problem-solving. These technologies not only provide immediate feedback but also help learners develop critical thinking and communication skills, which are essential for academic success in the digital age (Zhang & Aslan, 2021).

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Despite these advantages, research suggests that AI use in education often remains limited to surface-level tasks, and its full potential in improving measurable learning outcomes has yet to be realized (Rodway, 2023). While students are increasingly turning to AI for academic support, gaps remain in understanding how frequency, nature of use, and demographic factors such as sex, year level, and socio-economic status influence academic performance.

For science major students, who regularly engage with demanding coursework requiring both analytical reasoning and practical application, AI educational tools could play a critical role in improving academic outcomes and fostering innovation. However, without structured integration and clear pedagogical guidance, the benefits of these technologies may remain underutilized. This highlights the need for research investigating not only students' engagement with AI but also its actual impact on academic performance.

1.1 Aim of the Study

This study aimed to determine the impact of adopting AI educational tools on the academic performance of science major students enrolled in the Bachelor of Secondary Education, major in Science at Northern Iloilo State University – Ajuy Campus during the second semester of the 2023–2024 academic year. Specifically, the study sought to answer the following questions:

1. How many science major students use AI educational tools?
2. Which AI tools are most commonly utilized by students?
3. What is the level of AI tool utilization when classified by sex, year level, and socioeconomic status?
4. What is the impact of AI tool usage on students' academic performance overall and by demographic group?
5. Is there a significant relationship between AI tool usage and academic performance according to sex, year level, and socio-economic status?

1.2 Hypothesis

H_1: There is no significant relationship between AI educational tool usage and academic performance of science major students when grouped according to sex, year level, and socio-economic status.

2. Literature Review

2.1 Global Perspectives on AI in Education

AI has emerged as a transformative force in education worldwide, enabling machines to perform functions traditionally requiring human cognition, such as decision-making, problemsolving, natural language processing, and learning from data (Bonk & Wiley, 2020). The rapid adoption of AI-powered applications

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offers tools for learning analytics, personalized recommendations, and diagnostics, reshaping teaching and learning when balanced with pedagogy and ethical considerations (Zhai et al., 2021).

2.2 Pedagogical Applications of AI

AI tools have been widely integrated across educational levels. Digital libraries, adaptive learning systems, and platforms like Google Scholar and YouTube allow learners to customize learning paths and receive real-time feedback (Edtech, 2020; García-Vélez et al., 2021). Teachers also benefit from AI through automated support for **lesson planning, monitoring participation, and grading** (Wang et al., 2020). UNESCO (2020) emphasized that AI can enhance teacher effectiveness and student outcomes when applied responsibly, while Mahmoud (2020) highlighted its potential to reduce routine workloads and foster deeper engagement.

2.3 Challenges and Ethical Considerations

Despite its promise, AI integration faces challenges including equitable access, ethical concerns, and risks of over-reliance. Estrellado (2023) noted that Philippine education institutions could leverage AI for assessment and teacher upskilling but must address responsible use. Students generally perceive AI positively, yet concerns about accuracy and negative effects persist (Idroes et al., 2023; Dhara et al., 2022). ChatGPT, for example, demonstrates strong generative capabilities but may present limitations in factual accuracy and reliability (Zhai, 2022).

2.4 Philippine Context

In the Philippines, higher education institutions are progressively embracing AI to align with global trends. Initiatives such as Silliman University's Gen-AI Integration Framework, Batangas State University's AI and data science programs, and the University of the Philippines'
AI research centers reflect efforts to build digital literacy and innovation skills among students (Gamboa, 2024). These programs demonstrate growing recognition of AI's role in preparing Filipino students for the digital workforce.

2.5 Summary

Overall, the literature indicates that AI tools provide personalized learning, adaptive feedback, and instructional support, but their effectiveness depends on structured integration and pedagogical guidance. For science majors facing rigorous curricula, AI presents opportunities to enhance academic performance and innovation, though challenges related to reliability, ethical use, and consistent adoption remain.

3. Research Framework

Figure 1 illustrates the conceptual framework of the study, highlighting the key variables and their relationships. The independent variable is the use of Artificial Intelligence (AI) educational tools, including applications such as ChatGPT, Quillbot, and Grammarly, which students utilize to support various academic tasks, enhance learning, and improve performance.

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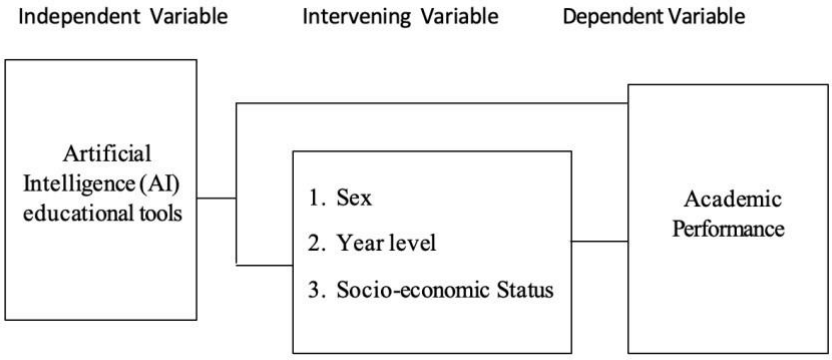

Figure 1. Schematic Diagram of the Study Variables

The dependent variable in this study is the academic performance of science major students, which serves as the primary outcome of interest. This is assessed through students' academic results and learning achievements, reflecting their overall proficiency in sciencerelated coursework. The framework posits that the use of AI educational tools may positively influence or contribute to improved academic performance. Positioned between the independent and dependent variables are the intervening variables: sex, year level, and socio-economic status. These factors are considered because they may moderate or shape the relationship between AI tool usage and academic performance. For instance, differences in gender, academic year, or financial background could influence how students access, engage with, and benefit from AI tools.

Overall, the figure illustrates that while AI educational tools are expected to impact academic performance, the strength and nature of this effect may vary according to demographic and socio-economic characteristics. The framework thus provides a structured approach for investigating not only the direct influence of AI tools on learning outcomes but also the moderating role of key intervening factors, offering a comprehensive lens to understand the dynamics of AI integration in higher education.

4. Methodology

4.1 Research Approach and Design

This study employed a descriptive–correlational research design, which was deemed appropriate as it allows for the examination of relationships between variables without asserting causal inferences (Bhat, 2024). Specifically, the study investigated the relationship between the utilization of Artificial Intelligence (AI) educational tools and the academic performance of students enrolled in the Bachelor of Secondary Education, major in Science at Northern Iloilo State University – Ajuy Campus during the second semester of the 2023–2024 academic year. The descriptive component provided a clear profile of students' demographic characteristics and levels of AI tool utilization, while the correlational component determined the extent to which AI tool usage was associated with academic outcomes.

4. 2 Data Collection

The study employed total enumeration sampling, including all BSE Science major students from first to fourth year. A total of 96 students participated, comprising 27 males (28.1%) and 69 females (71.9%). By year level, 24 (25.0%) were first-year, 26 (27.1%) second year, 21 (21.9%) third-year, and 25 (26.0%)

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fourth-year students. Regarding socio-economic status, 82 students (85.4%) were classified as poor, 13 (13.5%) as low-income, and 1 (1.0%) as lower-middle-income.

Data were collected using a researcher-developed questionnaire consisting of 30 items divided into two sections: Part I collected demographic information, while Part II assessed the frequency and extent of AI educational tool usage. The instrument was validated by a panel of experts and pilot-tested on 50 BSE English major students at the same campus. Cronbach's alpha values ranged from 0.876 to 0.946, indicating high reliability. The questionnaire was administered online via Google Forms to ensure accessibility and efficiency.

4.3 Data Analysis

Collected data were systematically organized, tabulated, and analyzed using both descriptive and inferential statistics. Frequency counts, percentages, and means were computed to describe participants' demographic profiles and levels of AI tool utilization. Correlation analysis was conducted to determine relationships between AI tool usage and academic performance. Comparisons were also made across sex, year level, and socioeconomic status to identify potential differences in patterns of AI tool use and its impact on student outcomes.

4.4 Ethical Considerations

The study strictly adhered to ethical research standards involving human participants. Approval was secured from the Chairperson of the Secondary Education Department and the Campus Administrator of NISU Ajuy Campus. Informed consent was obtained from all respondents, who were assured that participation was voluntary and that they could withdraw at any time without consequences. Participant confidentiality was strictly maintained, and data were used solely for academic purposes. Compliance with Republic Act 10173 (Data Privacy Act of 2012) ensured the protection of personal information and privacy rights of all participants.

5. Results and Discussion

Table 1 presents the frequency and distribution of science major students who reported using AI educational tools. It highlights the extent of adoption across the sample, providing a clear profile of student engagement with platforms such as ChatGPT, Quillbot, and Grammarly. The data serves as a foundation for understanding patterns of AI tool utilization and its potential relationship with academic performance.

Table 1. Number Of Science Major Students Who Are Using Artificial Intelligence (AI)

Educational Tool

	Category	Frequency	Percentage
No	5		5.2%
Yes	91		94.8%
Total	96		100%

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As shown in Table 1, out of 96 science major students, 91 (94.8%) reported using Artificial Intelligence (AI) educational tools, while only 5 (5.2%) indicated that they do not use them. This high level of adoption reflects the growing integration of AI technologies into students' academic routines and learning practices.

These findings are consistent with Nguyen (2023), who reported that AI applications are increasingly popular in educational contexts, and that stakeholders—including teachers, administrators, and policymakers—are generally receptive to the integration of such technologies. Similarly, Partners (2023) found that 75% of students actively use generative AI tools, often expressing the willingness to continue using them even in the absence of formal institutional endorsement.
The results suggest that AI educational tools have become a ubiquitous part of students' learning environment, offering support in tasks such as writing, editing, problem-solving, and research. This widespread utilization indicates not only students' openness to technological innovations but also a shift toward more self-directed and technology-enhanced learning approaches. Furthermore, the nearly universal engagement with AI tools underscores the potential for these applications to positively influence academic performance if integrated strategically into the curriculum.

Overall, the findings highlight the need for educators and institutions to leverage students' existing engagement with AI, guiding effective and ethical use while developing structured strategies to maximize learning outcomes. The data also point to opportunities for future research to explore how different patterns of AI tool use affect specific academic skills, particularly in rigorous programs such as science majors.

Table 2 presents the extent to which science major students employ AI educational tools in their academic activities. It highlights patterns of usage across the sample, providing insight into students' engagement with platforms such as ChatGPT, Quillbot, and Grammarly, and serves as a foundation for analyzing the relationship between AI tool utilization and academic performance.

Table 2. Artificial Intelligence (AI) Is an Educational Tool Used by Science Major Students.

AI Educational Tools	YES		No	
	Frequency	Percentage	Frequency	Percentage
ChatGPT	47	51.6%	44	48.4%
Quillbot	48	52.7%	43	47.3%
Grammarly	33	36.3%	58	63.7%

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BingChat	1	1.1%	90	98.9%
CopyAI	0	0%	91	100%
Summarize Tech	1	1.1%	90	97.8%
Perplexity	2	2.2%	89	97.8%
ChatPDF	2	2.2%	89	97.8%
Others	3	3.3%	88	96.7%

Table 2 presents the utilization of nine Artificial Intelligence (AI) educational tools by science major students. Among the tools, three were predominantly used: Quillbot (52.7%), ChatGPT (51.6%), and Grammarly (36.3%). These findings indicate that students primarily rely on paraphrasing, conversational AI, and grammar-checking applications to support various academic tasks, including writing, editing, and problem-solving.

The results are consistent with Austria et al. (2022), who reported that AI tools such as Grammarly, Quillbot, and ChatGPT rank among the most frequently used by students for academic purposes. Similarly, Wulandari et al. (2024) found that learners depend on these applications for their ability to provide immediate feedback, generate corrections, and support writing development. Raheem et al. (2023) further emphasized that AI-powered tools enhance efficiency, accuracy, and overall quality of academic outputs, making them valuable assets in educational contexts.

These findings suggest that science major students are increasingly integrating AI tools into their learning processes, leveraging technology to improve productivity and learning outcomes. The preference for Quillbot, ChatGPT, and Grammarly also reflects students' inclination toward tools that directly assist in text generation, refinement, and comprehension, highlighting the practical utility of AI in meeting academic demands.

Overall, the widespread use of these AI tools underscores the importance of structured guidance and pedagogical integration. By providing students with strategies for effective and responsible use, educators can maximize the potential of AI to enhance academic performance, promote self-directed learning, and foster digital literacy skills. These results also highlight opportunities for future research to examine how specific AI tools impact learning outcomes across different disciplines and skill levels.

Table 3 indicates that the overall level of utilization of AI educational tools among both male and female students was classified as occasional, suggesting that while most students engage with these technologies, their use is not yet consistent or fully integrated into daily academic practices.

Table 3. Level of Utilization of Science Majors

		n	Mean	Std. Deviation	Description
Sex	Male	26	2.92	0.44	Occasional
	Female	65	2.74	0.58	Occasional
Year Level	First	22	2.70	0.55	Occasional
	Second	25	2.74	0.60	Occasional

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	Third	19	2.95	0.45	Occasional
	Fourth	25	2.80	0.55	Occasional
Socio-Economic Class	Poor	77	2.80		Occasional
	Low-income class	13	2.73	0.54	Occasional
	Lower middle-income class	1	2.70	0.60	Occasional

Scale and Interpretation: 3.26-4.00 = Always; 2.51-3.25 = Occasional; 1.76-2.50= Rarely; 1.00-1.75 = Never

Male students reported a mean utilization score of 2.92 (SD = 0.44), while female students reported a slightly lower mean of 2.74 (SD = 0.58), indicating that both genders engaged with AI educational tools at an occasional level. When analyzed by year level, all groups similarly demonstrated occasional use: first-year students (M = 2.70, SD = 0.55), second-year (M = 2.74, SD = 0.60), third-year (M = 2.95, SD = 0.45), and fourth-year (M = 2.80, SD = 0.55). Regarding socio-economic status, students from poor (M = 2.80, SD = 0.54), lowincome (M = 2.73, SD = 0.60), and lower-middle-income (M = 2.70) households also reported occasional use.

These results indicate that the frequency of AI tool utilization is relatively uniform across demographic categories, suggesting that sex, year level, and socio-economic background do not strongly influence how often students engage with AI technologies. This finding aligns with Garrel and Mayer (2023), who reported that nearly half of the surveyed students (47.8%) used AI-based tools occasionally, reflecting a broader trend of moderate and non-intensive reliance on AI for academic purposes.

The consistency across demographic groups suggests that while students are generally aware of and capable of using AI tools, the integration into routine academic practice remains limited. Factors such as familiarity, accessibility, perceived usefulness, and guidance from instructors may influence the occasional rather than frequent use. These findings underscore the importance of structured instructional strategies and pedagogical support to promote more consistent and effective engagement with AI educational tools, maximizing their potential to enhance learning outcomes.

Table 4 presents the analysis of how the use of AI educational tools affects the academic performance of science major students. It includes results for the entire sample as well as for subgroups categorized by sex, year level, and socio-economic status, highlighting potential variations in the effectiveness of AI tool utilization across demographic factors. The data provide insights into both the general and context-specific impact of AI integration on student learning outcomes.

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Table 4. *The Impact of Artificial Intelligence (AI) Educational tools on the academic performance of science major students when taken as a whole and grouped according to sex, year level, and socio-economic status*

		n	Mean	Std. Deviation	Description
Entire Group		91	3.3	0.49	Moderate Impact
Sex	Male	26	3.32	0.53	Moderate Impact
	Female	65	3.30	0.54	Moderate Impact
Year Level	First	22	3.20	0.64	Moderate Impact
	Second	25	3.12	0.56	Moderate Impact
	Third	19	3.58	0.51	High Impact
	Fourth	25	3.36	0.31	Moderate Impact
Socio-Economic Class	Poor	77	3.31	0.53	Moderate Impact
	Low-income class	13	3.24	0.58	Moderate Impact
	Lower middle-income class	1	3.55		High Impact

Scale and Interpretation: 4.21-5.00 = Very high impact; 3.41-4.20 = High impact; 2.61-3.40 = Moderate impact; 1.81-2.60 = Low impact; 1.00-1.80 = Very low impact

Table 4 indicates that the use of AI educational tools had a moderate impact on the academic performance of science major students, with an overall mean of 3.33 (SD = 0.49). When analyzed by sex, both male (M = 3.32, SD = 0.53) and female (M = 3.30, SD = 0.54) students experienced a similar moderate effect, suggesting that gender did not significantly influence the perceived benefits of AI tools.

By year level, first-year (M = 3.20, SD = 0.64), second-year (M = 3.12, SD = 0.56), and fourth-year (M = 3.36, SD = 0.31) students also reported moderate impacts. Notably, third-year students reported a higher impact (M = 3.58, SD = 0.51), indicating that at this stage, AI tools may have been more effectively applied to support academic tasks, possibly due to more advanced coursework requiring analytical and integrative skills.

Regarding socio-economic status, students from poor (M = 3.31, SD = 0.53) and low-income (M = 3.24, SD = 0.58) backgrounds experienced moderate benefits, while the lower-middle-income group reported a slightly higher impact (M = 3.55). This pattern suggests that although AI tools generally support learning across all groups, students with better access to resources may derive slightly greater academic advantages.

These findings align with Xu and Ouyang (2022), who reported that AI tools enhance student engagement and understanding of complex concepts but typically produce moderate improvements in grades and test performance. The results highlight the potential of AI to support learning while also

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emphasizing the importance of structured integration, guided usage, and targeted instructional strategies to maximize its impact on academic outcomes across diverse student populations.

Table 5 presents the test of significance examining the relationship between the use of AI educational tools and the academic performance of science major students, highlighting whether the frequency and manner of AI tool utilization are associated with measurable differences in academic outcomes.

Table 5. *A significant relationship between Artificial Intelligence (AI) Educational tools and Academic performance of science major when grouped according to sex, year level, and socioeconomic status.*

Categories	Correlation	n	Spearman's Rho	Sig. (2-tailed) (p-value)
Sex	AI Educational Tools	26	-0.13	0.54
Male Female	* Academic	65	0.12	0.35
Year level First Year Second Performance				
Year Third Year Fourth		21	0.11	0.64 0.32
Year		25	-0.21 0.11	0.65 0.93
Socio-economic status Poor		20	-0.02	0.75
Low-income class		25	-0.04	0.74
		76	-0.10	
		13		

**Sig at 0.05 alpha level*

Analysis of Table 5 shows that for sex, male students obtained a p-value of 0.54 and female students 0.35, both exceeding the 0.05 significance level. When grouped by year level, first-year students had a p-value of 0.64, second-year 0.316, third-year 0.65, and fourth-year 0.93, all above 0.05. Similarly, regarding socio-economic status, the poor-income group had a p-value of 0.75 and the low-income group 0.74, again exceeding the threshold.

These results indicate that there is no statistically significant relationship between the utilization of AI educational tools and the academic performance of science major students when classified by sex, year level, or socio-economic background. Consequently, the null hypothesis is accepted.

This finding is consistent with Bancoro (2024), who also reported no significant correlation between AI usage and student academic performance. However, it is important to note that a nonsignificant result does not imply the absence of any relationship. Rather, it suggests that the observed association was not strong enough to reach statistical significance and may be influenced by random variation or other intervening factors, such as the quality of tool usage, instructional integration, or study habits, which were beyond the scope of this study.

These findings highlight the need for structured integration, guided usage, and pedagogical strategies to maximize the potential of AI tools in enhancing learning outcomes, rather than relying solely on their availability.

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6. Implications of the Results

The findings of this study carry several important implications for science education and institutional practice. First, although a large majority of students (94.8%) reported using Artificial Intelligence (AI) educational tools, their engagement was generally **occasional**, indicating a gap between access and meaningful utilization. While students recognize the potential of AI resources such as Quillbot, ChatGPT, and Grammarly, these tools are not yet fully integrated into their learning routines. Institutions should therefore implement structured interventions, including guided workshops, classroom demonstrations, and embedded curricular activities, to foster consistent and purposeful engagement with AI.

Second, the moderate impact of AI tools on academic performance highlights both opportunities and limitations. Students benefit from AI-assisted writing, editing, and problem solving; however, these tools alone do not significantly enhance overall academic achievement. This underscores the need for pedagogical alignment and teacher guidance, ensuring AI is used to support higher-order thinking, problem-solving, and meaningful learning rather than as a standalone solution.

Third, the absence of a significant relationship between AI use and academic performance across sex, year level, and socio-economic status suggests equitable access among students. Educators and policymakers can leverage this equity to design inclusive programs that encourage all learners to use AI in ways that genuinely enhance comprehension and critical thinking.

Finally, the findings emphasize the importance of ethical and responsible AI use. Institutions should promote awareness of potential risks, such as over-reliance, academic dishonesty, or diminished critical thinking, and provide clear guidelines aligned with global digital literacy and ethical standards. This approach ensures that students can maximize the benefits of AI while maintaining academic integrity and developing lifelong learning skills.

7. Conclusion

The study found that science major students at NISU Ajuy Campus actively use Artificial Intelligence (AI) educational tools, with Quillbot, ChatGPT, and Grammarly being the most frequently utilized. Students employed these tools for various academic activities, including writing, editing, problem-solving, and research tasks. Despite widespread usage, the level of engagement was occasional, regardless of sex, year level, or socio-economic status, suggesting a need for better integration and promotion of AI tools to foster more consistent and effective use.

The impact of AI educational tools on academic performance was moderate, indicating that while these tools are beneficial, they are not yet fully optimized or sufficiently embedded in students' learning processes. This moderate effect across demographic variables suggests that AI tools alone are not a primary determinant of academic achievement but can serve as valuable supplementary resources when integrated with guided instruction and pedagogical strategies. The findings highlight the importance of structured training and workshops to enhance students' understanding of AI tools and their practical applications in science education. Teachers should provide clear guidelines for ethical and responsible use, encouraging collaboration, problemsolving, and critical thinking. Incorporating AI educational tools into the curriculum can equip students with essential skills in technology, data analysis, and academic research. Future research is recommended to explore additional factors or conditions under which AI tools can further enhance academic performance, as well as strategies to maximize their educational potential for science major students.

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