

Perceptions of Technical Vocabulary Learning in Physics ESP: A Survey Study

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ABSTRACT

This study investigates Physics students' perceptions of technical vocabulary learning in an English for Specific Purposes (ESP) context. Using a quantitative descriptive survey, data were collected from 50 undergraduate Physics students through a 25-item questionnaire covering five dimensions: relevance and importance, difficulty and comprehension, learning strategies, usage and application, and context and exposure. The findings indicate that students strongly recognize the academic importance of technical vocabulary; however, they continue to experience substantial challenges in comprehension and productive use, particularly in formal academic writing. Students primarily rely on exposure-based and memorization strategies, which appear insufficient for deeper conceptual understanding and accurate application. The results reveal a clear gap between students' awareness of technical vocabulary importance and their actual learning outcomes, underscoring the need for more contextualized, discipline-integrated, and learner-centered ESP instruction in Physics.

Keywords: English for Specific Purposes (ESP), Physics Education, Students' Perceptions, Technical Vocabulary, Vocabulary Learning Strategies

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INTRODUCTION

Technical vocabulary plays a central role in English for Specific Purposes (ESP), particularly in science-based disciplines such as Physics. Unlike general vocabulary, technical terms carry precise, discipline-bound meanings that are essential for understanding scientific concepts, interpreting data, and communicating academic ideas accurately. Words such as *velocity*, *momentum*, and *resistance* represent specific physical quantities that cannot be adequately replaced by everyday language. Without sufficient mastery of this specialized vocabulary, students may struggle to comprehend scientific texts, follow lectures, or express their understanding of Physics concepts in English.

In the context of ESP, technical vocabulary refers to specialized lexical items that are closely associated with a particular field of study or profession. These terms are commonly used by experts, researchers, and students within the discipline to describe concepts, processes, and phenomena in a precise and unambiguous manner. In Physics, many technical terms are abstract, symbolic, and mathematically grounded, which makes them inherently challenging for learners, especially those studying in a foreign language. Previous studies have noted that Physics vocabulary often involves abstract concepts and overlapping meanings between everyday English and scientific usage, which can lead to misunderstanding and confusion among learners (Binder, 2023; Shektibaev & Rozimatov, 2024).

Recent conditions in teaching and learning technical vocabulary in Physics ESP contexts indicate that many students experience considerable difficulties. Limited exposure to English-based Physics resources, insufficient opportunities to use technical terms in meaningful contexts, and a lack of integration between language instruction and content learning remain persistent challenges. As a result, students often rely on rote memorization rather than conceptual understanding, which negatively affects their ability to retain and apply technical vocabulary effectively (Kholmatova, 2022). This

situation suggests that traditional vocabulary teaching approaches may not adequately address the specific linguistic demands of Physics ESP learners.

A growing body of research has examined technical vocabulary learning within ESP; however, much of this research has primarily focused on instructional strategies, material development, or linguistic analysis. While these studies provide valuable insights, they tend to overlook students' own perspectives on learning technical vocabulary, particularly in the context of Physics. Understanding students' perceptions is important because perceptions influence motivation, strategy use, and engagement in learning activities. Learners' views can reveal the challenges they face, the strategies they find helpful, and the extent to which existing ESP instruction meets their academic needs (Muryani & Yunus, 2024). In addition, preliminary observations and prior studies suggest that Physics students often struggle to distinguish between the general and technical meanings of certain terms. Words such as *work*, *force*, and *power* are commonly used in everyday English but have specific scientific definitions in Physics. This lexical overlap frequently leads to misconceptions and hinders students' comprehension of scientific texts and problem-solving tasks (Grea & Viard, 1995; Shrestha et al., 2023). These challenges are further intensified by limited exposure to authentic Physics materials in English and insufficient practice using technical vocabulary in academic communication.

Based on classroom observations and learning experiences in Physics ESP settings, students often demonstrate hesitation and low confidence when using technical vocabulary in English. Many students avoid using specific Physics terms during discussions or written tasks due to uncertainty about meaning or pronunciation. Such affective factors, including anxiety and fear of making mistakes, can negatively influence students' participation and learning outcomes (Cohen, 2012). These observations highlight the need to consider not only cognitive but also affective dimensions of technical vocabulary learning. Despite the recognized importance of technical vocabulary in Physics ESP, there remains a noticeable research gap concerning students' perceptions of learning such vocabulary, particularly in higher education contexts. Most existing studies emphasize how technical vocabulary should be taught, rather than how it is experienced by learners themselves. Therefore, this study aims to investigate Physics students' perceptions of learning technical vocabulary in ESP courses. By exploring students' views on the importance, difficulties, learning strategies, and contextual exposure related to technical vocabulary, the study seeks to provide insights that may inform more contextualized, learner-centered, and effective ESP instruction in Physics.

Literature Review

English for Specific Purposes (ESP) in Higher Education

English for Specific Purposes (ESP) has become an essential component of higher education, particularly in disciplines that require engagement with international academic literature and professional communication. ESP focuses on equipping learners with language skills that are directly relevant to their academic or professional fields, rather than emphasizing general communicative competence alone. In academic contexts, ESP is closely associated with English for Academic Purposes (EAP), which supports students in reading scholarly articles, writing academic texts, and presenting research findings using discipline-appropriate language (Shalash, 2024).

For students in science-based disciplines such as Physics, ESP plays a critical role in facilitating access to subject knowledge. Physics students are frequently required to read English-language textbooks, research articles, and laboratory manuals that employ highly specialized terminology. Without adequate ESP support, students may struggle to comprehend these materials or to communicate their scientific understanding effectively. Previous studies have emphasized that ESP instruction in higher education should integrate language learning with disciplinary content to ensure that students can function competently within their academic communities (Rahman & Rukmana, 2022).

Technical Vocabulary in Physics

Technical vocabulary in Physics is characterized by its symbolic, abstract, and discipline-specific nature. Many Physics terms are closely linked to mathematical expressions, symbols, or formulas, such as $F = ma$ or $E = mc^2$, which require learners to understand both linguistic and conceptual representations simultaneously. In addition, Physics vocabulary often refers to abstract concepts that cannot be directly observed, including *energy*, *force*, and *electric field*. These characteristics make technical vocabulary particularly challenging for learners studying Physics through a foreign language (Shektibaev &

Rozimatov, 2024).

Another major challenge in learning Physics vocabulary arises from lexical overlap between everyday English and scientific usage. Common words such as *work*, *power*, and *momentum* have specific definitions in Physics that differ significantly from their general meanings. Research has shown that this overlap frequently leads to misconceptions and misunderstanding, especially when students rely on prior everyday knowledge rather than scientific definitions (Binder, 2023; Yun & Park, 2015). Consequently, insufficient mastery of technical vocabulary can hinder students' ability to read scientific texts, interpret experimental results, and articulate Physics concepts accurately in academic settings.

Students' Perceptions and Vocabulary Learning Strategies

Students' perceptions play a crucial role in vocabulary learning, as they influence motivation, engagement, and the choice of learning strategies. Learners who perceive technical vocabulary as important for their academic success are more likely to invest effort in learning and applying specialized terms. Conversely, negative perceptions or high levels of anxiety may reduce students' willingness to use technical vocabulary, particularly in oral or written communication (Miroshnychenko, 2024).

Previous research indicates that students employ a range of strategies to learn technical vocabulary in ESP contexts. Cognitive strategies, such as memorization, repetition, note-taking, and relating new terms to prior knowledge, are commonly used to support vocabulary retention. While these strategies can be effective to some extent, studies suggest that relying solely on rote memorization may limit deeper conceptual understanding, especially in scientific disciplines (Khamees, 2016). As a result, learners may remember definitions without being able to apply terms accurately in problem-solving or academic discourse.

In addition to cognitive strategies, social strategies have been identified as an important factor in vocabulary development. Peer discussion, collaborative learning, and interaction with instructors allow students to negotiate meaning, clarify misunderstandings, and gain confidence in using technical language. Research has demonstrated that collaborative learning environments promote deeper processing of scientific concepts and encourage active use of specialized vocabulary (Gjerde & Hagane, 2024; Kholmetov, 2024).

Research Gap

Although existing studies have contributed valuable insights into ESP instruction and technical vocabulary learning, there remains a limited focus on students' perceptions within Physics ESP contexts. Much of the prior research emphasizes instructional methods or curriculum design, with less attention given to how students experience the process of learning technical vocabulary. Understanding learners' perceptions is essential, as it can reveal mismatches between instructional practices and students' actual needs. Therefore, further investigation into Physics students' perceptions of technical vocabulary learning is necessary to inform more effective, contextualized, and learner-centered ESP instruction.

METHODS

Research Design

This study employed a quantitative descriptive survey design to investigate Physics students' perceptions of learning technical vocabulary in English for Specific Purposes (ESP) courses. A descriptive survey design is appropriate for research that aims to describe attitudes, opinions, and perceptions of a specific population using numerical data (Creswell, 2012). This design was chosen because it allows the researcher to systematically capture students' views regarding the importance of technical vocabulary, perceived difficulties, learning strategies, usage, and exposure within the Physics ESP context.

Participants

The participants of this study were 50 undergraduate students enrolled in the Physics Education program at Syarif Hidayatullah Jakarta Islamic State University, Indonesia. All participants were taking an English for Specific Purposes (ESP) course at the time of data collection. The ESP course focuses on developing students' ability to understand and use Physics-related English, particularly technical vocabulary commonly found in textbooks, scientific articles, and academic discussions.

The participants were selected using convenience sampling, as they were readily accessible to the researcher and met the criteria of having experience learning Physics content through English. Participation was voluntary, and students were informed that their responses would remain anonymous and used solely for research purposes.

Research Instrument

The primary instrument used in this study was a structured questionnaire titled “Physics Students’ Perceptions of English Technical Vocabulary in ESP Courses.” The questionnaire consisted of 25 items designed to measure students’ perceptions across five dimensions of technical vocabulary learning.

The five dimensions of the questionnaire were as follows:

1. Relevance and Importance (Items 1–5): students’ awareness of the importance and usefulness of technical English vocabulary in Physics.
2. Difficulty and Comprehension (Items 6–10): perceived difficulty in understanding and learning Physics-related technical terms.
3. Learning and Acquisition Strategies (Items 11–15): strategies used by students to learn and remember technical vocabulary.
4. Usage and Application (Items 16–20): students’ confidence and accuracy in using technical vocabulary in academic contexts.
5. Context and Exposure (Items 21–25): students’ exposure to technical vocabulary and motivation to master it.

Each item was rated using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

To ensure content validity, the questionnaire items were developed based on previous studies related to ESP and vocabulary learning and were reviewed by two experts—one in English for Specific Purposes and one in Physics Education. Feedback from the experts was used to refine the clarity and relevance of the items before data collection.

Data Collection Procedure

Data collection was conducted in October 2024 using a structured questionnaire administered online through Google Forms. The questionnaire was distributed to 50 Physics students enrolled in the ESP course, and all participants were given one week to complete the survey. Prior to analysis, the responses were carefully screened to ensure completeness and consistency. All 50 returned questionnaires were valid and included in the final data set.

Data Analysis

The collected data were analyzed using descriptive statistical techniques. Frequencies, mean scores, and standard deviations were calculated for each questionnaire item to identify overall trends in students’ perceptions. In addition, mean scores were computed for each of the five thematic dimensions: relevance and importance, difficulty and comprehension, learning and acquisition strategies, usage and application, and context and exposure. These descriptive statistics were used to interpret students’ levels of agreement with statements related to technical vocabulary learning in Physics ESP courses and to address the research questions.

RESULTS/FINDINGS

This section presents a comprehensive analysis of the data obtained from the questionnaire, focusing on Physics students’ perceptions of technical vocabulary learning within an English for Specific Purposes (ESP) context. The findings are structured according to the five thematic dimensions measured in the instrument, allowing for a systematic examination of students’ attitudes, perceived challenges, learning strategies, usage, and exposure to technical vocabulary.

Table 1

Students’ Perceptions of the Relevance and Importance of Technical Vocabulary

Statement	Mean Score
English technical terms make Physics sound more scientific and professional.	3.70
English technical terms help me grasp Physics concepts more precisely.	3.10

The results indicate that students demonstrate a generally positive perception of the relevance and importance of technical vocabulary in Physics learning. As shown in Table 1, the statement “English technical terms make Physics sound more scientific and professional” recorded the highest mean score ($M = 3.7$), suggesting that students strongly associate technical vocabulary with academic legitimacy and disciplinary identity. This finding implies that learners recognize technical terminology as an essential linguistic marker that distinguishes scientific discourse from everyday communication.

The comparatively lower mean score for the statement “English technical terms help me grasp Physics concepts more precisely” ($M = 3.1$) reveals a nuanced perception among students. While they acknowledge the formal importance of technical vocabulary, they appear less convinced of its direct contribution to conceptual understanding. This discrepancy suggests that students may perceive technical vocabulary more as a surface-level academic requirement rather than as an integral tool for constructing and internalizing Physics knowledge.

Table 2

Students' Perceptions of Difficulty and Comprehension in Learning Technical Vocabulary

Statement	Mean Score
I often misunderstand Physics texts because of unfamiliar English terms.	3.76
I find it difficult to pronounce certain English Physics terms correctly.	3.34

Findings related to difficulty and comprehension highlight substantial challenges faced by students when engaging with Physics content in English. Table 2 shows that the statement “I often misunderstand Physics texts because of unfamiliar English terms” achieved the highest mean score within this dimension ($M = 3.76$), indicating that unfamiliar technical vocabulary significantly impedes students' comprehension of written materials. This result suggests that lexical barriers remain a dominant obstacle in accessing Physics knowledge through English.

The statement “I find it difficult to pronounce certain English Physics terms correctly” obtained a lower mean score ($M = 3.34$), implying that pronunciation difficulties, while present, are perceived as less problematic than comprehension issues. Collectively, these findings indicate that receptive challenges—particularly in reading and understanding technical texts—are more prominent than productive phonological difficulties, emphasizing the central role of vocabulary knowledge in comprehension.

Table 3

Students' Perceptions of Learning and Acquisition Strategies

Statement	Mean Score
I learn new Physics terms by reading English textbooks or articles.	3.68

I write notes or summaries to help me remember new technical vocabulary.	3.34
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The analysis of learning and acquisition strategies reveals that students employ a range of approaches to cope with technical vocabulary demands. As presented in Table 3, the statement “I learn new Physics terms by reading English textbooks or articles” received the highest mean score ($M = 3.68$), indicating that exposure through academic reading is a primary strategy for vocabulary acquisition. This finding reflects the centrality of written materials in ESP learning contexts, particularly in science-based disciplines.

Meanwhile, the statement “I write notes or summaries to help me remember new technical vocabulary” showed the lowest mean score in this category ($M = 3.34$), suggesting that metacognitive strategies such as summarization and systematic note-taking are not consistently utilized by all students. The overall pattern of results indicates that while students rely heavily on exposure-based strategies, fewer actively engage in elaborative practices that support long-term retention and deeper processing of technical terms.

Table 4

Students’ Perceptions of Usage and Application of Technical Vocabulary

Statement	Mean Score
I can explain English Physics terms to my peers in Indonesian.	3.54
I can use English Physics terms accurately in my lab reports.	3.30

With regard to usage and application, the findings suggest moderate levels of confidence and ability among students. Table 4 demonstrates that the statement “I can explain English Physics terms to my peers in Indonesian” obtained the highest mean score ($M = 3.54$), indicating that students are more comfortable mediating technical concepts through their first language. This result implies that translation and bilingual explanation function as coping mechanisms that facilitate understanding while reducing linguistic pressure.

Conversely, the statement “I can use English Physics terms accurately in my lab reports” recorded the lowest mean score in this dimension ($M = 3.3$). This finding highlights students’ difficulties in applying technical vocabulary accurately in formal academic writing, where precision and disciplinary conventions are required. Overall, the results suggest a gap between receptive understanding and productive academic use of technical vocabulary in English.

Table 5

Students’ Perceptions of Context and Exposure to Technical Vocabulary

Statement	Mean Score
I can distinguish between general and technical meanings of English words in Physics (e.g., work, field).	4.12
I often see English Physics terms used in diagrams, graphs, or tables.	3.92

The findings related to context and exposure indicate relatively high awareness but uneven experiential engagement with technical vocabulary. As shown in Table 5, the statement “I can distinguish between general and technical meanings of English words in Physics (e.g., work, field)” achieved the highest mean score

across all questionnaire items ($M = 4.12$). This suggests that students possess a strong conceptual awareness of semantic distinctions between everyday and scientific language.

The statement “I often see English Physics terms used in diagrams, graphs, or tables” obtained the lowest mean score within this dimension ($M = 3.92$), indicating that students may encounter limited multimodal exposure to technical vocabulary in visual academic materials. Although the mean score remains relatively high, this finding points to a potential lack of varied contextual reinforcement, which is essential for strengthening vocabulary retention and application. Collectively, these results suggest that while students demonstrate awareness of technical meanings, consistent and diverse exposure to technical vocabulary in authentic academic contexts remains limited.

Discussion

The findings confirm that students’ recognition of the importance of technical vocabulary does not automatically lead to effective mastery or confident application. Although participants demonstrated positive attitudes toward technical terminology, the results indicate persistent difficulties in comprehension and productive use, particularly in formal academic contexts. This discrepancy suggests that awareness alone is insufficient without systematic instructional support, a pattern also identified in previous ESP research (Sadri, 2015; Zufahmi & Kardenia, 2024).

The moderate reliance on exposure-based strategies, such as reading English textbooks, indicates that students primarily engage with technical vocabulary through passive input rather than through active or elaborative learning processes. While reading contributes to vocabulary recognition, limited use of metacognitive strategies such as summarization and structured note-taking may explain the weak transfer of vocabulary knowledge into academic writing. This finding supports Khamees’ (2016) argument that memorization-oriented approaches often fail to promote deep conceptual understanding in scientific disciplines.

Furthermore, the results highlight the role of first-language mediation in facilitating comprehension. Students’ greater confidence in explaining Physics terms in Indonesian suggests that bilingual explanation functions as a compensatory strategy to bridge conceptual gaps. However, this reliance may also delay the development of precise academic expression in English, particularly in written genres such as laboratory reports. This aligns with previous studies emphasizing the need for guided transitions from receptive understanding to productive academic use (Kholmetov, 2024).

Overall, the findings suggest that challenges in technical vocabulary learning are not solely linguistic but also pedagogical in nature. High levels of awareness and conceptual recognition are insufficient when instructional practices do not provide sustained, contextualized, and productive engagement with technical terms. This reinforces the argument that ESP instruction in science disciplines should move beyond exposure-based approaches and incorporate task-based, multimodal, and discipline-integrated activities that promote active vocabulary use. Such instructional alignment is essential to support students’ transition from receptive familiarity to confident academic application of technical vocabulary.

CONCLUSION

This study examined Physics students’ perceptions of technical vocabulary learning within an English for Specific Purposes (ESP) context and revealed a clear disparity between students’ awareness of vocabulary importance and their actual ability to comprehend and use technical terminology effectively. While the findings indicate that students strongly recognize technical vocabulary as an essential component of scientific communication and academic legitimacy, this recognition alone does not ensure successful vocabulary mastery or confident application in academic tasks.

The results demonstrate that unfamiliar technical terms continue to pose significant challenges to students’ comprehension of Physics texts, outweighing difficulties related to pronunciation or surface-level language use. Although students employ various learning strategies—primarily exposure through reading and memorization-based practices—these approaches appear insufficient to support deeper conceptual understanding and accurate productive use, particularly in formal academic writing such as laboratory reports. Furthermore, students’ reliance on first-language mediation suggests that bilingual

explanation functions as a temporary coping strategy rather than a pathway toward full academic fluency in English.

Importantly, the study highlights that limited and uneven contextual exposure to technical vocabulary constrains students' ability to internalize and flexibly apply specialized terms. Despite high awareness of the distinction between general and technical meanings, students' encounters with technical vocabulary across authentic and multimodal academic contexts remain restricted. This finding underscores the need for ESP instruction that goes beyond vocabulary recognition and emphasizes repeated, contextualized, and discipline-integrated practice.

Overall, this study contributes empirical evidence to the growing body of ESP research by demonstrating that positive perceptions of technical vocabulary do not automatically translate into effective learning outcomes in Physics education. The findings suggest that Physics ESP instruction should prioritize learner-centered approaches that integrate authentic disciplinary content, active vocabulary use, and strategic scaffolding to bridge the gap between awareness, comprehension, and application. Future research may extend this investigation by employing mixed-method designs or experimental approaches to examine the effectiveness of specific instructional interventions in enhancing technical vocabulary acquisition in science-based ESP contexts.

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