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Abstract

Studying students' use of AI chatbots for academic writing can lead to improved teaching strategies and enhance digital literacy in the classroom. In this context, the study examined the level of student skills in Using AI chatbots for academic writing, including AI literacy, information processing, and referencing and attribution skills, in one of the public secondary schools in a large-sized division during the school year 2025-2026 as the basis for a proposed lesson enhancement plan. Data for this descriptive study were collected from 104 students using a self-developed data collection instrument that has passed stringent validity and reliability tests. Initial analysis of the demographic profile revealed an almost equal distribution by sex, with a slight female majority; generally higher parental educational attainment; nearly equal representation from lower- and higher-income households; and mostly small family sizes. The analysis of student skills showed a moderate level of competence in Using AI chatbots, with females generally performing slightly higher than males in AI literacy and information processing. Students demonstrated strengths in organizing ideas and identifying gaps in their work, but weaknesses in editing drafts, comparing information, and formatting citations. A significant difference in information-processing skills was observed across groups based on the number of siblings. The results of this study highlight the need for structured instructional guidance, explicit lessons on citation and referencing, and activities that foster critical evaluation and synthesis of AI-generated content. Based on these findings, recommendations include guided writing revisions, analytical tasks comparing AI and non-AI sources, citation instruction, and continuous monitoring to promote responsible and effective use of AI chatbots.

Keywords: *AI chatbots, academic writing, student skills*

Bio-profiles

Gerryl Mae A. Ferrer earned her Bachelor of Arts major in English (Cum Laude) from Bago City College. She is currently serving as a Teacher under the Department of Education (DepEd), where she teaches English. Her professional experience in language education has driven her to pursue research, particularly in the integration of Artificial Intelligence (AI) in teaching and learning. This has led her to focus on examining student's skill in using AI chatbots for academic writing.

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Introduction

Rationale

In the Philippines, the Department of Education has emphasized the importance of digital literacy and the responsible use of emerging technologies in secondary schools, where AI-powered chatbots such as conversational agents and writing assistants are increasingly used to help students generate ideas, organize information, and refine drafts. These features are designed to improve student performance and boost productivity while providing necessary scaffolding to complete higher-order writing tasks, contributing to SDG 4: Quality education by supporting equitable access to technology and promoting lifelong learning opportunities, and SDG 9: Industry, innovation, and infrastructure, as the implementation of new technology into the classroom context strengthens educational infrastructure and promotes the development of a creative and tech-savvy generation of students. The student's reliance on the AI chatbot to boost confidence and productivity is, of course, tempered by the crucial realization that his writing ability is solely determined by individual skill (Kasneci et al., 2023; Stokel-Walker & Van Noorden, 2023).

Correspondingly, Asio (2024) and Kasneci et al. (2023) stated that AI literacy is the capacity to assist students in organizing their work, properly structuring content, and making informed decisions while simultaneously preventing the technology from taking the place of critical thinking processes. Coherent written texts require the ability to comprehend information in reference to other sources, and students still find it difficult to apply higher-order thinking skills like comparison without the assistance of an AI chatbot (Kasneci et al., 2023). Additionally, students still struggle with correctly formatting sources despite being required to provide references and cites in order to comply with academic integrity requirements and prevent plagiarism (Perkins et al., 2023). Numerous studies have looked into how AI chatbots might help students with academic writing assignments. According to a study by Urza et al. (2025), AI can be helpful for phrase correction and information organization, but not for comprehensive revision or draft verification. According to Perkins et al. (2023), students are at a high risk of citation and authorship errors even when AI can create bibliographies, despite the fact that AI technologies have been demonstrated to support rational information organization, they do not support higher-level skills like comparing and evaluating different sources.

While previous studies have focused on the application of AI in academic writing by university students, little is known about how secondary learners acquire AI literacy, information processing skills, and reference-related skills. Previous research has concentrated on the use of AI in academic writing by university students. Furthermore, secondary students still rely on their teachers for writing abilities even if they frequently use AI chatbots to increase their confidence and productivity. This distinction is important in and of itself. In order to protect instructors' and students' mental health, the discovery has also led researchers to address work-related stress.

Literature Review

Artificial intelligence (AI) chatbots are becoming more beneficial in education because of their capacity to deliver personalized learning experiences and real-time feedback. While Labadze et al. (2023) found that chatbots improve learning efficiency and response time, Gökçearslan et al. (2024) demonstrated that they decrease students' cognitive burden and increase engagement. As to Xu et al. (2023) showed increased student motivation and retention, whereas Guo et al. (2022) highlighted their significance in enabling tailored and flexible learning. Furthermore, Caldarini et al. (2022) noted that AI chatbots help to address gaps in distant learning, particularly in educational settings during a pandemic.

Additional study supports the broader benefits of AI chatbots in the classroom in terms of increasing engagement and learning outcomes. While Ngai et al. (2021) examined their effectiveness in both education and service structures, Loncar et al. (2021) confirmed increased student involvement and comprehension in interactive learning settings. According to Mulyano et al. (2022), using chatbots improves students' understanding and system usability, resulting in more effective learning procedures. The importance of AI chatbots in intelligent tutoring systems and individualized learning was also highlighted by Sharma and Kaur (2020).

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Theoretical frameworks emphasize AI technologies' shortcomings while also explaining how they contribute in learning processes. Although Kuhlthau (2020) noted that higher-order abilities such as comparison and judgment necessitate explicit instruction, he also stated that digital technologies enhance retrieval processes and aid in information organization. In a similar vein, UNESCO (2023) noted that while AI technologies facilitate information organization across socioeconomic classes, automation of synthesis and critical review is still challenging. According to Holmes et al. (2022), social learning environments have an impact on organizing and planning abilities, highlighting the significance of human contact in education.

Furthermore, the research also provides persuasive evidence that AI chatbots are useful and effective in academic writing and language development. Gkearslan et al. (2024), Labadze et al. (2023), Xu and Wang (2020), Kim and Gilman (2019), Guo et al. (2022), and Caldarini et al. (2022) all reported improvements in grammar accuracy, writing fluency, confidence, academic literacy, and learning efficiency. These findings show that AI chatbots are effective tools for promoting student writing improvement and engagement in both traditional and online learning environments.

There are studies which have found that AI chatbots have a damaging impact on pupils' higher-order writing skills. Several studies (Urzúa et al., 2025; Son et al., 2025; Kasneci et al., 2023; Perkins et al., 2023) indicated that students struggled with citation formatting, source comparison, and critical assessment, needing teacher intervention. While according to several authors, Zawacki-Richter et al. (2020), Tang and Zhang (2022), and Selwyn (2022) found comparatively minor demographic disparities in AI adoption, they also noted that AI literacy develops across populations. As to Eaton (2023) and Holmes et al. (2022), intervention is still required for advanced abilities including referencing, editing, and analytical writing.

Correspondingly, in the Philippines by Santos and Cruz (2021), Garcia et al. (2022), Mendoza and Reyes (2023), and Villanueva et al. (2024) showed that there are improvements in vocabulary, grammar, understanding, and feedback response. Similar developments in writing performance, motivation, and individualized learning were distinguished by Dela Cruz et al. (2021), Ramos and Bautista (2022), Flores et al. (2023), Navarro and Lim (2024), and Cruz and Santos (2023). More recent research by several authors like Lopez and Santiago (2020), Torres and Aquino (2021), Bautista and Ramos (2022), Cruz and Villanueva (2023), and Marquez and Soriano (2025) confirmed advancements in vocabulary growth, teamwork, sentence form, and writing confidence.

While AI chatbots have been demonstrated to improve students' performance on procedural tasks like grammar correction, sentence fluency, and idea organization, they are still unable to support higher-order thinking skills like comparison, evaluation, and synthesis, which require more in-depth cognitive engagement than automated outputs. Because students frequently rely on AI-generated bibliographies that contain formatting problems or fake references, there are ongoing issues with referencing and attribution. In the Philippine setting, deficiencies in inference, revision, and critical literacy persist despite increases in grammar, vocabulary, and involvement. These trends show that a three-pronged evaluation, AI literacy, information processing, and referencing/attribution is necessary to identify the advantages and disadvantages of secondary students' usage of AI chatbots in academic writing.

Theoretical Underpinnings

The study is anchored to Mayer's Cognitive Theory of Multimedia Learning (2005). It explains that systematic processing of information through both verbal and visual channels improves learning by lowering cognitive overload. In this concept, AI literacy serves as scaffolding through the segmentation principle: students receive structured instruction from AI chatbots while breaking down difficult writing assignments into simple phases, such as organizing, planning, and rewriting. By keeping pupils from being overloaded with information, this segmentation lessens cognitive load and frees them up to concentrate on higher-order abilities. As interactive multimedia tools, chatbots adhere to Mayer's coherence and redundancy criteria by offering comments and ideas in a regulated, dialogue-based manner. In this sense, AI literacy serves as a scaffold that directs students toward autonomous, ethical, and critical academic writing in addition to supporting the development of technological skills.

This theory is closely related to the current study on using AI chatbots to improve secondary students' academic writing skills. Students are guided through the writing process by AI chatbots, which serve as

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adaptable multimedia tools that combine structured feedback with written suggestions. Students will receive writing assistance in a controlled, structured manner through the chatbot's interactive, dialogue-based system, which aligns with Mayer's theory of guided cognitive processing.

Objectives

This study aimed to determine students' level of skill in using Artificial Intelligence (AI) chatbots for academic writing at one of the public secondary schools in a large division during the school year 2025-2026, as a basis for a lesson enhancement plan. Specifically, this study sought to determine: 1) the profile of the respondents in terms of sex, parents' highest educational attainment, parents' average family monthly income, and number of siblings; 2) the level of students' skills in using Artificial Intelligence (AI) chatbots for academic writing according to AI literacy, information processing skills, and referencing and attribution skills; and 3) if a significant difference exists in students' skills in using Artificial Intelligence (AI) chatbots for academic writing when grouped and compared according to the aforementioned variables.

Methodology

This chapter discusses the research design, locale of the study, respondents, data gathering instrument, validity and reliability, data gathering procedure, analytical schemes, and statistical tools.

Research Design

The study utilized a descriptive research design to determine students' capability to use AI chatbots for academic writing in a public secondary school in a large division for the school year 2025-2026, and to serve as a basis for an improvement plan in teaching. A descriptive research design is a method for systematically observing and describing the characteristics of a population or a phenomenon without manipulating variables. This design aims to describe the characteristics of a population or phenomenon under study without modifying or intervening in the environment (Flick, 2020). Hence, a descriptive design was used in this research because the researcher considered it the most suitable design in determining the effect of students' skills in using Artificial Intelligence (AI) chatbots for academic writing. This design was suited to studies that aimed to describe, explain, and validate findings to achieve high-quality data.

Respondents of the Study

The respondents in the study were 104 secondary learners from a total population of 142. Since the number of respondents is quite large to handle, probability sampling techniques, using stratified sampling and random sampling techniques, were used, and the Cochran formula was used to find the sample size. To get the percentage, the respondents were divided by the total number of respondents and multiplied by the sample size. The lottery method was applied inside each stratum: eligible students' names were added to a pool, and responders were chosen at random until the necessary sample size was attained. This procedure ensured that all students had an equal chance of being chosen while keeping demographic groups balanced.

Data Gathering Instrument

This study utilized a researcher-developed questionnaire divided into two parts: Part 1 gathered respondents' profile data such as sex, parents' educational attainment, parents' average monthly income, and number of siblings, while Part 2 measured AI literacy, information processing skills, and referencing and attribution skills using 30 items (10 per domain). Responses were rated using a five-point Likert scale ranging from 5 (always) to 1 (almost never). To ensure validity, the instrument underwent face and content validation by three experts in educational leadership, ICT integration, and research. Using the criteria of Carter V. Good and Douglas V. Scates, the instrument obtained a mean rating of 4.89, interpreted as "excellent," confirming its validity.

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For reliability, the instrument was subjected to a dry run involving 30 secondary learners who were not part of the actual study. Internal consistency was measured using Cronbach's Alpha, which is appropriate for multi-item scales assessing attitudes and skills. The accepted threshold for reliability was set at 0.70 and above. The computed Cronbach's Alpha value was 0.950, interpreted as "excellent," indicating a very high level of internal consistency. This result confirms that the instrument is reliable and suitable for data collection in the study.

Data Gathering Procedure

After confirming the validity and reliability of the research instruments, the questionnaire was reproduced. Permission to conduct the survey and administer the questionnaire to the participants was obtained from the School Heads and the Schools Division Superintendent (SDS) through the Public Schools District Supervisor (PSDS).

The instruments were distributed in person while following safety guidelines. The researcher provided clear instructions and explained the study's objectives, as well as the terms and items in the instruments, to ensure that respondents fully understood their tasks in answering the questions. The completed research questionnaires were also collected in person, maintaining strict compliance with safety protocols.

The data gathered from respondents' answers were collated and organized using appropriate statistical tools. The raw data were transformed into numerical codes based on a coding manual, facilitating computer processing, statistical analyses, and tabular presentations. The Statistical Package for the Social Sciences (SPSS) was used to process the encoded data.

Ethical Considerations

To assure ethical behavior, the study followed the principles of beneficence, justice, and respect for others. All replies were handled as anonymous data used only for academic reasons, and no personally identifying information was gathered in accordance with the Data Privacy Act of 2012. Parental agreement was obtained through comprehensive documents outlining the study's objectives, methods, voluntary participation, and the right to withdraw at any moment without penalty, given the respondents were minors. This protected the participants' autonomy as well as their guardians' rights.

Strict adherence to confidentiality was maintained, and data was safely stored and shielded from unwanted access. To ensure adherence to educational governance procedures, institutional and division-level clearances were acquired from the School Heads, Public Schools District Supervisor (PSDS), and Schools Division Superintendent (SDS). The study focused on strengthening participant protection in addition to procedural safeguards: assurance of voluntary involvement, reinforcement of withdrawal options, and clear explanation of risks and benefits reduced potential harm. Together, these actions preserved the integrity of the research process and complied with national and international ethical guidelines for educational research.

Analytical and Statistical Schemes

Objective No. 1 used a descriptive-analytical approach and frequency count and percentages to determine the profile of respondents by sex, parents' highest educational attainment, parents' average monthly family income, and number of siblings. Objective No. 2 used a descriptive-analytical scheme and mean to determine the level of Students' skills in using Artificial Intelligence (AI) chatbots for academic writing across the following areas: AI literacy, information processing skills, and referencing and attribution skills. Objective No. 3 used a comparative-analytical scheme and Mann-Whitney U Test to determine if a significant difference exists in students' skills in using Artificial Intelligence (AI) chatbots for academic writing, grouping and comparing according to the aforementioned variables.

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Results and Discussion

This section summarizes the study's findings, which come from careful data gathering, in-depth analysis, and thoughtful interpretation. After this, meaningful conclusions were drawn from the initial phase, offering valuable insights

Profile of the Respondents in Terms of Variables Sex, Parents' Highest Educational Attainment, Parents' Average Family Monthly Income, and Number of Siblings

Table 1
Profile of the Respondents

Variables	Categories	Frequency	Percentage
	Male	49	47.1
	Female	55	52.9
		104	
Parents' Highest Educational Attainment	Lower (Elementary level – High School level)	39	37.5
	Higher (High School Graduate – College Graduate)	65	62.5
		104	
Parents' Average Family Monthly Income	Lower (10,000 and below)	51	49.0
	Higher (Above 10,000)	53	51.0
		104	
Number of Siblings	Few (below 5 siblings)	59	56.7
	Many (5 siblings and above)	45	43.3
	Total	**104**	**100.0**

Regarding the respondents' demographics, there is an almost equal distribution: 52.9% female and 47.1% male, indicating fair representation of learners. As for their parents' highest level of education, more respondents, 62.5%, hail from homes where their parents attained higher levels of education than the rest, 37.5%, whose parents have at least attained elementary to high school levels. Hence, most learners may have a supportive home environment to help them when they have problems related to their academic needs. The distribution is quite similar across household income levels: 49% have less than P10,000 per month, and 51% have more than P10,000 per month, suggesting diverse socio-economic backgrounds among the students.

Among the respondents, more than half, or 56.7%, are part of families with fewer than 5 siblings, while 43.3% have 5 or more; thus, a remarkable portion are part of larger households, suggesting that technology may not be widely accessible. The profile implies diverse learners who can be generalized as students who benefit from AI chatbot skills across various demographic groups. Overall, the profile represents a diverse group of learners; however, the general trend indicates female, educated parents, higher-income households, and smaller family sizes, which generally denote a good context for learning and technology use.

Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing when grouped according to AI Literacy, Information Processing Skills, and Referencing and Attribution Skills

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Table 2
Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing when grouped according to AI Literacy

Items	Mean	Interpretation
Through AI Chatbots, I...		
1. can plan and organize my writing.	3.44	Moderate Level
2. find and choose good information for my topic.	3.39	Moderate Level
3. can use correct grammar, spelling, and punctuation.	3.38	Moderate Level
4. can make my writing more formal and academic.	3.49	Moderate Level
5. can improve my word choice and sentence structure.	3.39	Moderate Level
6. can write clear and easy-to-read sentences.	3.56	High Level
7. find reliable information for my topic.	3.41	Moderate Level
8. can summarize information in my own words.	3.30	Moderate Level
9. can edit and improve my drafts.	3.24	Moderate Level
10. can manage my time better when writing.	3.61	High Level
Overall Mean	**3.42**	**Moderate Level**

Table 2 shows the level of students' skills in using artificial intelligence (AI) chatbots for academic writing, grouped by AI literacy, with an overall mean score of 3.42, indicating a moderate level.

The highest mean score is recorded for item 10, which states that students can manage their time better when writing, with a mean score of 3.61, interpreted as high level. This suggests that students find AI chatbots helpful in speeding up the writing process and organizing their workflow more efficiently. On the other hand, the lowest mean score is for item 9, which states that students can edit and improve their drafts, with a mean score of 3.24, interpreted as moderate level.

This disparity shows that although AI technologies increase productivity, they cannot completely replace critical analysis in writing. The limits of AI in taking subtle parts of academic writing are reflected in students' apparent reliance on teacher input or their own judgment for modifications. According to the research, instructional scaffolding should prioritize editing and revision techniques so that students evaluate AI outputs critically rather than taking them at face value. This is consistent with more general worries about relying too much on automated recommendations, when efficiency gains run the risk of overshadowing the growth of independent writing proficiency. The minimum score indicates that students use their own or their teacher's feedback when revising drafts, as reported by Urza et al. (2025) and Jin et al. (2025).

Table 3
Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing when grouped according to Information Processing Skills

Items	Mean	Interpretation
Through AI Chatbots, I…		
1. find ideas that match my writing topic.	3.69	High Level
2. summarize information shortly and clearly.	3.50	High Level
3. organize information to fit my outline.	3.50	High Level
4. can choose the most important points for my paper.	3.59	High Level
5. can identify gaps or missing points in my work.	3.63	High Level
6. can create well-structured paragraphs for my paper.	3.41	Moderate Level
7. arrange my ideas in a logical order.	3.79	High Level
8. improve my arguments using clear evidence.	3.37	High Level
9. see what is missing in my work.	3.58	High Level
10. can compare different information.	3.29	Moderate Level
Overall Mean	**3.53**	**High Level**

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Table 3 shows the level of students' skills in using AI chatbots for academic writing, separated by information processing skills, with an overall mean score of 3.53, meaning, as it shows, a high level.

The highest mean score is in Item 7, which measures "Students can sequence the ideas," and this item also shows a high-level score. The lowest mean score is found in Item 10, which measures "Students can compare information," and it is rated moderate. This implies that although AI helps students organize and clarify concepts, they continue to rely on automated outputs rather than doing more in-depth analytical work. The results highlight the need for instructional support that teaches students to self-reliantly cross-check, contrast, and integrate information since higher-order skills like comparison and synthesis demand critical decision beyond what AI normally delivers. AI essentially promotes productivity and order, but in the absence of supervised practice, learners run the risk of receiving shallow processing skills rather than strong analytical abilities. The mean score supports the study by Kasneci et al. (2023), which found that higher-order skills, such as comparing sources and evaluating contrary evidence, are areas where students struggle because they require much deeper cognitive engagement than a typical AI answer can provide.

Table 4
Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing when grouped according to Referencing and Attribution Skills

Items	Mean	Interpretation
Through AI Chatbots, I…		
1. learn how to give credit or cite authors correctly	3.56	High Level
2. follow and get the correct format for citations	3.09	Moderate level
3. make a proper list of sources or reference list	3.24	Moderate Level
4. can determine ways to avoid plagiarism	3.33	Moderate Level
5. find where the information initially came from.	3.34	Moderate Level
6. put quotes or quotations the right way.	3.47	Moderate Level
7. understand how to use my words and the author's words.	3.46	Moderate Level
8. use the correct style for in-text citations.	3.53	High Level
9. check if all sources are listed.	3.59	High Level
10. follow the rules of referencing or citing sources	3.37	Moderate Level
Overall Mean	**3.40**	**Moderate Level**

Table 4 shows the level of students' skills in using AI chatbots for academic writing, grouped by referencing and attribution skills, with an overall mean score of 3.40, indicating a moderate level. This indicates that while students have some understanding of citation and academic integrity, their referencing skills still need improvement.

The highest mean score is for item 9, indicating that students check whether all sources are listed, with a mean score of 3.59, interpreted as a high level. In contrast, the lowest mean score is for item 2, which refers to following and using the correct citation format, with a mean score of 3.09, interpreted as moderate level.

This disparity implies that although students are skillful at spotting references, they lack the procedural understanding necessary to guarantee precise citation style and formatting. Over-reliance on AI-generated bibliographies, which often yield credible but mistaken or "hallucinated" items, can account for the disparity. Students could rely on these results without checking them against accepted guidelines like APA 7th edition, which could result in formatting and attribution mistakes.

This finding is supported by Perkins et al. (2023), who reported that while AI tools assist students in recognizing citation requirements and checking reference completeness, learners often struggle with correct citation formatting and adherence to citation style. The study emphasized that AI-generated references still require human verification to ensure accuracy and adherence to academic standards.

Comparative Analysis in the Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing when grouped according to AI Literacy, Information Processing Skills, and

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Referencing and Attribution Skills when grouped according to Sex, Parents' Highest Educational Attainment, Parents' Average Family Monthly Income, and Number of Siblings

Table 5
Difference in the Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing according to AI Literacy and when grouped according to Number of Sex, Parents' Highest Educational Attainment, Parents' Average Monthly Income, and Number of Siblings

Variable	Category	N	Mean Rank	Mann-Whitney U	*p*-value	*Sig. level*	Interpretation
Sex	Male	49	48.45	1149.0	0.195		Not Significant
	Female	55	56.11				
Parents' Highest Educational Attainment	Lower	39	56.56	1109.0	0.286		Not Significant
	Higher	65	50.06				
Parents' Average Family Monthly Income	Lower	51	51.03	1276.5	0.625	0.05	Not Significant
	Higher	53	53.92				
Number of Siblings	below 5 siblings	59	50.13	1187.5	0.358		Not significant
	5 siblings and above	45	55.61				

Table 5 presents differences in the level of students' skills in using AI chatbots for academic writing, by AI Literacy, sex, parents' highest educational attainment, parents' average monthly income, and number of siblings.

For sex, males had a mean rank of 48.45, while females had a mean rank of 56.11, with a p-value of 0.195, interpreted as not significant. For parents' highest educational attainment, students from lower-education households had a mean rank of 56.56. In contrast, those from higher-education households had a mean rank of 50.06, with a p-value of 0.286 (not significant). For parents' average monthly income, the lower-income group had a mean rank of 51.03. In contrast, the higher-income group had a mean rank of 53.92 (p-value = 0.625), indicating that the difference is not significant.

For the number of siblings, students with fewer than 5 siblings had a mean rank of 50.13, while those with 5 or more siblings had a mean rank of 55.61 (p-value = 0.358; not significant).

Thus, the hypothesis is accepted, since the statistical results indicate no significant differences across sex, parental education, income, and family size.

This implies that no significant difference has shown and the lack of notable variation suggests that the availability of AI tools and standardized digital platforms may be leveling the playing field, enabling students from different backgrounds to learn comparable abilities. This result is significant because it shows that differences in AI literacy are not always correlated with differences in demographic characteristics. Rather, the findings highlight the widespread exposure to and use of AI among secondary students, supporting the notion that the availability of technology and instructional support influence skill development in this domain more than demographic traits.

The lack of significant differences supports Zhai et al. (2021), who concluded that AI literacy skills develop similarly across demographic groups due to widespread access to AI tools and standardized digital platforms.

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Table 6
Difference in the Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing according to Information Processing Skills, and when grouped according to Sex, Parents' Highest Educational Attainment, Parents' Average Monthly Income, and Number of Siblings

Variable	Category	N	Mean Rank	Mann-Whitney U	*p*-value	*Sig. level*	Interpretation
Sex	Male	49	48.86	1169.0	0.244		Not Significant
	Female	55	55.75				
Parents' Highest Educational Attainment	Lower	39	55.86	1136.5	0.378		Not Significant
	Higher	65	50.48				
Parents' Average Family Monthly Income	Lower	51	50.85	1276.5	0.584	0.05	Not significant
	Higher	53	54.08				
Number of Siblings	below 5 siblings	59	47.27	1019.0	0.043		Significant
	5 siblings and above	45	59.36				

Table 6 shows differences in students' information-processing skills by sex, parents' highest educational attainment, parents' average monthly income, and number of siblings.

For sex, males had a mean rank of 48.86, while females had a mean rank of 55.75, with a p-value of 0.244, interpreted as not significant. This indicates that both groups process information similarly when using AI chatbots.

For parents' highest educational attainment, the lower-education group had a mean rank of 55.86. In contrast, the higher-education group had a mean rank of 50.48, with a p-value of 0.378 (not significant). For parents' average monthly income, the lower-income group had a mean rank of 50.85, while the higher-income group had a mean rank of 54.08 (p-value = 0.584), indicating no significant difference. However, for the number of siblings, students with fewer than five siblings had a mean rank of 47.27, while those with five or more siblings had a mean rank of 59.36 (p-value = 0.043; interpreted as significant). Thus, the hypothesis is rejected based on the number of siblings, as it showed a significant difference, whereas sex, parental education, and income did not.

Overall, only the number of siblings shows a significant difference, whereas the other variables do not affect information processing skills.

This implies that family size has a significant impact on cognitive methods, perhaps as a result of learners in bigger households being more used to sharing resources, working together, and juggling conflicting demands. Stronger self-control and information management abilities may be fostered by such circumstances, leading to improved performance while utilizing AI systems. This explanation is consistent with more general research showing that students from larger households frequently acquire more effective coping strategies and organizing abilities.

This finding aligns with OECD (2022), which reported that students from larger households often develop stronger self-regulation and information management skills, potentially explaining the significant difference observed in information processing abilities.

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GEO Academic Journal Vol. 7 No. 3 – 2026 series

Table 7
Difference in the Level of Students' Skills in Using Artificial Intelligence (AI) Chatbots for Academic Writing according to Referencing and Attribution Skills, and when grouped according to Number of Sex, Parents' Highest Educational Attainment, Parents' Average Monthly Income, and Number of Siblings

Variable	Category	N	Mean Rank	Mann-Whitney U	*p*-value	*Sig. level*	Interpretation
Sex	Male	49	50.89	1268.5	0.606		Not Significant
	Female	55	53.94				
Parents' Highest Educational Attainment	Lower	39	56.82	1099.0	0.257		Not Significant
	Higher	65	49.91				
Parents' Average Family Monthly Income	Lower	51	51.00	1275.0	0.618	0.5	Not Significant
	Higher	53	53.94				
Number of Siblings	below 5 siblings	59	50.94	1235.5	0.545		Not Significant
	5 siblings and above	45	54.54				

Table 7 presents differences in students' referencing and attribution skills across sex, parents' highest educational attainment, parents' average monthly income, and number of siblings.

For sex, males had a mean rank of 50.89, while females had a mean rank of 53.94, with a p-value of 0.606, interpreted as not significant. This means that the skills referenced are similar for both groups.

For parents' highest educational attainment, the lower-education group had a mean rank of 56.82. In contrast, the higher-education group had a mean rank of 49.91, with a p-value of 0.257 (not significant). This suggests that parental education does not influence students' referencing abilities.

For parents' average monthly income, the lower-income group had a mean rank of 51.00. In contrast, the higher-income group had a mean rank of 53.94 (p-value = 0.618), indicating no significant difference.
For the number of siblings, students with fewer than 5 siblings had a mean rank of 50.94, while those with 5 or more siblings had a mean rank of 54.54 (p-value = 0.545; not significant).

All p-values are greater than 0.05, indicating no significant differences across all variables. The results show that referencing and attribution skills remain consistent across all demographic groups, indicating that regardless of sex, parental education, income, or family size students have the same experiences and applied skills in referencing and attribution . Thus, the hypothesis that there is no significant difference in students' skills in using AI chatbots for academic writing when grouped and compared according to the aforementioned variables is accepted, as the statistical results indicate no significant differences across sex, parental education, income, and family size.

The results align with Eaton and Turner (2020), who found that referencing and attribution skills are consistently moderate across demographic groups, suggesting that mastery depends on academic training rather than personal background variables.

Conclusion

The study found that respondents had a generally balanced demographic profile in terms of sex, parental education, income level, and family size, reflecting diverse backgrounds. Students demonstrated a moderate level of skill in using AI chatbots for academic writing and referencing, while their information

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processing skills were generally high. Female students slightly outperformed males, although both groups shared similar weaknesses in editing, information comparison, and citation formatting. Minimal differences were observed across most demographic variables, except for a significant difference in information processing skills when grouped by number of siblings. Overall, the findings indicate that students are at an emerging level of competence in AI chatbot use, where they can organize ideas effectively but still need guidance in higher-order thinking skills and accurate referencing, therefore, to strengthen higher-order thinking and academic integrity, a structured instructional approach is recommended, exemplified by a Model Lesson Framework such as a 40-minute "AI Citation Verification" activity where students generate AI-based bibliographies, collaboratively cross-check them against authentic sources, and correct formatting errors using APA guidelines, ensuring that AI tools serve as scaffolds for productivity while teachers guide learners toward critical evaluation, ethical referencing, and independent writing proficiency.

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Conflict of Interest

The authors declare the absence of any conflict of interest that could have influenced the content or conclusions of this paper. They affirm that no financial, personal, or professional relationships with other individuals or organizations have compromised the objectivity, integrity, or impartiality of the research work. As a final point, no external parties influenced the study design, data collection, analysis, or interpretation.

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