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UNPACKING THE IMPACT OF WRITING TASK COMPLEXITY, USE OF DIGITAL TOOLS, AND ENGAGEMENT STRATEGIES ON UNIVERSITY STUDENTS' ACADEMIC WRITING PERFORMANCE

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ABSTRACT

Aim/Purpose	This study aims to investigate how writing task complexity, digital tools, and writing engagement strategies impact students' academic writing performance, identifying their direct and mediated effects.
Background	There is little exploration regarding the interplay of technological, cognitive, and affective-related factors, such as the use of digital tools, the complexity of writing tasks, and engagement strategies contributing to students' academic writing performance, which has prominently emerged in higher education. Such exploration is essential to provide clear nuance and the importance of technological, cognitive, and affective roles in academic writing practices.
Methodology	Employing Partial Least Squares-Structural Equation Modeling (PLS-SEM), this quantitative study used a validated 20-item questionnaire adapted from past research. Data were collected from 211 undergraduate students majoring in English Education and English literature from fourteen Indonesian universities.
Contribution	This research systematically explores how digital tools and engagement strategies mediate the relationship between writing task complexity and academic

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writing performance. Distinct from previous research on writing task complexity, use of digital tools, and engagement strategies, which were studied in isolation, the findings of this study offer nuanced insights into how the use of digital tools and engagement strategies simultaneously mediate the effect of task complexity into potential interconnected pathways and mechanisms influencing academic writing outcomes. These insights highlight that students do not merely respond to complex tasks cognitively but also use digital support systems and perform engagement strategies to optimize their writing. These findings inform the design of integrated writing instruction that aligns task difficulty with digital scaffolding and engagement strategies, particularly in EFL higher education settings.

Findings — The results revealed significant positive effects of writing task complexity directly affecting academic writing performance (β=0.363), writing engagement strategies (β=0.560), and use of digital tools (β=0.694). Furthermore, use of digital tools significantly influenced writing performance (β=0.222) and engagement strategies (β=0.278), while engagement strategies notably affected academic writing performance (β=0.294). These findings underscore that appropriately structured complex tasks, enhanced by digital support and active engagement strategies, significantly bolster students' academic writing capabilities.

Recommendations for Practitioners — Educational practitioners can leverage these insights to design complex yet manageable writing tasks and integrate digital tools effectively, thereby fostering improved student engagement and enhanced academic writing outcomes.

Recommendations for Researchers — Indonesian ELT scholars may conduct future research to investigate additional elements such as individual differences in digital literacy, motivation, and language competency to better understand the complex relationships between writing task complexity, use of digital tools, engagement strategies, and academic writing performance. Researchers may also investigate the efficacy of specific digital tools or technologies in various academic and cultural contexts to determine optimal integration strategies.

Impact on Society — This study clarifies the roles of task complexity, technology, and engagement in providing educators with evidence-based approaches to improve academic writing instruction, thereby preparing students more effectively for academic and professional contexts.

Future Research — This paper has figured out the collective impact of writing task complexity, use of digital tools, and writing engagement strategies on academic writing performance using the PLS-SEM approach as a framework for analysis. Future studies are called to examine different approaches regarding these research findings, such as experimental design, which can manipulate task complexity to provide deeper insights into optimal task design.

Keywords — academic writing performance, use of digital tools, writing engagement strategies, writing task complexity

INTRODUCTION

Academic writing is a fundamental skill in higher education, particularly in the context of English as a Foreign Language (EFL), where students face significant challenges in meeting academic literacy standards (AlMarwani, 2020). This academic writing has become a very complex skill as it is not only a linguistic task but also a cognitively demanding process, requiring high-level thinking processes

such as planning or drafting text (Rogers & Graham, 2020). As it involves both linguistic and cognitive complexity, understanding the factors that support students in mastering this skill is critical, not only for their academic achievement but also for their overall success in higher education and future employment (Hyland, 2013; Wingate, 2012). Many aspects may contribute to this academic writing success, such as the use of digital tools, the complexity of the required writing task, motivation, and engagement strategies employed by both teachers and students (Birhan & Nurie, 2024; Graham, 2022; Nurharjanto & Widyantoro, 2020). However, prior studies (e.g., Graham, 2022; Nurharjanto & Widyantoro, 2020) reported those aspects separately in the field of EFL academic writing. The interplay among writing task complexity, the use of digital tools, and writing engagement strategies concerning students' academic writing performance becomes the concern of this research.

These factors have been explored in various studies, such as the study conducted by Rahimi and Zhang (2019), who examined the effect of increasing task complexity on learners' writing accuracy syntactically, which indicates an increase in subordinate use and a decrease in writing accuracy. In addition, texts are commonly more appropriate and communicative in terms of the content and more coherent and united in terms of their organization when they are produced in the complex task situation (Li et al., 2024). However, the research did not elaborate in detail on the impact of task complexity on students' academic writing performance, which remains a critical concern for university students. Furthermore, digital tools have also become central to academic writing processes, especially in EFL contexts. Schcolnik (2018) found that students use a range of digital tools, including online research platforms, mind-mapping software, citation managers, and collaborative tools, to support idea generation, organization, and peer collaboration. In the same line, Tusino et al. (2024) reported that the use of computer-assisted writing tools contributes to improved vocabulary, critical thinking, social interaction, and overall writing motivation. These findings underscore the supportive role of technology in reducing cognitive load and enhancing writing fluency; however, they stop short of analyzing how these tools interact with task complexity or student engagement. Related to this, student engagement in academic writing has been linked to the use of feedback-rich and collaborative environments. Shen et al. (2023) showed that computer-based feedback tools significantly enhance students' writing engagement and learning outcomes.

While those studies have provided valuable insights, they have predominantly explored each factor in isolation, leaving a limited understanding of how these variables may interact in complex academic writing contexts. This presents a significant gap in the literature, particularly in EFL settings where students must simultaneously manage cognitive, technological, and motivational challenges. Investigating the impact of these elements is crucial for developing a more integrated and effective approach to academic writing instruction. Therefore, this study intends to fill this gap by examining how writing task complexity, use of digital tools, and writing engagement strategies collectively impact university students' academic writing performance. Employing Partial Least Squares-Structural Equation Modeling (PLS-SEM), the study provides a comprehensive analysis of both the direct and indirect relationships among these variables, offering pedagogical insights for improving academic writing instruction in EFL higher education contexts. Based on the discussion presented, this study proposes a research question to guide the study:

RQ: How do writing task complexity, use of digital tools, and writing engagement strategies interact to impact students' academic writing performance?

LITERATURE REVIEW

The following review draws on a broad range of empirical studies in the field over the past decade. Particular emphasis is placed on recent and relevant studies that have shaped ongoing discussions around writing task complexity, use of digital tools, and engagement strategies in EFL academic writing. This approach ensures that foundational or current works critical to understanding these domains have not been overlooked.

Writing Task Complexity

In the academic writing context, the concept of task complexity refers to the cognitive demands placed on students as they engage with writing tasks of varying difficulty (Robinson, 2001). Rahimi and Zhang (2019) elaborated on writing task difficulty by identifying key dimensions, including overall perceived difficulty, stress levels, motivation to complete the task, perceived ability to do so, and interest in the task. Writing tasks vary significantly in complexity depending on their genre and cognitive demands. Simpler genres, such as descriptive or narrative writing, typically impose lower cognitive loads, however, expository writing is cognitively more demanding, while more advanced academic genres, such as argumentative essays, synthesis writing, and literature reviews, are the most complexly demanding as it requires abstract reasoning, critical evaluation, and integration of multiple sources (Pu et al., 2022; Vandermeulen et al., 2023; Zheng & Barrot, 2024).

Empirical research supports this progression in writing task complexity. More demanding tasks often engage students in higher-order thinking skills, such as analyzing and synthesizing, which in turn promote deeper learning and the development of advanced writing abilities (Ghaderi et al., 2022; Li et al., 2024). However, as Sweller et al.'s (2011) cognitive load theory suggests, if students are presented with highly complex tasks without appropriate scaffolding, their cognitive resources can become overwhelmed, leading to diminished learning outcomes. To address this, studies emphasize the effectiveness of incremental increases in task complexity when accompanied by supportive instructional strategies. For example, Tabari et al. (2024) found that L2 students benefit from tiered task designs that gradually increase in complexity, helping them build the necessary cognitive strategies to manage sophisticated academic writing over time. Despite these findings, it is also important to recognize that overly complex tasks, when not sufficiently supported, can negatively impact student outcomes. These may include reduced motivation, heightened anxiety, and lower-quality writing, particularly among novice writers (Teng & Ying, 2023). While task complexity has been acknowledged as one of the key factors influencing academic writing performance, other aspects, including digital tools and writing engagement strategies, need to be explored to get a more comprehensive understanding of complex associations among those aspects.

Digital Tools in Academic Writing

The integration of digital tools in the writing process, such as grammar checkers, collaborative writing platforms, automated feedback systems, and artificial intelligence tools, has shown potential to promote students' competence in academic settings. Empirical studies reported that real-time feedback of students' writing using digital tools, followed by practical and instructional examples, allows students to have a new personalized learning experience (Cavaleri & Dianati, 2016; Nazari et al., 2021). More recent studies support these findings, showing that AI-based tools, like Paragraph Punch, ProWritingAid, Chat-GPT, Copy.ai, Essay writer, Paperpal, Quilbot, Jenni, and WordTune, enable students to structure and organize their writing and self-correct grammatical errors, thereby improving writing quality and confidence over time (Marzuki et al., 2023; Pitukwong & Saraiwang, 2024). Additionally, the improvement in quality, content, and organization of student writing can be affected by collaborative digital tools, such as Google Docs and wikis, which may reflect on their writing performance (Pardede, 2024). By fostering a collaborative environment, these tools allow students to engage in peer review and receive continuous feedback, which has been reported to encourage self-regulation and enhance learning outputs (Zou et al., 2022). Digital tools also promote students' learning independence by providing students with control over their writing process, enabling them to identify and address their weaknesses. In addition, Cavaleri and Dianati (2016) found that students who used digital platforms, specifically Grammarly, as grammar checkers during drafting and revising showed significant improvements in writing performance, as they were able to recheck and refine their work iteratively.

Despite the benefits of digital tools, studies have also raised concerns about the potential that students might rely overly on these tools, possibly diminishing the human teaching interaction between

students and teachers, which is crucial to education. Subsequently, they may lead to superficial engagement with the learning material. (Marzuki et al., 2023). Moreover, while AI-based and collaborative tools provide timely feedback during students' writing, they may fall short in delivering the emotional support and motivation typically associated with human feedback and face-to-face collaboration often provide elements that are crucial for students navigating the challenges of acquiring a new language (Wiboolyasarin et al., 2024). These limitations suggest that digital tools are most effective when combined with explicit instruction, goal-oriented tasks, and teacher feedback. As the exploration mentioned the significance of digital tools towards students' performance in academic writing, this research is intended to carry out further analysis on how it correlates with other significant aspects, such as writing task complexity, writing engagement strategies, which lead to promoting students' writing performance in academic settings.

Writing Engagement Strategies

Writing engagement strategies are vital for inspiring students and increasing their commitment to achieving good learning outcomes. Engagement is often conceptualized as active involvement of learners and the degree of contribution in an activity (Hiver et al., 2024). Effective engagement strategies, such as providing clear objectives, fostering collaboration, and giving timely feedback, have been associated with students' writing performance (F. Zhang et al., 2023). Empirical studies have reported that various strategies employed to enhance writing performance, such as self-regulated strategy development that involves teaching students strategies for planning and composing writing, have significantly improved writing quality and composition elements (Finlayson & McCrudden, 2020). Peer feedback is another effective engagement strategy that enhances cognitive engagement and reflection. Wu and Schunn (2021) found that giving and taking feedback from peers improved students' performance in writing and overall learning outcomes.

Embedding a cooperative learning strategy within writing instruction can increase behavioral and affective engagement, which may lead to improving the quality of writing, although it may not significantly impact cognitive engagement (Prataa et al., 2019). In addition, Birhan and Nurie (2024) also highlight that corpus-based instruction positively impacts students' engagement in their academic writing performance. Furthermore, Z. Zhang and Hyland (2023) demonstrated that feedback-rich environments, where students receive detailed, constructive feedback, lead to greater writing satisfaction and higher-quality outputs. It shows that engaging students throughout the writing process is essential, as it may help them to have better competence and writing outputs. Research has also highlighted the potential benefits of combining writing engagement strategies with digital tools to create an enriched learning environment. Zou et al. (2022) argue that digital tools that support collaborative engagement, such as Google Docs and Flipgrid, enhance students' behavioral and cognitive engagement and allow for ongoing feedback and reflection. This approach is particularly beneficial in exploring students' engagement for complex writing tasks, as students can receive continuous support while increasing their writing skills.

Structural Equation Modeling (SEM) in Academic Writing Research

Structural Equation Modeling (SEM) is increasingly employed in educational research to investigate the associations between variables that influence academic performance. SEM is especially helpful for studies that explore numerous aspects concurrently because it offers a rigorous framework for analyzing complex, interrelated variables (Hair et al., 2014). In the academic writing context, SEM, in particular, Partial Least Squares (PLS), has been employed to model the correlations between writing feedback literacy on feedback engagement and writing performance, offering valuable insights into their combined effects on student ability (Lu et al., 2024). Prihandoko et al. (2024) used PLS-SEM to analyze psychological factors, self-efficacy, growth mindset, and metacognition on academic writing performance, finding that growth mindset functioned as a crucial foundation leading to success in EFL writing. Their findings indicate that a growth mindset directly and indirectly affects academic

writing, mediated by metacognition and self-efficacy. Another recent research conducted using the SEM framework was reported by Nurkamto et al. (2024). They examined the factors behind writer's block, which consist of several variables: reading attitude, mental toughness, writing self-efficacy, academic pressure, academic writing performance, and writer's block. Their findings indicated that statistically significant interplay relationships between the constructs and academic writing competence exert the most substantial positive impact on writer's block.

Another PLS-SEM study was conducted by Ardi et al. (2024), who examined the interplays among related-self-efficacy in writing and literacy in research of the students, as well as related-immediacy and clarity factors of the teachers in shaping the enjoyment in writing among Indonesian EFL students at the postgraduate level. Their findings indicated positive relationships among the variables; however, the relationship between students' writing enjoyment and teachers' immediacy and clarity is not statistically significant, implying that teacher factors may not have significantly affected students' enjoyment in writing. This insight implies the importance of a multifaceted approach to writing instruction, where many factors may contribute and are viewed as interconnected elements that collectively shape learning outcomes.

The reviewed studies across the three domains, task complexity, digital tools, and engagement strategies, highlight their interdependent roles in shaping academic writing performance. As writing tasks become more complex, students must draw on a range of cognitive, metacognitive, and emotional resources. Without support, such tasks can lead to overload, but when paired with engagement strategies and digital scaffolding, students are more likely to succeed. Digital tools serve as cognitive and affective support systems, helping students manage the demands of complex writing tasks and engage more deeply with the writing process. Similarly, engagement strategies enhance students' ability to persist through challenges, regulate their performance, and reflect on their learning. A growing body of research supports the idea that these three factors, task complexity, use of digital tools, and engagement, do not operate in isolation but rather interact to shape writing outcomes in dynamic ways.

Accordingly, this study lays the foundation for examining how the associations among writing task complexity, the use of digital tools, and writing engagement strategies collectively shape academic writing performance. The following hypotheses are proposed:

H1: Writing task complexity correlates with academic writing performance.

H2: Writing task complexity correlates with writing engagement strategies.

H3: Writing task complexity correlates with the use of digital tools.

H4: Use of digital tools is associated with academic writing performance.

H5: Use of digital tools is associated with writing engagement strategies.

H6: Writing engagement strategies are associated with academic writing performance.

These hypotheses are grounded in a broad body of research that demonstrates how cognitively demanding writing tasks often require higher-order thinking and are associated with deeper learning outcomes (Ghaderi et al., 2022; Li et al., 2024). However, when task complexity is not properly scaffolded, it may lead to cognitive overload and decreased performance (Sweller et al., 2011; Teng & Ying, 2023). Digital tools, such as grammar checkers, AI writing assistants, and collaborative platforms, have been shown to help students manage the cognitive demands of complex tasks while improving the quality and structure of their writing (Cavaleri & Dianati, 2016; Marzuki et al., 2023; Zou et al., 2022). Moreover, students who engage in writing through strategies like self-regulation, peer feedback, and cooperative learning tend to perform better in academic writing tasks (Wu & Schunn, 2021; Z. Zhang & Hyland, 2023). Taken together, the studies suggest that these three domains, task complexity, use of digital tools, and writing engagement strategies, interact in meaningful ways, and their combined influence on academic writing performance warrants empirical investigation.

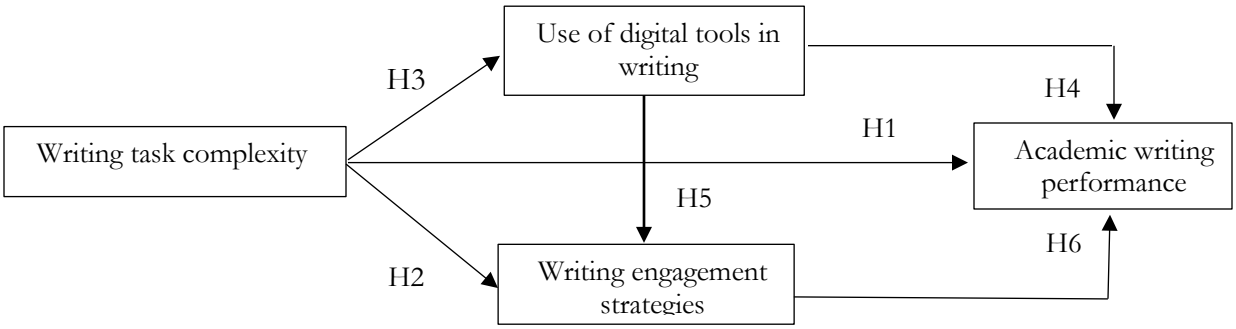

Figure 1. Conceptual model

METHODOLOGY

This study employed a quantitative exploratory analysis, investigating the interplay among writing task complexity, the use of digital tools, writing engagement strategies, and academic writing performance. A theory-driven model comprising six hypotheses (as shown in Figure 1) was tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). This PLS-SEM technique was selected over covariance-based SEM (CB-SEM) and multiple regression models due to its suitability for exploratory or predictive research where the focus is on maximizing explained variance rather than model fit (Hair et al., 2021). Then, PLS-SEM is robust in handling non-normal data and moderate sample sizes, making it more appropriate than CB-SEM when multivariate normality and large samples cannot be assumed (Henseler et al., 2015). Furthermore, unlike traditional regression, PLS-SEM allows for the simultaneous estimation of measurement models (latent variable reliability/validity) and structural paths, providing a comprehensive analysis of complex models like the one used in this study, which includes multiple latent variables (e.g., writing task complexity, use of digital tools, engagement strategies, and academic writing performance) and hypothesized direct and mediated relationships among them.

RESEARCH PARTICIPANTS

A total of 211 undergraduate students from English Education and English Literature departments at 14 Indonesian universities, located in Java, Sumatra, Bali, and Sulawesi, participated in this study. The participants were selected using homogeneous purposive sampling, a strategy designed to ensure comparability across individuals who share key characteristics directly aligned with the research aims (Etikan et al., 2016). This approach was adopted to ensure that the sample comprised participants with sufficient and relevant experiential knowledge of academic writing practices, particularly in contexts involving cognitively demanding tasks, digital tool usage, and strategic engagement (Hair et al., 2021).

The core inclusion criteria were: (1) students must be enrolled in or have completed an argumentative academic writing course, a common component in EFL writing curricula and one of the most cognitively complex genres in undergraduate-level academic writing due to its demands on critical reasoning, evidence integration, and rhetorical structuring (Li et al., 2024; Ozfidan & Mitchell, 2020; Sweller et al., 2011); and (2) students must be active users of digital tools, such as grammar checkers, AI writing assistants, or collaborative platforms, during their writing process, as these tools are now widely used to support drafting, revising, and editing in academic contexts (Marzuki et al., 2023; Nazari et al., 2021).

Students who had no formal exposure to argumentative writing or did not use digital tools in their academic writing were excluded from the study, as they would not have been able to meaningfully respond to the questionnaire items, which were designed to measure latent constructs such as writing task complexity, digital tool use, and writing engagement. Participants were recruited by coordinating

with lecturers at the participating universities. The research team distributed a survey link via institutional WhatsApp groups, facilitated by instructors who were briefed on the inclusion criteria to ensure appropriate targeting. This recruitment process ensured that participants were both academically situated within writing-focused curricula and technologically engaged, thus supporting the validity of their responses in relation to the hypothesized model (Hair et al., 2021). These shared characteristics not only align directly with the study's core constructs but also improve measurement precision and construct validity, ensuring that all participants had relevant experiences with the cognitive, technological, and behavioral dimensions central to academic writing in EFL contexts. This homogeneity contributed to data coherence and model interpretability by reducing extraneous variance, thereby enabling robust estimation of the structural relationships within the PLS-SEM framework (Hair et al., 2021).

While purposive sampling limits statistical generalizability, it enhances the internal validity and explanatory strength of the model by concentrating on participants whose academic experiences are directly aligned with the latent variables under investigation. The specificity of the sample, undergraduate EFL students with formal exposure to argumentative writing and frequent use of digital tools, supports the development of precise, context-sensitive interpretations of the relationships modeled. These characteristics reflect the writing challenges and technological engagement common in many higher education EFL contexts. To assess whether these findings may be applicable to other settings, researchers and educators can refer to the demographic and contextual data provided (Table 1), which enables informed comparisons and judgments about contextual similarity.

Table 1. Demographic details of 211 participants

Category		Number	Percentage (%)
Gender	Male	93	44.1
	Female	118	55.9
Age	19 years	5	2.4
	20 years	56	26.5
	21 years	77	36.5
	22 years	50	23.7
	23 years	23	10.9
Academic discipline	English Education	136	64.5
	English Literature	75	35.5
Digital tools used	Notebook/laptop	193	91.5
	PC	11	5.2
	Smartphone	207	98.1
	Tablet	34	16.1
Daily time spent reading academic books or research articles	< 1 hour	28	13.3
	1-2 hours	91	43.1
	2-3 hours	65	30.8
	3-4 hours	23	10.9
	> 4 hours	4	1.9
Daily time spent using a computer/laptop	< 1 hour	5	2.4
	1-2 hours	24	11.4
	2-3 hours	24	11.4
	3-4 hours	65	30.8
	> 4 hours	93	44.1
Digital tools used during the writing process	Collaborative writing platforms	197	93.4
	Grammar checkers	156	73.9
	Paraphrasing tools	145	68.7
	AI Generative tools	163	77.3

However, some limitations of the sampling approach should be noted. Since participation was voluntary, self-selection bias may have occurred. In addition, students from non-English majors or from institutions with limited access to technology were not included. These factors may influence how broadly the results can be applied. Therefore, the findings should be interpreted with caution and are most relevant to learners with similar academic writing experiences and technological engagement. Despite these limitations, the sampling remains appropriate for the theory-driven PLS-SEM model, and the sample size exceeds recommended minimum thresholds (Wong, 2013), ensuring sufficient statistical power for model estimation.

As shown in Table 1, the participant group was relatively balanced in terms of gender, with female students slightly outnumbering males (55.9% vs. 44.1%), which reflects typical enrollment trends in English education programs in Indonesia. The majority of students were aged 20-22, indicating a population composed primarily of second and third-year undergraduates with mid-level academic writing exposure. In terms of academic background, 64.5% were from English education programs and 35.5% from English literature departments, both of which commonly include academic writing components in their curricula. Regarding device usage, 98.1% reported using smartphones, and 91.5% used laptops, suggesting that participants had strong access to mobile and desktop digital platforms for writing tasks. However, tablet and PC use remained limited, at 16.1% and 5.2%, respectively. Daily academic reading habits revealed that most participants (43.1%) read for 1–2 hours per day, with another 30.8% reading for 2–3 hours, indicating moderate academic engagement. Similarly, computer usage was highest in the >4-hour range (44.1%), suggesting substantial digital engagement. Finally, participants reported extensive use of digital tools in their writing process, particularly collaborative platforms (93.4%), grammar checkers (73.9%), AI generative tools (77.3%), and paraphrasing tools (68.7%), demonstrating strong familiarity with technology-assisted academic writing, which aligns well with the constructs of digital tool use and engagement strategies explored in this study.

Research Instruments

In conducting this study, we provided the participants with an online questionnaire adapted from existing past research. The writing task complexity was measured using items adapted from Rahimi and Zhang (2019), which assessed perceived difficulty, stress levels, motivation to complete the task, perceived ability to do so, and interest in the task. Digital tools were measured using items adapted from Alkamel and Alwagieh (2024), capturing students' purposes for using tools such as Grammarly, Google Docs, and ChatGPT in their writing process. Writing engagement strategies were assessed using five items adapted from Parsons et al. (2023), focusing on students' affective, behavioral, cognitive, and social aspects during planning, revision, feedback use, and the collaboration process in writing. Finally, academic writing performance was assessed using items adapted from Razı (2015), capturing students' perceived ability to write organized, coherent, and argument-driven academic texts. Each construct consists of five questions for a total of 20 items. The instrument used also underwent validation related to its content, ensuring its clarity, alignment with the variables, and suitability for the participants. The validation was conducted by two experts, particularly university professors in ELT who have expertise in teaching writing and applied linguistics. Minor revisions were made based on the content to improve wording and remove ambiguity. Subsequently, a pilot study was conducted with 30 students who met the same inclusion criteria as the main sample in one of the universities in East Java. The pilot confirmed that items were clearly understood, and therefore, the result was acceptable. Minor revisions were made to improve wording and remove ambiguity. Cronbach's alpha values for the four subscales ranged from 0.78 to 0.85, indicating acceptable internal consistency. Based on this process, the final instrument was deemed reliable and valid for use in the main study.

Data Collection

Data for this research were obtained using a 5-point Likert scale online questionnaire, ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), to strongly agree (5), which was administered

via a Google Form. We distributed the questionnaire link by collaborating with English lecturers at universities across Indonesia, who shared the link with eligible students through institutional WhatsApp groups. Participants typically required approximately 7–10 minutes to complete the questionnaire. All ethical guidelines were followed, including a digital consent form, a clear explanation of the study's purpose, participant rights, and data confidentiality. Students could only proceed with the questionnaire after confirming their consent. The survey remained open for two weeks, after which the number of responses was considered sufficient for analysis. Despite the practical advantages and broad institutional reach of online distribution, this approach is subject to several limitations. Self-selection bias may have occurred, as students who were more motivated, confident in their writing ability, or more technologically proficient were likely more inclined to participate. Additionally, students with limited internet access or less familiarity with digital platforms may have been unintentionally excluded, potentially limiting the diversity of participant backgrounds and reducing the representativeness of the sample. Because participation was limited to English majors, students from other academic disciplines were also not included, which may further narrow the scope of applicability. Finally, the use of self-report data introduces the possibility of response bias, such as social desirability or recall inaccuracies. While these limitations are common in survey-based research, the data collection strategy was ethically conducted and allowed access to a geographically and institutionally diverse pool of participants, enhancing the study's relevance within the Indonesian EFL higher education context.

DATA ANALYSIS

In analyzing the data of this quantitative study which examined the interplay among writing task complexity, use of digital tools in writing, writing engagement strategies, towards academic writing performance, we used Partial Least Square-Structural Equation Modelling (PLS-SEM) methodology, which is especially beneficial for examining complicated theoretical connections among multiple variables in social science and second language learning studies (Hair & Alamer, 2022). The data were derived from the results of questionnaires that had been filled out by the respondents, which were then input into the intended application. The data analysis used the SmartPLS 4.1 application of Structural Equation Modeling (SEM) to extract valuable understanding and wrap up fruitful conclusions. Analysis followed two analytical steps: evaluation of the measurement model and the structural model, as recommended by Hair et al. (2021). In the first step, the measurement model was established to ensure the validity and reliability of the proposed model. The model was assessed through carrying out measurement model evaluation (inner and outer). The outer model was then assessed to obtain the indicator loading value, composite reliability, average variance extracted (AVE), and the Heterotrait-Monotrait Ratio (HTMT). In the second step, the structural model was measured to test the six hypotheses. Multicollinearity was examined using variance inflation factor (VIF) values, path coefficients were estimated using bootstrapping with 5,000 resamples, significance was determined using t-values and p-values, predictive accuracy was evaluated using R-squared values, predictive relevance was examined through Q-squared (Q^2) values obtained via blindfolding, and effect sizes (f^2) were calculated to determine the strength of individual predictors.

No major analytical challenges were encountered during the analysis. Minor non-normality was detected in the data distribution, which is not problematic given that PLS-SEM does not assume multivariate normality. The use of PLS-SEM thus allowed for a robust, flexible, and theoretically grounded analysis of the complex relationships proposed in the conceptual model of this study.

FINDINGS

The following explanation elucidates the research results, which focus on the interplay between writing task complexity, use of digital tools, and writing engagement strategies in contributing to university students' academic writing performance.

Measurement Model

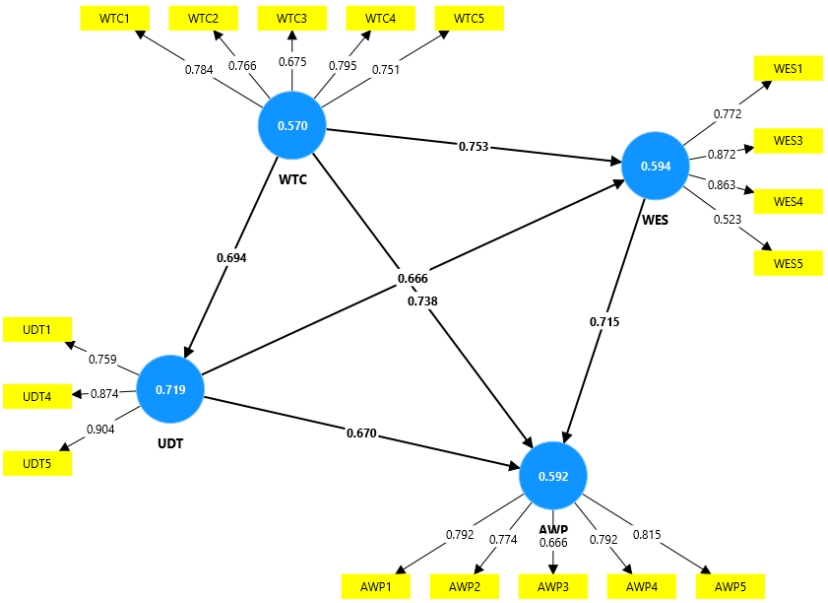

Figure 2. Confirmatory factor analysis of measurement model

The exogenous construct in the designed model was writing task complexity (WTC); the exogenous constructs, which also became endogenous constructs at the same time, referred to the use of digital tools (UDT) and writing engagement strategies (WES). Academic writing performance (AWP) was the endogenous construct. This section presents the indicator loading of the constructs, composite reliability (CR), and average variance extracted (AVE) measurements. The model specification consisted of 4 main inner models and 17 outer models, as shown in Figure 2. In the analysis, indicator loading measures the degree of correlation between a construct and its associated indicators, with the values reflecting the strength of this relationship. During the analysis phase, three items were removed because their indicator loadings fell below the threshold value of 0.50 (Hair et al., 2016). Subsequently, composite reliability (CR) was utilized to assess the internal consistency and reliability of the constructs, with acceptable values ranging from 0.70 to 0.95 (Hair et al., 2014). In this study, the CR values for all constructs ranged from 0.850 to 0.884, demonstrating high levels of consistency and reliability. In addition, convergent validity was examined to evaluate construct validity, with the average variance extracted (AVE) indicating the proportion of variance captured by the construct relative to the measurement error. AVE values exceeding 0.50 are deemed satisfactory (Hair et al., 2014), and in this study, the AVE values presented in Table 2 range from 0.570 to 0.719, confirming adequate convergent validity for all constructs. Therefore, the findings indicate that the constructs in this study exhibit strong internal consistency and validity.

Table 2. Indicator loading, composite reliability (CR), average variance extracted (AVE) measurement

Construct	Items	Loading	CR	AVE
Writing task complexity	WTC1	0.784	0.869	0.570
	WTC2	0.765		
	WTC3	0.676		
	WTC4	0.794		
	WTC5	0.751		

Construct	Items	Loading	CR	AVE
Use of digital tools in writing	UDT1	0.747	0.884	0.719
	UDT4	0.852		
	UDT5	0.900		
Writing engagement strategies	WES1	0.762	0.850	0.594
	WES3	0.868		
	WES4	0.861		
	WES5	0.521		
Academic writing performance	AWP1	0.793	0.878	0.592
	AWP2	0.775		
	AWP3	0.530		
	AWP4	0.789		
	AWP5	0.831		

Discriminant Validity

Table 3 presents the Heterotrait-Monotrait Ratio (HTMT) values of the constructs examined in the study, which include writing task complexity, the use of digital tools, writing engagement strategies, and academic writing performance. The HTMT is employed to assess the discriminant validity of the constructs, ensuring that each construct is distinct from the others. A commonly accepted threshold for adequate discriminant validity is an HTMT value below 0.90 (Henseler et al., 2015). As shown in Table 3, the HTMT values range from 0.762 to 0.898. Thus, the discriminant validity is confirmed, with no indication of construct overlap or measurement bias within the outer model, demonstrating that the constructs are clearly differentiated and capture distinct dimensions of the phenomenon under investigation.

Table 3. Heterotrait-Monotrait Ratio (HTMT)

	AWP	UDT	WES	WTC
AWP				
UDT	0.762			
WES	0.874	0.762		
WTC	0.849	0.791	0.898	

AWP = Academic Writing Performance; UDT = Use of Digital Tools; WES = Writing Engagement Strategies

Structural Model Assessment

Multicollinearity

When evaluating a structural model, it is essential to examine multicollinearity, which arises when independent variables are highly correlated, potentially distorting the path coefficient estimates. In this study, multicollinearity was assessed using the Variance Inflation Factor (VIF). A commonly accepted threshold for VIF is 5.00 or below, indicating that multicollinearity does not significantly affect the model (Hair et al., 2017). As shown in Table 4, all VIF values remained under the 5.00 threshold, confirming that no multicollinearity issues exist in this analysis.

Table 4. Multicollinearity using VIF

	AWP	UDT	WES	WTC
AWP				
UDT	2.127		1.931	
WES	2.540			
WTC	2.727	1.000	1.931	

PATH ANALYSIS

In the path analysis, the proposed model was evaluated using bootstrapping, with the significance level set at 5%. As shown by the numerical values on the arrows in Figure 3, each construct exhibits a positive value of +1. These results indicate each construct has a significant positive correlation value, consistent with the threshold proposed by Hair et al. (2014), where a value of -1 represents a strong negative relationship and +1 represents a strong positive relationship. Additionally, the obtained T-values (see Table 5 for detailed T-statistics) exceed 1.96. At a 0.05 level of significance, a T-statistic greater than 1.96 is considered acceptable. This study adopted the standard criterion for hypothesis acceptance, requiring T-statistics greater than 1.96 (Wong, 2013).

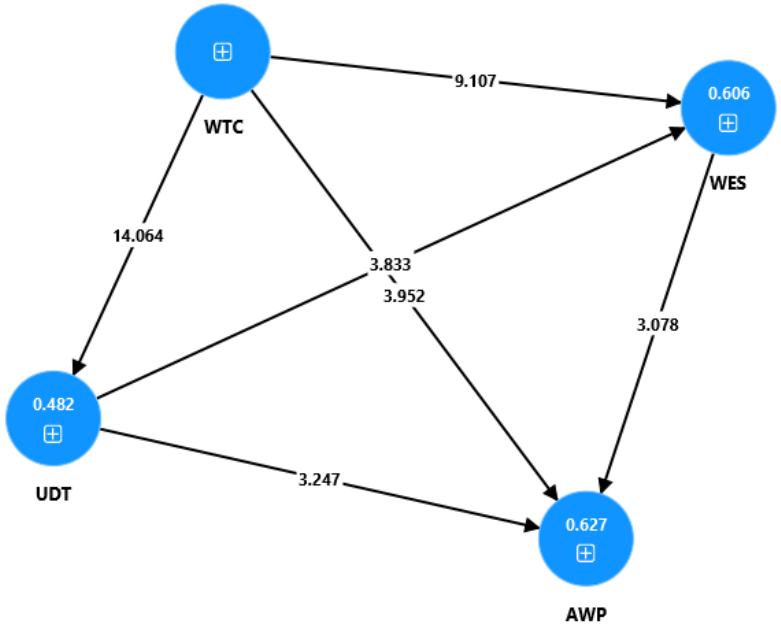

Figure 3. Path coefficient

Table 5 presents the outcomes of the path analysis, which assesses the relationships among the constructs within the model. T statistics and P values were computed to evaluate the statistical significance of the hypothesized relationships. The findings reveal that the hypotheses WTC ->AWP, WTC -> WES, WTC -> UDT, UDT -> AWP, UDT -> WES, and WES -> AWP are supported, as their P values are below 0.05, and their T statistics are greater than 1.96.

Table 5. Result of path analysis

	Hypotheses	β	Mean	SD	T statistics	P values	Significance
H1	WTC -> AWP	0.363	0.357	0.092	3.952	0.000	Supported
H2	WTC -> WES	0.560	0.560	0.061	9.107	0.000	Supported
H3	WTC -> UDT	0.694	0.695	0.049	14.064	0.000	Supported
H4	UDT -> AWP	0.222	0.224	0.068	3.247	0.001	Supported
H5	UDT -> WES	0.278	0.278	0.072	3.833	0.000	Supported
H6	WES -> AWP	0.294	0.298	0.096	3.078	0.002	Supported

Note: $p < 0.05$ indicates that the hypothesis is supported

Coefficient of Determination (R-Squared) and Effect Size (f2)

To measure the predictive accuracy of the model, the coefficient of determination (R-squared) and predictive relevance (Q-squared) were examined. Table 6 presents the coefficient determination (R-squared) values for the study's constructs. The R-squared values range from 0.482 to 0.627, reflecting moderate to strong levels of determination. The adjusted R-squared values, which account for the number of predictors in the model, range from 0.480 to 0.622.

Table 6. Coefficient determination (R-squared) and predictive relevance (Q-squared)

Construct	R-square	R-square adjusted	Consideration	Q-squared predict	Predictive relevance
AWP	0.627	0.622	Strong	0.540	Large
UDT	0.482	0.480	Moderate	0.473	Medium
WES	0.606	0.603	Strong	0.557	Large

Based on the classification proposed by Hair and Alamer (2022), the R-squared values for AWP and WES are considered strong, whereas the value for UDT is considered moderate. This classification follows the ranges of 0- 0.10 (weak), 0.11-0.30 (modest), 0.30-0.50 (moderate), and greater than 0.50 (strong). Subsequently, a PLSpredict procedure was conducted to obtain the predictive relevance value (Q-squared), categorized as small (0), medium (0.25), and large (0.50) (Hair & Alamer, 2022). Meanwhile, Sarstedt et al. (2020) proposed that a well-constructed model has predictive relevance >0. The obtained value of Q-squared in the model (see Table 6) shows that predictive relevance in the constructs of AWP and WES was in the category of large (> 0.50). Meanwhile, the construct of UDT was in the category of medium predictive relevance (> 0.25). All Q-squared values exceeded the 0.25 threshold, indicating high predictive relevance for the model's endogenous constructs.

Conversely, Table 7 shows the constructs' effect size (f2) in the model. This analysis aims to evaluate the strength of the correlations among constructs, with exogenous constructs serving as independent variables and endogenous constructs as dependent variables (Hair & Alamer, 2022). The f^2 value is used to determine the effect size, which, according to Hair et al. (2014), is categorized into three levels: small (0.02), medium (0.15), and large (0.35).

Table 7. Effect size (F^2)

	f^2	Effect size
WTC -> AWP	0.130	Medium
WTC -> WES	0.412	Large
WTC -> UDT	0.931	Large
UDT -> AWP	0.062	Small
UDT -> WES	0.101	Medium
WES -> AWP	0.091	Small

Based on the data presented, the PLS-SEM analysis confirmed all six hypothesized relationships in the model. Writing task complexity was the most influential predictor, directly enhancing academic writing performance and indirectly strengthening outcomes through its significant effects on digital tool use and writing engagement strategies. While digital tools had a modest direct effect on writing performance, they played an important role in promoting engagement behaviors that contributed to writing success. Writing engagement strategies, in turn, demonstrated a meaningful impact on academic writing performance, underscoring the value of active, self-regulated approaches to writing.

These findings collectively highlight the importance of designing cognitively challenging tasks supported by digital resources and engagement scaffolds to improve academic writing in EFL contexts.

DISCUSSION

This study examined the relationships among writing task complexity, use of digital tools, writing engagement strategies, and academic writing performance among EFL university students in Indonesia. The findings confirmed all six hypothesized paths, indicating that these constructs are interconnected and collectively shape student writing performance. Rather than viewing these factors in isolation, this study underscores the importance of understanding how task demands, student engagement, and digital mediation operate together in shaping writing outcomes. The following discussion interprets the findings, revisits the earlier literature, and considers both theoretical contributions and practical applications.

H1: Writing Task Complexity Correlates with Academic Writing Performance

The finding that writing task complexity significantly predicts academic writing performance ($\beta = 0.363$, $T = 3.952$, $p < 0.05$) confirms Hypothesis 1, indicating that cognitively demanding tasks can enhance learners' ability to produce structured, coherent, and high-quality academic texts. This aligns with Rahimi and Zhang (2019), who found that increased task complexity stimulates more cohesive and organized writing. Similarly, Li et al. (2024) demonstrated that argumentative and synthesis-based writing tasks challenge learners to think more critically and organize their ideas more effectively. This outcome also supports Sweller et al.'s (2011) cognitive load theory, particularly the claim that appropriate task complexity, when matched with student readiness, can stimulate productive cognitive engagement. In this study, students likely benefited from their prior academic writing experience, which enabled them to manage complexity without overload. This is consistent with Tabari et al. (2024), who advocated tiered task difficulty in academic writing instruction. However, the moderate effect size suggests that while complexity contributes to improved writing, it is insufficient to explain academic performance variance alone. As Teng and Ying (2023) argued, students' emotional and motivational responses to task demands also play a role. Therefore, task design must be balanced with adequate support to ensure that complexity leads to learning rather than frustration. Similarly, Ghaderi et al. (2022) emphasized that while cognitively demanding tasks promote higher-order thinking skills, their benefits are contingent upon students receiving appropriate scaffolding and support. Without such instructional mediation, excessive complexity may overwhelm learners and inhibit performance gains. This reinforces the importance of designing academic writing tasks that are challenging yet attainable, accompanied by strategic guidance to sustain cognitive engagement.

H2: Writing Task Complexity Correlates with Writing Engagement Strategies

The strong effect of task complexity on writing engagement strategies ($\beta = 0.560$, $T = 9.107$, $p < 0.05$) confirms Hypothesis 2, reinforcing the view that more cognitively demanding tasks encourage students to invest effort and adopt goal-directed behaviors. This result aligns with Z. Zhang and Hyland (2023), who found that EFL learners respond to complex academic writing tasks with increased effort in planning, organizing, and revising their work. Such demands encourage students to develop goal-directed behaviors, rather than relying on rote task completion. This finding also supports the engagement framework proposed by Hiver et al. (2024), who emphasized that writing engagement encompasses not only behavioral dimensions (e.g., time-on-task) but also cognitive and emotional investment. In the current study, writing tasks that were cognitively complex likely activated all three dimensions, behaviorally through planning and revision, cognitively through idea organization, and affectively through sustained effort. Although the overall effect is positive, the variability in student engagement remains a concern. As Teng and Ying (2023) have argued, some learners, particularly

those with lower self-efficacy or limited writing confidence, may perceive high task complexity as intimidating rather than motivating. These students may resort to surface-level strategies or disengage entirely, especially in the absence of clear guidance. Future research could explore how perceptions of task difficulty and emotional responses influence the depth and quality of engagement strategies across different learner profiles.

H3: Writing Task Complexity Correlates with the Use of Digital Tools

The strong and statistically significant relationship between writing task complexity and the use of digital tools ($\beta = 0.694$, $T = 14.064$, $p < 0.05$) confirms Hypothesis 3 and illustrates that students respond to cognitively demanding tasks by strategically engaging with technology. As writing complexity increases, learners turn to digital tools not only to manage linguistic accuracy but also to support idea development and text organization. This finding aligns with Tusino et al. (2024), who observed that when tasks require sophisticated argumentation or source integration, students rely more heavily on tools such as grammar checkers and paraphrasing software to scaffold their writing. Likewise, Schcolnik (2018) emphasized the cognitive function of digital tools in lowering mental load, thereby allowing students to redirect attention toward higher-order concerns such as structure and coherence. Importantly, this study also supports Nazari et al. (2021), who found that students increasingly use tools to refine content-level features when faced with complex prompts. These tools act not merely as error detectors but as platforms for exploring alternatives in phrasing, cohesion, and flow, especially under pressure to perform on cognitively intensive tasks. Pardede (2024) adds further insight by highlighting how collaborative tools like Google Docs enhance interaction and co-construction of text. In complex assignments, these tools enable distributed idea generation and real-time revision, allowing learners to manage task demands more efficiently.

Although the findings affirm the role of digital tools as cognitive supports, the relationship may be partially shaped by the characteristics of the sample. Since all participants were English majors with formal training in argumentative writing and regular use of digital tools, they may have been particularly responsive to task difficulty and better equipped to integrate technology strategically. In more diverse student populations, such as those with less writing instruction or limited access to technology, this relationship may be less pronounced. Future research could explore these individual and contextual differences further. Ultimately, writing task complexity emerges as a key predictor of digital tool use, underscoring the need to consider both cognitive demand and technological readiness when designing effective academic writing instruction.

H4: Use of Digital Tools Is Associated with Academic Writing Performance

The finding that the use of digital tools positively influences academic writing performance ($\beta = 0.222$, $T = 3.247$, $p < 0.05$) supports Hypothesis 4, suggesting that these tools can improve written outcomes, although with a modest effect. This is consistent with previous studies showing that digital tools help students improve grammar, organization, and cohesion, especially when feedback is applied critically (Cavaleri & Dianati, 2016; Pitukwong & Saraiwang, 2024). However, the relatively small effect size may reflect differences in how students engage with these tools, with some using them strategically and others more superficially. Marzuki et al. (2023) and Wiboolyasarin et al. (2024) note that students often lack the metacognitive skills to evaluate and implement feedback from AI or grammar checkers effectively. Therefore, explicit training in how to use digital tools for higher-order writing development is essential. Additionally, the limited effect of digital tools on performance may reflect a saturation point among the sampled students. As English majors who had completed or were enrolled in academic writing courses and used digital tools regularly, participants may have already reached a level of writing competence where digital support brings only incremental improvement. In contrast, novice writers or students in other disciplines might experience stronger gains

from tool use. These findings suggest that the influence of digital tools may vary depending on learners' writing backgrounds and should be interpreted in context.

H5: Use of Digital Tools Is Associated with Writing Engagement Strategies

The significant relationship between the use of digital tools and writing engagement strategies ($\beta = 0.278$, $T = 3.833$, $p < 0.05$) confirms Hypothesis 5 that technology not only supports product development but also facilitates process-oriented engagement. Zou et al. (2022) found that access to feedback-enabled platforms encourages students to plan, revise, and reflect on their work more actively. Shen et al. (2023) also highlighted that such tools promote sustained involvement by making revision more interactive and manageable. However, as Marzuki et al. (2023) noted, the effectiveness of digital tools in supporting engagement is closely tied to students' ability to use them reflectively. If tools are used passively, their impact on strategic engagement diminishes. This reinforces the need for instructors to teach students how to engage with tools purposefully, for example, through revision tracking, reflection tasks, or peer feedback comparisons. Furthermore, different types of digital tools may promote distinct forms of engagement. Feedback-focused platforms, such as AI-assisted evaluators or automated writing assessment systems, can stimulate reflective revision strategies, while collaborative writing tools like Google Docs tend to foster planning, peer dialogue, and iterative drafting. Therefore, instructors should purposefully align tool selection with the engagement outcomes they seek to cultivate, providing explicit training on both the technical and strategic use of these tools.

H6: Writing Engagement Strategies Are Associated with Academic Writing Performance

The final result, that writing engagement strategies significantly predict academic writing performance ($\beta = 0.294$, $T = 3.078$, $p < 0.05$), supports Hypothesis 6, reaffirming the central role of strategic behavior in academic writing success. This aligns with Finlayson and McCrudden (2020), who emphasized that goal-setting, monitoring, and self-revision contribute directly to writing quality. Z. Zhang and Hyland (2023) similarly found that students who actively engaged in peer review and feedback usage produced higher-quality academic texts. Hiver et al. (2024) conceptualized engagement as more than task completion, encompassing cognitive and emotional investment. In the present study, students who actively revised, reflected, and structured their writing more deliberately were better able to meet academic writing demands. However, as Wu and Schunn (2021) observed, students often emphasize lower-order revisions unless explicitly guided. Teachers must therefore scaffold engagement strategies explicitly, helping students internalize the skills necessary for recursive, process-driven writing.

The findings of this study offer several practical implications for EFL academic writing instruction, particularly in contexts where students have prior academic writing experience and regular access to digital tools. Because writing task complexity significantly influences academic writing performance, both directly and indirectly through the use of digital tools and engagement strategies, teachers should design cognitively demanding tasks that are carefully scaffolded. For instance, structured argumentative writing tasks can promote higher-order thinking while minimizing cognitive overload. The strong relationship between task complexity and digital tool use suggests that students are more likely to engage with technology when faced with intellectually challenging tasks. Therefore, educators should integrate digital tools such as AI-based writing assistants or collaborative platforms like Google Docs into instruction and provide guided training on their effective use. The mediating role of engagement strategies also underscores the need to foster active student involvement through peer feedback, guided revision, and reflective checklists that support sustained attention and self-regulation. However, these strategies may be most effective for learners with similar profiles to those in this study, namely, English majors with academic writing backgrounds and familiarity with digital tools. In more diverse classrooms, students with limited experience or access may require additional support to fully benefit from these interventions. Overall, the findings support a pedagogical model that

combines complex task design, digital integration, and engagement-oriented scaffolding, adapted to learners' needs to enhance academic writing outcomes in EFL higher education contexts.

While the findings of this study offer meaningful insights into the interplay between writing task complexity, use of digital tools, writing engagement strategies, and academic performance in EFL academic writing, several limitations should be acknowledged. First, the study employed purposive sampling from a well-defined group of English major students enrolled in academic writing courses at Indonesian universities. While this approach ensured alignment with the study's constructs, particularly argumentative writing competence and digital tool engagement, it also limits the generalizability of the findings to broader populations, such as students in other disciplines, educational levels, or regional contexts. Future studies should consider including participants across diverse fields or employing stratified sampling to enhance representativeness. Second, the study relied solely on self-report instruments, which are subject to social desirability bias and may not fully capture actual tool use or engagement behaviors. Although the measures were carefully validated, triangulating self-report data with log data from writing platforms, revision histories, or observational checklists would provide a more comprehensive view of learners' writing processes. Third, instructional variables such as teaching approach, feedback delivery, or task type were not controlled across participants. These contextual factors could have significantly influenced how students engaged with complex tasks or digital tools. Future research could adopt a quasi-experimental or classroom-based design to account for instructional variation and better isolate the effects of the studied variables. Fourth, the cross-sectional design of this study limits conclusions about causality and change over time. Longitudinal studies tracking students' development in tool use and engagement strategies over an academic semester, or across multiple writing tasks, could yield richer insights into how these constructs evolve. Finally, while this study examined engagement and tool use at a general level, it did not distinguish between specific types of engagement strategies (e.g., planning vs. revision) or tool functions (e.g., grammar-checking vs. paraphrasing). Future studies could benefit from finer-grained analysis to determine which strategies and tools are most effective for which types of writing tasks. Despite these limitations, the study offers a robust foundation for understanding how cognitive, behavioral, and technological factors interact in EFL academic writing. Addressing these limitations in future research will strengthen both the theoretical grounding and practical applicability of findings in the evolving landscape of digital academic literacy.

CONCLUSIONS

This study explored the complex relationships among writing task complexity, use of digital tools, writing engagement strategies, and academic writing performance among EFL university students. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), the findings confirmed all six proposed hypotheses, offering empirical support for a model that integrates cognitive, behavioral, and technological dimensions of writing. The results showed that writing task complexity significantly predicted both digital tool use and writing engagement strategies, emphasizing the role of cognitive demand in shaping learners' writing behaviors. The use of digital tools, in turn, was found to influence not only engagement but also writing performance, though with a relatively modest effect size. Engagement strategies emerged as a strong predictor of academic writing performance, confirming the importance of self-regulation, planning, and revision in producing high-quality texts. These findings reinforce the importance of designing writing instruction that strategically integrates complex tasks, tool-supported revision, and engagement scaffolding. In particular, the study highlights that tool use alone does not ensure improved performance; learners must be taught how to interact meaningfully with digital feedback and apply it reflectively. This can be facilitated through instructional strategies such as modeling how to revise using tool-generated suggestions, guiding students in comparing their original and revised drafts, and encouraging reflection on tool-based revisions. These practices can help learners move beyond superficial corrections and make more meaningful improvements in their academic writing.

A key contribution of this study is the development and validation of a model that captures the interplay between cognitive writing demands, technological tools, and student engagement. This area remains underexplored in EFL writing research. The inclusion of digital tools as both a response to complexity and a contributor to performance is especially relevant given the increasing integration of AI-driven technologies in higher education. Nonetheless, several limitations must be acknowledged. The cross-sectional design, use of self-report data, and homogeneous purposive sampling of English majors with prior academic writing experience and regular digital tool use limit the broader applicability of the findings. These results are most relevant to learners with similar academic and technological profiles. Future research should adopt longitudinal or mixed-method designs and include more diverse populations to explore how digital tool use and engagement strategies develop across varied learning contexts. In conclusion, effective academic writing instruction in EFL contexts must move beyond task completion, equipping students with the metacognitive, technological, and strategic competencies needed to manage task complexity, engage deeply, and use digital tools not as shortcuts, but as supports for meaningful and reflective revision.

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