

Attitudes Towards an AI-Augmented Pedagogy in Enhancing English Academic Writing Proficiency: Empirical Evidence from Electrical Engineering Students

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ABSTRACT

This quantitative survey study investigates the perceptions of Electrical Engineering students toward the integration of Artificial Intelligence (AI)-augmented pedagogy in improving English academic writing proficiency. A total of 48 students majoring in electrical engineering at Bangka Belitung State Manufacturing Polytechnic participated in the study. Data were collected through close-ended questionnaires. The data were analyzed using SPSS 25, revealing strong internal consistency (Cronbach's $\alpha = 0.92$). The findings revealed that students' overall attitudes toward the integration of AI were strongly positive ($M = 79.69$, $SD = 11.07$), with all three attitudinal dimensions namely cognitive ($M = 40.33$, $SD = 5.18$), affective ($M = 20.37$, $SD = 2.97$), and behavioral ($M = 18.98$, $SD = 3.34$) which also falling within the positive category. These findings reflect the students' preparedness to engage in technology-supported language learning. Moreover, the study concludes that AI-augmented pedagogy holds significant potential to strengthen students' academic writing proficiency, particularly in technical and vocational education. Hence, it is recommended that AI tools be integrated into writing instruction while simultaneously fostering the students' critical digital literacy and sense of ethical awareness.



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A. INTRODUCTION

In recent years, the artificial intelligence has increasingly influenced language education, particularly by contributing to notable improvements in university-level teaching practices. AI exemplifies the convenience with which everyone could access information at anytime and anywhere (Butson & Spronken-Smith, 2024). Furthermore, AI-based personalized learning systems have been designed to adapt instructional materials to learners' individual requirements by applying advanced machine-learning techniques, thereby enhancing students' involvement and improving their learning outcomes (Adenubi & Samuel, 2024).

It has been noted that academic writing is recognized as a central component of research and education, as it involves a systematic and organized way of conveying ideas that is commonly engaged by researchers and educators in scholarly contexts to present data-driven arguments and logical reasoning (Khalifa & Albadawy, 2024). This formula of writing covers a broad range of genres, including research articles, essays, dissertations, theses, and book reviews (Tumiran, 2024). Moreover, (Niekerk et al., 2025) emphasize that academic writing skills function not only as a means of communicating knowledge and understanding within a particular discipline, but also as a framework for developing and presenting complex arguments and hypotheses.

Having good writing in an academic setting is an essential skill for college students across disciplines, since it helps them to build and share knowledge in their areas of study. In addition, it also allows students to systematically present their ideas, arguments, and research results in well-organized academic forms. As stated by Fortinasari & Malasari, (2025) that writing is made of micro skills namely as grammar, paragraphing, spelling, diction as well as punctuation.

Nevertheless, previous studies have reported that students at the university level, including both undergraduate and postgraduate learners, commonly encounter challenges in English academic writing (Nenotek et al., 2022). Budjalemba and Listyani (2020) argue that many students experience anxiety about their writing performance due to various factors, such as limited language proficiency, low motivation, and insufficient knowledge. Additionally, many students also struggle with learning the rules of English writing needed for academic purposes, which includes creating clear arguments and following the writing style specific to their field. In addition, Jezniy & Bapir (2021) highlight that students' difficulties in academic writing are often related to the use of articles, punctuation, prepositions, irregular verb forms, ineffective expressions, inconsistencies in parallel structure, and inappropriate use of verb tenses. This is supported by (Rehman et al., 2025) that when writing in English, students struggle with syntax formation, punctuation rules, vocabulary selection, and grammar usage. Additionally, learners find it difficult to develop and improve their writing skills due to a lack of practice, which can reduce their confidence if not addressed. These barriers can negatively impact the quality of students' writing and reduce their confidence in their writing skills (Sandi et al., 2025).

The emergence of AI-assisted writing tools offers new possibilities for addressing these challenges. These technology developments assist students in overcoming the most difficult academic writing tasks, including creating, composing, and proofreading literature reviews (Nguyen et al., 2024). The incorporation of artificial intelligence-based language tools into academic essay writing reflects a transformative integration within the educational context, where technological innovation and pedagogical practices interact and reinforce one another (Boillos & Idoiaga, 2025). AI applications such as QuillBot, AI Writer, and Typeset support writers by rephrasing original texts through adjustments in sentence structure or lexical substitution using appropriate synonyms (Aljuaid, 2024). Moreover, these tools assist improve writing style and tone, making the content more logical and suited for academic settings (Eragamreddy, 2024). AI-driven writing assistants are reshaping not only how students produce written texts but also how educators conceptualize writing instruction, assessment, and feedback practices. However, the success of AI writing tools in improving students' writing content and organizational quality largely depends on how strategically they are integrated into instructional practices, emphasizing guided use rather than replacing authentic writing development (Garg, 2024).

Furthermore, within this rapidly changing educational environment, how students feel and think about AI-assisted writing tools greatly influences how well these technologies can support learning. As what (Gado et al., 2022) revealed that attitude is one of the significant predictors of students' willingness to utilize AI. There are three aspects of attitude in language: cognitive, affective, and behavioural (Orfan, 2020).

A growing body of research has examined the role of artificial intelligence in supporting students' academic writing. First, He (2024) reported that AI-supported features and feedback positively contributed to improvements in EFL learners' writing skills, writing motivation, enjoyment in writing activities, academic buoyancy, and overall writing achievement. Moreover, a study conducted by Afifah (2024) shows that the participants found that AI tools reliable for generating ideas, outlining, editing, and proofreading and improving writing quality. In addition, a study conducted by Nugroho & Trisusana, (2025) revealed that the integration of AI tools provided various benefits for students, including time efficiency, improved writing quality, and personalized learning experiences. Furthermore, Winarti et al., (2025) observed that students generally demonstrated positive attitudes toward the use of AI in writing, particularly because it accelerated the writing process and supported better text structure and organization in which they appreciate the practical benefits of AI, including grammar checking, organizing ideas, and generating helpful suggestions to enhance their writing quality.

Despite the growing body of research on AI-assisted writing, a significant theoretical gap remains in understanding how students' attitudes toward AI are conceptualized within a comprehensive and integrated framework. Existing studies have largely focused on the effectiveness and practical benefits of AI tools, such as improving writing quality, efficiency, and motivation, yet they tend to overlook the multidimensional nature of attitude, particularly the interaction between cognitive, affective, and behavioural components in shaping students' academic writing development. Furthermore, limited attention has been given to how these attitudinal dimensions relate to deeper learning constructs, including critical thinking, learner autonomy, and ethical awareness in AI-mediated writing contexts. As a result, the current literature lacks a coherent theoretical model that explains how AI integration not only enhances writing performance but also influences students' engagement and reflective learning processes within academic writing practices.

Building on these findings, the present study investigates the students' attitudes toward AI-assisted writing practices to develop English academic writing proficiency among Electrical Engineering students. Ultimately, the findings are expected to inform the design of evidence-based strategies for AI-augmented writing pedagogy that promotes both linguistic competence and critical digital literacy among future engineers. The study thus formulates its main research questions as follows:

RQ1: What are students' attitudes toward the integration of AI in academic writing, and how are these attitudes associated with their motivation and engagement in academic writing activities?

B. METHODS

To address the research question, this study this study adopted a quantitative survey design to investigate the relationship between the use of AI-assisted writing tools and the development of English academic writing proficiency among Electrical Engineering students at Polman Babel. Though this methodology, the researcher was able to explore in-the students' attitudes toward their enhancement of English academic writing proficiency by using AI.

1. Research design

This study employed a quantitative survey method to examine the electrical engineering students toward the integration of artificial intelligence in academic writing practices. The study was set up to gather information from different students within a specific timeframe, which is called cross-sectional. This approach was chosen so that the researchers could analyse how often students use AI, how they feel their writing has improved, and their attitudes toward AI-facilitated writing pedagogy.

2. Population and Sample/ Participants of the Study

The population in this study consisted of undergraduate students enrolled in the Electrical Engineering program at Politeknik Manufaktur Negeri Bangka Belitung (Polman Babel) during the 2024–2025 academic year. A purposive sampling method was used to identify participants who met specific inclusion criteria: (1) students who had employed at least one AI-assisted writing tool, such as ChatGPT, Grammarly, Quillbot, within the previous twelve months, and (2) students who had completed a minimum of two semesters of English language courses offered as part of their academic program. Based on these criteria, 48 students were finally selected to participate in the study.

3. Research Setting

This study was carried out at Bangka Belitung State Manufacturing Polytechnic (Polman Babel), a vocational higher education institution in Indonesia focusing on applied engineering, manufacturing, and technological innovation. The institution was selected as the research site because its Electrical Engineering program combines technical expertise with the development of language competencies, particularly English for academic and professional purposes.

4. Research Instrument

The data for this study were collected by using a structured and close-ended questionnaire designed to measure students' utilization of AI-assisted writing tools, their attitudes toward AI integration in writing instruction, and their self-reported proficiency in English academic writing. The instrument consisted of demographic information, including age, gender, and semester and students' attitudes toward AI-assisted writing. All items were measured using a five-point Likert scale ranging from strongly disagree (1), disagree (2), neutral (3), agree (4) to strongly agree (5).

5. Data Collection

The data for this study were collected through a quantitative survey administered to 48 undergraduate students enrolled in the Electrical Engineering Department at Bangka Belitung State Manufacturing Polytechnic (Polman Babel). The data collection process was carried out around four weeks, encompassing instrument validating, participant recruitment, and formal data gathering sessions. Questionnaires were distributed during scheduled class hours under the supervision of the researcher, ensuring standardization of instructions and reducing response bias.

6. Data Analysis

The collected data in this study were processed and analysed using IBM SPSS Statistics version 25 to ensure accuracy as well as consistency. Prior to analysis, data screening was performed to identify missing values, incomplete responses, and potential outliers. Reverse-coded items were properly recoded, and internal consistency for each construct was verified using Cronbach's alpha, yielding coefficients above 0.70, which indicated acceptable reliability. Including measures of central tendency and distribution such as mean, standard deviation, frequency, and percentage, were employed in order to summarize the students' attitudes toward AI-Augmented pedagogy in the context of English academic writing.

C. RESULT AND DISCUSSION

1. Results

The results of the data analysis are presented in this section. It begins with a description of the respondents' demographic characteristics, followed by an analysis of their attitudes toward AI-augmented pedagogy in enhancing their English academic writing proficiency. A total of 48 electrical engineering students participated in this study. The demographic characteristics of the respondents were analysed using descriptive statistics through SPSS 25. The results are presented in Table 1.

Table 1. Demographic Characteristics of the Respondents

Variabel	Category	Frequency (n)	Percentage (%)
Gender	Male	34	70.8
	Female	14	29.2
Age	18-20	7	14.6
	21-23	40	83.3
	>23	1	2.1
Prior Experience with AI Tools (e.g., ChatGPT, Grammarly)	Yes	48	100
	No	0	0

From Table 1 which depicts out the demographic characteristics of the 48 electrical engineering students involved in the study show that the majority of respondents were male (70.8%), while female students represented 29.2% of the sample. In terms of age distribution, most respondents in this study were around 21 to 23 years old (83.3%), followed by those aged 18–20 years (14.6%), while only one respondent (2.1%) was above 23 years of age.

Moreover, all participants (100%) reported having prior experience with AI-based tools such as ChatGPT, Grammarly, and Quillbot. This finding indicates that the respondents were already familiar with technology-assisted writing platforms, which may have contributed to their positive engagement with AI-augmented pedagogical approaches. Hence, the demographic composition portrays that students are well-equipped to integrate AI into their academic writing.

Following the demographic information analysis, the next step involved assessing the validity and reliability of the research instruments used in this study to confirm their accuracy and consistency. The instrument consisted of 20 items designed to assess students' attitudes toward AI in enhancing their academic writing proficiency. The instrument's validity was analyzed using Pearson's Product-Moment Correlation. The findings revealed that all items obtained r-count values higher than the r-table value (0.2845), with significance levels (Sig. 2-tailed) less than 0.05. Hence, all items in the questionnaire were confirmed as valid.

Additionally, the reliability test was conducted through Cronbach's Alpha analysis. The result showed a Cronbach's Alpha coefficient of 0.92, surpassing the commonly accepted threshold of 0.70, which demonstrates strong internal consistency among the items. Thus, the instrument was verified to be both valid and reliable.

Table 2. Reliability Test Result

Reliability Statistics	
Cronbach's Alpha	N of Items
.942	20

Table 3. Attitude Categories

Attitude Categories	Score
High/Positive	74–100
Moderate/Neutral	47–73
Low/Negative:	20-46

Moreover, to verify the distribution pattern of the data, the Kolmogorov–Smirnov and Shapiro–Wilk tests were conducted in this study. The result of tests of normality is presented in Table 4.

Table 4. Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
VAR00022	.096	48	.200*	.968	48	.211

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on Table 4, the results of the Kolmogorov–Smirnov and Shapiro–Wilk normality tests shown significance values of 0.200 and 0.211, respectively. Since these values are greater than the significance level of 0.05, it can be decided that the data are normally distributed.

Furthermore, Table 5 below outlines the classification criteria for each component of attitude namely cognitive, affective, and behavioral as well as the overall attitudes. These classifications were determined based on the ideal mean and standard deviation ranges to identify whether respondents' attitudes are categorized as positive, neutral, or negative.

Table 5. Classification Criteria for Each Component of Attitude

No	Attitude Components	Positive	Neutral	Negative
1.	Cognitive	$X > 30 + 6.67 = >36.67$	$23.33 \leq X \leq 36.67$	$X < 23.33$
2.	Affective	$X > 15 + 3.33 = >18.33$	$11.67 \leq X \leq 18.33$	$X < 11.67$
3.	Behavior	$X > 15 + 3.33 = >18.33$	$11.67 \leq X \leq 18.33$	$X < 11.67$
4.	Overall Attitudes	$X > 60 + 13.33 = > 73.33$	$47 \leq X \leq 73$	$X < 20$

As shown in the table, a positive attitude is represented by scores above $M_i + SD_i$, while scores below $M_i - SD_i$ indicate a negative attitude. The total score above 73.33 signifies a positive overall attitude, scores between 47 and 73 denote a moderate level, while scores below 47 reflect a negative attitude. This classification enables the identification of respondents' general tendency toward the studied construct.

The table presents the mean scores and standard deviations for each attitude component.

Table 6. Results of the Mean scores and Standard Deviations for each attitude

No	Attitude Components	Mean	Std. Deviation	Interpretation
1.	Cognitive	40.33	5.183	Positive
2.	Affective	20.37	2.965	Positive
3.	Behavior	18.98	3.342	Positive
4.	Overall Attitudes	79.69	11.065	Positive

The results in the table demonstrate that all three attitude dimensions namely cognitive, affective, and behavioral. According to the results, the cognitive dimension achieved a mean score of 40.33 (SD = 5.18), thus surpassing the positive threshold value of 36.67. This finding indicates that students possess a strong cognitive orientation toward the pedagogical value of AI-assisted writing tools. Furthermore, with a mean score of 20.37 and a standard deviation of 2.965, the affective component is also classified as positive. This suggests that participants exhibited positive emotional responses, including enthusiasm, interest, and approval of AI in academic writing. In the same vein, the behavioral component outperformed the criteria value of 18.33 with a mean score of 18.98 (SD = 3.342) meaning that this result indicates favorable emotional responses. Additionally, the overall attitude mean score was found to be above 73.33, falling within the positive category. This reflects that, collectively, respondents exhibit supportive cognitive, affective, and behavioral orientations toward the use AI in enhancing their academic writing proficiency.

2. Discussion

The present study explored Electrical Engineering students' attitudes toward the integration of artificial intelligence (AI) in academic writing instruction, revealing that their perceptions were overwhelmingly positive. The quantitative results showed a high overall mean score (M = 79.69, SD = 11.065), indicating that most participants held favorable attitudes toward using AI-based tools to enhance their English academic writing proficiency. This positive orientation reflects a growing acceptance of AI as a legitimate and effective learning companion in higher education contexts. Based on the three attitudinal dimensions namely cognitive, affective, and behavioural, the findings of this study find holistic understanding of how electrical engineering students perceive, respond to and interact with AI-assisted writing technologies.

Positive Attitudes Towards an AI-Augmented Pedagogy in Enhancing English Academic Writing Proficiency

The findings of this study indicate that the students of Electrical Engineering displayed highly positive attitudes toward the integration of AI-assisted pedagogy in enhancing their English academic writing proficiency. The overall mean score (M = 79.69, SD = 11.07) reflected strong acceptance and enthusiasm toward the use of AI-based tools in learning. In particular, AI applications like ChatGPT, Grammarly, and QuillBot were regarded as practical, efficient, and reliable supports that help them improve the structure, clarity, and linguistic accuracy of their academic writing. This study further demonstrates that the more students find AI tools relevant and beneficial, the more they believe these tools contribute to their progress as academic writers.

The results are consistent with previous studies by Malik et al. (2023) and (Afifah, 2024), which reported that AI tools were perceived as reliable for grammar correction, organization, and idea generation. Similarly, ("Motivation and Job Performance,"

2024)He (2024) noted that AI-assisted feedback increased students' motivation and enjoyment in writing. In the current study, engineering students viewed AI as a source of efficiency, accuracy, and linguistic confidence, particularly when dealing with complex sentence structures or technical vocabulary typical of their field.

Cognitive Attitudes

The results of the study indicate that students demonstrated highly favorable cognitive attitudes toward AI tools used in academic writing, with an average score of $M = 20.37$ $SD=2.965$. Most participants agreed that AI-assisted platforms helped them improve lexical choice, grammar accuracy, as well as text organization. A large majority agree (50%) and strongly agreed (29.2%) that AI made them in organizing ideas and arguments more systematically. This reveals that many students perceive AI as helpful in improving the logical flow of their academic writing. This finding is supported by AI- (Alharbi, 2023), (Khalifa & Albadawy, 2024), and (Deep & Chen, 2025) that AI helps to support academic writing in idea generation.

Additionally, they also think AI is useful for making their word choices and writing clearer (54.2% agree and 35.4% strongly agree). Programs like grammar checkers and paraphrasing tools support users in finding the right formal words for academic writing. The strong agreement indicates that students use AI to enhance how they use language in their studies, showing a good understanding of how AI can help improve their writing skills. This is in line with Nugroho & Trisusana (2025) who claim that AI tools provides various benefits for students, including time efficiency, improved writing quality, and personalized learning experiences.

To sum up, AI is perceived as an essential tool that promotes critical thinking and supports improved academic writing performance. In this light, cognitive attitudes toward AI can be seen as evolving beyond mere tool acceptance toward a more sophisticated understanding of its pedagogical and intellectual implications in academic writing.

Affective Attitudes

The results for affective attitudes also revealed a positive emotional engagement with AI-assisted writing activities ($M = 20.37$ $SD= 2.965$). Students reported that AI let the writing process becoming less stressful as well as it is more motivating. Many indicated that receiving immediate feedback on grammatical accuracy and text structure increased their confidence and reduced anxiety when writing in English, a language often perceived as challenging by technical students.

This study reveal that the use of AI in the academic writing helps to reduce writing anxiety and fear of making mistakes, emotional barriers often experienced by students. By serving as a consistent source of guidance, AI acts as a confidence scaffold, enabling students to build resilience, trust their linguistic abilirehmanties, and take creative and intellectual risks in their writing. Generally, the existence of AI-tools in academic writing promotes not only technical enhancement but also positive emotional development, empowering students to approach academic writing with increased enthusiasm.

In another side, while AI contributes to enhancing students' confidence, many still voice worry that its use might result in plagiarism. AS what is noted by Lee et al. (2024) The most frequently raised issues among the responses were related to plagiarism and reliability of AI generated content. As what Cotton et al. (2024) states that issues of

dishonesty and plagiarism may arise as potential challenges for students who are using AI tools in improving their English academic writing.

Behavioral Attitudes

From the third component, behavioral attitudes, this study presents that respondents displayed a positive behavioral attitude toward integrating AI into academic writing ($M= 18.98$ $SD= 3.342$). The majority of the respondents acknowledged that AI supports them in systematically structuring ideas and arguments, demonstrating openness to employing AI as a complementary writing aid.

Furthermore, many respondents maintained that AI should function as a complementary resource rather than replace human authorship. Students noted that ongoing support from lecturers remains vital to ensure the appropriate and ethical use of AI indicating that AI should be used as a supportive tool, not to replace human roles. Some students experienced challenges in interpreting AI suggestions, implying a continued need to strengthen users' digital literacy and critical evaluation skills. The declaration acknowledges both the advantages and drawbacks of AI technology in the educational process, demonstrating a realistic and balanced viewpoint. This statement essentially pictures a mature and considerate viewpoint in which students recognize the promise of AI while continuing to rely on lecturers as the primary source of intellectual growth and academic validation, reinforcing the crucial role that educators play in promoting ethical and critical learning methods.

The respondents' recognition of the lecturer's continuing role as pedagogical guide further supports (Marzuki et al., 2023), who emphasized that AI-driven writing assistants are reshaping not only how students produce written texts but also how educators conceptualize writing instruction, assessment, and feedback practices. Integrating technology into English academic writing can transform how writing is developed and assessed, but educators still have to balance tool use with teaching core writing skills to ensure continued improvement (Wulandari et al., 2024). AI has become a critical component of the modern academic landscape, offering significant benefits such as personalized learning, enhanced engagement, and improved access to educational resources (Vieriu and Petrea, 2025).

D. CONCLUSION AND SUGGESTIONS

This study demonstrates that AI-augmented pedagogy constitutes an effective and transformative approach to enhancing English academic writing proficiency among Electrical Engineering students. Students' consistently positive cognitive, affective, and behavioral attitudes indicate strong acceptance of AI as a supportive learning partner in academic writing. AI integration not only facilitates linguistic accuracy and structural clarity but also bridges the gap between technical expertise and academic communication in engineering education context. Future research will expand the scope a mixed-method and longitudinal design to triangulate perception data with performance-based writing assessments and classroom observations to depict out deeper insights into how sustained AI integration can foster long-term writing development, learner autonomy, and pedagogical innovation in engineering-based English instruction.

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