

## GRAMMAR CHALLENGES IN WRITING PHYSICS RESEARCH ABSTRACTS BY UNDERGRADUATE STUDENTS: A MIXED-METHODS STUDY

<sup>1</sup>Riandra Izazi, <sup>2</sup>Raden Mas Muhammad Yassin Hanif, <sup>3</sup>Wahyunengsih

<sup>1, 2, 3</sup> Faculty of Tarbiyah and Teacher Training, State

Islamic University Syarif Hidayatullah Jakarta

<sup>1</sup>riandra.izazi23@mhs.uinjkt.ac.id; <sup>2</sup>yassin.hanif23@mhs.uinjkt.ac.id;

<sup>3</sup>wahyu.nengsih@uinjkt.ac.id

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### ABSTRACT

This study aims to identify the grammar problems that undergraduate physics students have when writing research abstracts in English. A sequential explanatory mixed-methods design was employed, involving a survey of 50 undergraduate physics students followed by semi-structured interviews with two selected participants to gain deeper insights into the causes of the identified difficulties. The findings reveal four primary areas of difficulty: tense and verb-phrase accuracy, complex-sentence construction, article and determiner usage, and prepositional collocation errors. Quantitative results show that students have the most difficulty choosing the correct verb phrase, forming relative clauses, determining articles for abstract scientific concepts, and applying technical collocations. Further analysis showed that these mistakes came from not knowing enough about English grammar rules, translating directly from Indonesian, and not being familiar with how academic writing is done in English. These findings highlight the need for discipline-specific English for Academic Purposes (EAP) instruction, particularly in designing curriculum components that emphasize grammar usage, rhetorical tense functions, and technical collocations in physics abstract writing.

**Keywords:** academic writing, EAP, grammar challenges, physics abstract writing, undergraduate physics students

### INTRODUCTION

Abstracts play a crucial role in scientific writing as they provide a concise overview of research objectives, methods, and findings, enabling readers to quickly assess the relevance and credibility of a study (Andika et al., 2025; Flowerdew, 2012; Ghafar & Raheem, 2025; Hyland, 2004; Yu, 2024). In physics, where research is often complex and technical, a well-structured abstract is essential for effective scientific communication. The quality of an abstract therefore serves as an important indicator of both readability and academic rigor. Consequently, students' ability to write clear and grammatically accurate abstracts deserves serious academic attention, particularly in higher education contexts where English is used as the medium of scholarly publication.

However, writing abstracts in English poses substantial challenges for non-native speakers, including undergraduate physics students. These students must simultaneously demonstrate mastery of disciplinary content and apply appropriate academic grammar (Hyland, 2004; Lewis, 2025). Previous studies consistently report frequent grammatical

errors in students' academic writing, such as incorrect tense usage, article misuse, prepositional errors, and weak sentence structure (Alghazo & Alshraideh, 2020; Amir et al., 2023; Fiaz & Rubab, 2024; Jassada Buaboonnam, 2015; Nguyen, 2020). Similar findings are reported by (Agustin & Wulandari, 2022), who found that grammatical errors particularly in article usage, plural forms, and prepositions remain dominant in students' academic essays, often accompanied by difficulties in organizing ideas coherently. Recent EFL studies further confirm that unresolved grammatical weaknesses directly reduce clarity, coherence, and academic credibility in student writing (Ghafar & Raheem, 2025; Lewis, 2025). These persistent linguistic challenges have been widely reported in recent studies focusing on Indonesian EFL contexts, indicating that instructional and structural issues continue to hinder students' academic writing development (Mustakim et al., 2025; Syarfuni et al., 2025).

Despite extensive research on grammatical errors in academic writing, relatively few studies focus specifically on abstract writing by physics students within the Indonesian EFL context. Existing research tends to address general writing skills or broader STEM writing without closely examining how grammatical difficulties manifest in abstracts, which require high levels of conciseness, rhetorical awareness, and genre-specific language use. Moreover, instructional practices in scientific writing vary widely across institutions, and many physics students receive limited structured guidance on abstract writing (Lewis, 2025). Recent studies also suggest that while digital writing tools such as Grammarly can assist students in identifying surface-level grammatical errors, they do not fully resolve deeper issues related to sentence structure, word formation, and genre awareness (Suhayati, 2025; Sulistyanto, I., & Prayoga, K. A., 2025). This condition highlights a clear research gap concerning the specific grammatical challenges faced by physics students when composing English abstracts.

Grounded in the framework of English for Academic Purposes (EAP), which emphasizes discipline-specific language instruction (Hyland, 2004), this study aims to identify the most prevalent grammatical difficulties encountered by undergraduate physics students in writing English research abstracts. By combining quantitative and qualitative data, this research seeks to reveal dominant error patterns related to tense and verb forms, complex sentence construction, article and determiner usage, prepositions, collocations, and academic vocabulary. The findings are expected to contribute empirical evidence to the field of EAP for physics students and offer pedagogically actionable insights for designing grammar-focused, discipline-oriented abstract writing instruction in higher education.

## **METHOD**

### ***Research design***

This study employed a sequential explanatory mixed-methods design to investigate the grammatical difficulties faced by undergraduate physics students when writing research abstracts in English. In the first phase, quantitative data were collected through a survey to identify the types and levels of grammatical difficulties experienced by students. In the second phase, qualitative data were gathered through semi-structured interviews, which were designed based on the survey results to explore the underlying reasons for the identified difficulties.

This design was chosen because the study aimed not only to determine the frequency of grammatical problems but also to explain them from the students' perspectives. Compared to other mixed-methods designs, the sequential explanatory

approach allows qualitative findings to clarify and enrich quantitative results, making it particularly suitable for examining grammar challenges in academic writing within a non-English-major context.

### ***Participant***

The participants of this study were 50 undergraduate physics students enrolled at UIN Jakarta. These students had prior exposure to basic academic writing tasks and experience in writing research abstracts in English. They were selected because physics students, as non-English majors, commonly face challenges in applying English grammar when writing scientific texts.

A stratified convenience sampling technique was employed to ensure representation of students with different levels of academic experience. The strata were based on students' academic year, specifically second- and third-year students, as these groups had already completed introductory academic writing-related courses. Within each stratum, participants were selected based on accessibility and willingness to participate.

From the survey respondents, two students were purposively selected for follow-up interviews based on their questionnaire results to represent different levels of perceived grammatical difficulty. These interview participants provided more in-depth insights into the grammatical challenges identified in the quantitative phase.

### ***Research instrument***

Two research instruments were employed in this study: a questionnaire and a semi-structured interview guide. The questionnaire consisted of 20 items designed to measure students' perceived grammatical difficulties in writing English research abstracts, covering key aspects such as tense usage, verb phrases, sentence structure, articles, and prepositions. Responses were measured using a five-point Likert-type scale, ranging from 1 (very not difficult) to 5 (very difficult), with higher scores indicating greater perceived difficulty. In addition, a semi-structured interview guide comprising eight open-ended questions was used to obtain qualitative data by exploring students' experiences, challenges, and strategies related to grammatical issues in abstract writing.

### ***Data collection procedure***

The data collection in this study happened in three main steps.

1. The questionnaire was sent out online during the first semester of 2025 to let more students take part, including those who preferred different ways to access it. This helped get a good mix of quantitative data.
2. After that, all the responses were checked to make sure they were full, consistent, and right before moving on to analysis. This helped keep the data accurate.
3. Then, semi-structured interviews were done in Indonesian, and the notes were written down and translated into English to make sure everything was clear and ready for deeper analysis. Overall, all these steps were taken one after another to make sure the data was correct, meaningful, and helped reach the study's goals.

### ***Data analysis***

Quantitative data obtained from the questionnaires were analyzed using descriptive statistics, including mean scores, to identify grammatical aspects that

students perceived as most and least difficult when writing English research abstracts. The quantitative analysis was conducted using Microsoft Excel, with higher mean scores indicating greater levels of perceived grammatical difficulty. Qualitative data from the semi-structured interviews were transcribed and analyzed using thematic analysis, which involved coding similar responses, grouping them into categories, and identifying recurring themes that explained the quantitative findings. Due to the limited number of interview participants, the qualitative coding process was conducted manually without the use of specialized qualitative analysis software.

### ***Ethical Considerations***

Ethical considerations were observed throughout the study. All participants were informed about the purpose of the research and provided informed consent prior to data collection. Participation was voluntary, and participants were informed of their right to withdraw at any stage without penalty. To ensure confidentiality and anonymity, participants' identities were coded, and all collected data were used solely for research purposes.

## **FINDINGS AND DISCUSSION**

This study found various challenges in using grammar experienced by physics students when writing abstracts in English. These findings came from a combination of data surveys and interviews, which consistently showed that difficulties in grammar were a major obstacle in writing scientific abstracts. These results are in line with previous studies, which stated that science students often experience difficulties in applying grammar appropriately in the context of structured academic writing. The findings are presented based on mean scores obtained from a five-point difficulty scale, where higher scores indicate greater perceived difficulty.

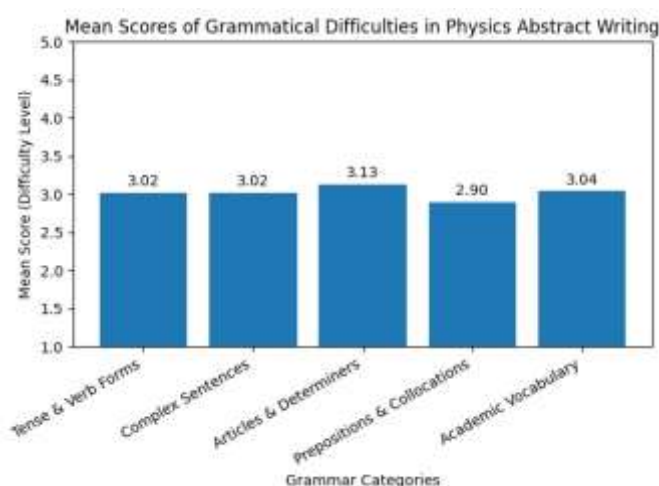


Figure 1. Mean Scores of Grammatical Difficulties in Physics Abstract Writing

To provide a clearer overview of grammatical difficulty trends, Figure 1 presents the mean scores across five major grammar categories. The figure shows that article and determiner usage constitutes the most challenging area for physics students ( $M = 3.13$ ), followed by academic vocabulary and word formation ( $M = 3.04$ ). Difficulties in tense and verb forms as well as complex sentence construction show similar levels of difficulty ( $M = 3.02$ ), while prepositions and collocations appear to be relatively less challenging ( $M = 2.90$ ). Overall, the visual representation highlights that grammar

issues related to abstract concepts and academic language pose greater challenges than those related to basic grammatical structures.

Table 1.  
Most and Least Frequent Difficulties in Tense and Verb Form Accuracy

Statement	Category	Mean Score
I have trouble writing clauses with the right verb phrase, such as “was found to increase.”	Most Frequent	3.02
I am having difficulty determining the correct tense to describe the purpose of a physics experiment (for example, “This study aims...” or “This study aimed...”).	Least Frequent	2.72

**Note. Scale:** 1 = Very Not Difficult, 2 = Not Difficult, 3 = Moderately Difficult, 4 = Difficult, 5 = Very Difficult.

The findings indicate that tense and verb phrase accuracy constitute one of the most prominent grammatical challenges faced by physics students when writing English abstracts. As shown in Table 1, difficulty in constructing clauses with appropriate verb phrases (e.g., *was found to increase*) received the highest mean score ( $M = 3.02$ ), while determining the correct tense to state research objectives showed a slightly lower mean score ( $M = 2.72$ ). Despite this difference, both aspects reflect persistent difficulties in applying tense accurately within academic writing contexts.

This quantitative result is reinforced by interview data, in which both respondents reported confusion in selecting appropriate tenses when writing abstracts. One respondent emphasized students’ limited understanding of temporal reference, leading to incorrect tense selection, while the other highlighted difficulties in applying tense according to rhetorical functions, such as using the present tense for general statements and the past tense for research procedures and findings. The convergence of survey and interview data suggests that tense-related errors stem from both insufficient grammatical knowledge and limited awareness of academic genre conventions.

From an EAP perspective, these findings align with previous studies indicating that non-native English speakers frequently struggle with tense usage due to the absence of grammatical time markers in Indonesian (Jassada Buaboonnam, 2015; Nguyen, 2020). In addition, academic abstracts require systematic shifts in tense according to rhetorical purpose, which poses further challenges for students unfamiliar with genre-based writing conventions (Hyland, 2004). Similar difficulties have also been reported among STEM students in other EFL contexts, suggesting that tense-related challenges are not unique to Indonesian physics students but represent a broader issue in scientific writing.

Pedagogically, these findings imply the need for discipline-specific EAP instruction that explicitly addresses rhetorical tense usage in physics abstracts. Instructors may incorporate guided abstract-writing activities that model appropriate tense use across abstract sections, as well as targeted exercises focusing on verb phrase construction commonly used in physics research. Such instructional strategies may help students develop greater grammatical accuracy and genre awareness in academic writing.



Table 2.  
Most and Least Frequent Challenges in Constructing Complex Sentences

Statement	Category	Mean Score
I have difficulty using relative clauses to describe tools, such as “The sensor that was used in this experiment...”	Most Frequent	3.02
I don't quite understand how to connect the results to the theory using connecting words such as <i>therefore</i> or <i>however</i> .	Least Frequent	2.59

**Note. Scale:** 1 = Very Not Difficult, 2 = Not Difficult, 3 = Moderately Difficult, 4 = Difficult, 5 = Very Difficult.

As shown in Table 2, constructing complex sentences, particularly through the use of relative clauses, emerged as a significant grammatical challenge for physics students when writing English abstracts. The survey results indicate that difficulty in using relative clauses to describe experimental tools and procedures received the highest mean score ( $M = 3.02$ ), while the use of logical connectors such as *therefore* or *however* showed a lower mean score ( $M = 2.59$ ). These findings suggest that students experience greater difficulty in combining information within a single sentence than in linking ideas across sentences.

Interview data further clarify these quantitative results. Both respondents reported that students often struggle to construct relative clauses due to limited understanding of syntactic relationships among sentence elements, such as subject, verb, and object. One respondent emphasized that students tend to write incomplete or illogical relative clauses when describing instruments or procedures, while the other noted that students frequently separate related information into short, simple sentences, resulting in reduced coherence. The convergence of survey and interview findings indicates that difficulties in complex sentence construction are closely related to weak syntactic awareness rather than a lack of familiarity with discourse connectors.

From a broader academic writing perspective, these findings are consistent with previous studies reporting that non-native English writers face challenges in producing complex sentences due to structural differences between English and their first language (Jassada Buaboonnam, 2015; Nguyen, 2020). In scientific abstract writing, the ability to compress information into concise and logically connected sentences is essential (Hyland, 2004). Similar challenges have been identified among STEM students in other EFL contexts, suggesting that difficulties in relative clause construction represent a common issue in academic English writing beyond the Indonesian context.

Pedagogically, these findings indicate that physics-oriented EAP instruction should explicitly address complex sentence construction, particularly the use of relative clauses in describing research instruments, procedures, and findings. Instructors should provide structured sentence-combination activities, explicit instruction on syntactic relationships (e.g., subject verb object patterns), and guided practice using authentic physics abstracts as models. By integrating sentence-level grammar instruction with discipline-specific writing tasks, EAP courses can help students improve coherence and precision in abstract writing.

Table 3.  
Most and Least Frequent Challenges in Article and Determiner Usage

Statement	Category	Mean Score
I'm not sure when to use theoretical or experimental results with the correct article.	Most Frequent	3.13
I often forget to add articles before experimental tools such as “a voltmeter” or “an oscilloscope.”	Least Frequent	2.47

**Note. Scale:** 1 = Very Not Difficult, 2 = Not Difficult, 3 = Moderately Difficult, 4 = Difficult, 5 = Very Difficult.

As presented in Table 3, difficulties in article and determiner usage represent a significant grammatical challenge for physics students when writing English abstracts. The survey results show that uncertainty in selecting appropriate articles for abstract scientific concepts, such as *theoretical* or *experimental results*, received the highest mean score ( $M = 3.13$ ). In contrast, the use of articles before concreting experimental tools, such as *a voltmeter* or *an oscilloscope*, showed a lower mean score ( $M = 2.47$ ). This pattern indicates that students experience greater difficulty when dealing with abstract or non-physical scientific terms.

Interview findings further illuminate this pattern. Both respondents reported that students find it easier to apply articles correctly when the noun refers to tangible objects that can be easily visualized. However, when dealing with abstract scientific terms, students often struggle to determine specificity and definiteness, leading to inappropriate article selection. One respondent emphasized students' limited understanding of conceptual meaning, while the other highlighted confusion between first mention (*a/an*) and specific reference (*the*) within academic contexts. The convergence of survey and interview data suggests that article-related errors are influenced by both semantic understanding and contextual awareness.

From an EAP perspective, these findings are consistent with previous research indicating that article usage poses persistent challenges for non-native English writers due to its reliance on context and specificity rather than fixed grammatical rules (Hyland, 2004). Similar difficulties have been documented among science and STEM students in various EFL contexts, suggesting that article-related errors are a common feature of academic writing beyond the Indonesian setting (Jassada Buaboonnam, 2015; Nguyen, 2020). This cross-context similarity highlights the complexity of article use in scientific discourse.

Pedagogically, the findings indicate that EAP instruction for physics students should explicitly focus on article usage in relation to abstract scientific concepts. Instructors should provide targeted practice that distinguishes generic and specific reference in academic texts, supported by examples drawn from authentic physics abstracts. Activities such as guided article analysis, contextualized rewriting tasks, and discipline-specific vocabulary instruction may help students develop greater accuracy and confidence in using articles appropriately in abstract writing.

Table 4.  
Most and Least Frequent Challenges in Preposition and Collocation Accuracy

Statement	Category	Mean Score
I sometimes mistakenly write “difference of potential” when it should be “difference in potential.”	Most Frequent	2.9
I often misuse prepositions for the location of experiments (“in the lab” vs. “at the lab”).	Least Frequent	2.61

**Note. Scale:** 1 = Very Not Difficult, 2 = Not Difficult, 3 = Moderately Difficult, 4 = Difficult, 5 = Very Difficult.

As shown in Table 4, difficulties in the accurate use of prepositions and technical collocations constitute a notable challenge for physics students when writing English abstracts. The survey results indicate that errors in scientific collocations, such as *difference in potential*, received the highest mean score ( $M = 2.90$ ), whereas difficulties in using basic prepositions related to location, such as *in the laboratory* or *at the laboratory*, showed a lower mean score ( $M = 2.61$ ). This pattern suggests that students are more likely to struggle with discipline-specific collocations than with commonly used prepositional phrases.

Interview findings provide further explanation for these quantitative results. Both respondents reported that students frequently rely on direct translation from Indonesian when producing scientific expressions in English, which leads to unidiomatic collocations. One respondent emphasized that students often assume literal equivalence between Indonesian and English prepositional patterns, while the other highlighted students' limited awareness of semantic relationships between verbs, nouns, and prepositions in technical contexts. The alignment between survey and interview data indicates that collocation-related errors primarily stem from transfer from the first language and insufficient exposure to academic English usage.

From an EAP and academic discourse perspective, these findings are consistent with previous studies showing that collocational competence is a critical yet challenging aspect of scientific writing for non-native English speakers (Hyland, 2004). Research conducted in various EFL contexts has similarly reported that STEM students frequently experience difficulties with technical collocations and preposition selection due to the idiomatic nature of academic language (Nguyen, 2020). This suggests that such challenges are not limited to the Indonesian context but reflect a broader issue in academic English writing.

Pedagogically, these findings indicate that EAP instruction for physics students should explicitly incorporate training in technical collocations and context-appropriate preposition use. Instructors are encouraged to integrate corpus-based activities, discipline-specific collocation lists, and contextualized sentence-rewriting exercises drawn from authentic physics texts. By systematically exposing students to common collocational patterns in scientific discourse, EAP courses can help reduce reliance on direct translation and improve linguistic accuracy in abstract writing.



Table 5.  
Most and Least Frequent Challenges in Word Formation and Academic Style

Statement	Category	Mean Score
I often rewrite ideas using the same words due to my limited academic vocabulary.	Most Frequent	3.04
I tend to use informal words such as “we got the result” rather than “the result was obtained.”	Least Frequent	2.68

**Note. Scale:** 1 = Very Not Difficult, 2 = Not Difficult, 3 = Moderately Difficult, 4 = Difficult, 5 = Very Difficult.

As presented in Table 5, limited academic vocabulary and difficulties in word formation represent a major challenge for physics students when writing English research abstracts. The survey results indicate that students’ tendency to repeatedly use the same words due to limited academic vocabulary received the highest mean score ( $M = 3.04$ ). In contrast, the use of informal expressions, such as “*we got the result*”, showed a lower mean score ( $M = 2.68$ ), suggesting that although students are aware of the need for formality in academic writing, they lack sufficient lexical resources to express ideas appropriately.

Interview findings further support these quantitative results. Both respondents emphasized that students often struggle to distinguish between related word forms, such as *measure*, *measurement*, and *measurable*, which leads to errors in word choice and sentence construction. One respondent highlighted student’s limited understanding of morphological structures, while the other noted that insufficient academic vocabulary often forces students to oversimplify ideas or produce grammatically inaccurate sentences. The convergence of survey and interview data suggests that vocabulary-related difficulties are closely linked to students’ limited exposure to academic texts and inadequate knowledge of word families.

From an EAP perspective, these findings are consistent with previous research emphasizing the central role of academic vocabulary in scientific writing (Hyland, 2004). Similar challenges have also been reported among science and STEM students in various EFL contexts, indicating that limited academic vocabulary and weak control of word formation are common obstacles in academic writing beyond the Indonesian context (Jassada Buaboonnam, 2015; Nguyen, 2020). This cross-context evidence highlights the importance of lexical competence in maintaining clarity, precision, and academic register in research abstracts.

Pedagogically, these findings indicate that EAP instruction for physics students should explicitly emphasize the development of academic vocabulary and word formation awareness. Instructors should integrate focused instruction on word families, discipline-specific academic vocabulary, and morphological patterns commonly used in physics discourse, supported by contextualized practice using authentic research abstracts. Activities such as vocabulary expansion tasks, word-formation exercises, and guided paraphrasing can help students maintain an academic register and improve overall clarity and accuracy in abstract writing.

## CONCLUSION

This study looked at the grammar problems that undergraduate physics students face when writing English research abstracts. The results show five main areas where students struggle: using the right tense and verb forms, building complex sentences, choosing the correct articles and determiners, using prepositions and common word combinations correctly, and having limited knowledge of academic vocabulary. The match between the survey results and the interview responses shows that these issues are consistent and come from both gaps in language skills and a lack of understanding about how to write academically.

The findings stress the importance of offering more support that is specific to physics in English for Academic Purposes programs. Physics students need clear teaching on how to use rhetorical tenses, create complex sentences, use scientific word pairs, and build academic vocabulary to write clear and correct abstracts. These results support earlier research on EFL academic writing and show the value of including focused grammar lessons in physics-related EAP courses to help students better prepare for scientific writing.

Therefore, EAP instructors are encouraged to integrate explicit grammar instruction into abstract-writing activities, provide model abstracts from physics journals, and offer structured feedback focusing on common grammatical errors. Such instructional actions can directly address the identified difficulties and improve students' ability to produce grammatically accurate and academically appropriate research abstracts.

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