Jurnal Ilmiah Profesi Pendidikan
Volume 11, Nomor 3, Agustus 2026
ISSN (Print): 2502-7069; ISSN (*Online*): 2620-8326

A Needs Analysis of English for Specific Purposes (ESP) for Biology Students

Roni Sofyan Hadi*, Ari Prasetyaningrum, Siti Maysuroh, M. Adib Nazri
Department of English Language Education, Faculty of Language, Art, and Humanities, Hamzanwadi University, Jl. TGKH. M. Zainuddin Abdul Madjid 132 Pancor, Lombok Timur, West Nusa Tenggara, 83611, Indonesia
*Corresponding Author: ronisofyanhadi@gmail.com

Article History
Received : June 06th, 2026
Revised : June 27th, 2026
Accepted : July 14th, 2026

Abstract: General English curricula often fail to equip non-English science majors with essential disciplinary vocabulary, leaving biology students unprepared for the global scientific community. This study aims to conduct a comprehensive needs analysis to identify the specific English learning needs and contextual linguistic barriers of undergraduate biology students. Employing a descriptive qualitative design, empirical data were collected from 31 Biology students at Hamzanwadi University through digital questionnaires and structured in-depth interviews. The findings reveal that students experience severe communicative paralysis when explaining biological concepts due to the morphological complexities of Latin nomenclature, heavily relying on digital translation tools. Conversely, their professional demands are highly specific, requiring skills to translate scientific abstracts, sharp listening for seminars, and tailored materials focusing on biotechnology. This study concludes that standard General English is fundamentally inadequate, mandating an urgent institutional pivot toward a tailored English for Specific Purposes (ESP) syllabus to align learning with industry standards.

Keywords: Biology Students, English for Specific Purposes, Linguistic Barriers, Needs Analysis.

INTRODUCTION

The international scientific community heavily relies on English as the primary medium for disseminating research findings, necessitating biology students to possess advanced language proficiency to read academic journals, write laboratory reports, and present their findings globally (Rompis et al., 2025 in Bondarchuk, 2025). However, Indonesian biology students operate under severe linguistic constraints, often characterized by low overall proficiency levels (EF English Proficiency, 2025). The systemic difficulties in understanding specialized texts, processing complex Latin nomenclature, and overcoming severe speaking anxiety present critical barriers to their academic success and professional readiness (Amrianto, et al., 2025).

The root of this chronic linguistic deficit lies in the standard General English curriculum, which consistently fails to equip non-English science majors with the vital disciplinary vocabulary they require (Hermawan in Mansor et al., 2025). While the field of English for Specific Purposes (ESP) has extensively investigated various disciplines, existing studies on biology students have largely been confined to qualitative observations rather than systematic measurements of specific skill deficits (Jubhari, et al.,2022). Consequently, a noticeable research gap persists regarding a comprehensive, mixed-methods needs analysis that explicitly connects precise linguistic deficits with biological themes, such as biotechnology, within an integrated framework (Wahyuni et al., 2024).

Addressing this pedagogical gap is highly urgent given the rapid expansion of biotechnology companies in Indonesia and the global science industry (Siahaan, 2025). Without immediate curricular intervention, higher education institutions will continue to produce biology graduates who lack the critical vocabulary to comprehend developmental biology literature or read foreign patents, ultimately rendering them uncompetitive in the modern job market. Reforming instructional materials toward an industry-calibrated ESP approach is no longer optional; it is an immediate necessity to salvage the professional competence of science graduates (Muliana et al, 2025).

In response to this urgency, this study aims to conduct a rigorous needs analysis to determine the specific English language skills required by undergraduate biology students. The research is driven by two primary objectives: to identify the exact English learning needs necessary for academic and professional environments (Target Situation Analysis), and to comprehensively

investigate the current linguistic difficulties and barriers these students face in learning English (Present Situation Analysis).

By meticulously mapping these requirements, this article strives to provide a robust theoretical contribution to ESP literature by capturing the complex intersection between biological science cognition and second-language acquisition. Practically, the empirical findings of this study will serve as a foundational blueprint for lecturers, syllabus designers, and university administrators to develop highly tailored, authentic English learning materials that effectively bridge the gap between classroom instruction and the real-world demands of the biological sciences.

English for Specific Purposes (ESP) serves as the grand theoretical framework for this study, defined as a highly practical approach to language teaching where all methodological decisions are tailored to the specific academic or professional needs of the learners (Hutchinson et al, 1987; Zhao et al., 2025). Within higher education, ESP is operationalized through specialized branches such as English for Science and Technology (EST) and English for Academic Purposes (EAP), which equip students with the cognitive and linguistic proficiency required to navigate technical phenomena, synthesize theoretical texts, and participate in global scientific discourse (Dirgeyasa, 2024; Zhao & Li, 2025). The core conceptual mechanism driving ESP curriculum design is the Needs Analysis, a systematic evaluation divided into Target Needs—the objective language skills required in professional environments—and Learning Needs—the subjective preferences and psychological processes of the learners (Wahyuni et al., 2024).

For biology students, learning needs are heavily influenced by their rigorous scientific training, resulting in cognitive preferences for structured, analytical, and practical learning environments (Amrianto, Rohman et al., 2025; Setianingrum et al., 2022; Saifuddin & Puspitasari, 2022). However, applying general language acquisition to these cognitive models presents severe challenges. The linguistic demands of the biological sciences require mastery over dense scientific jargon, polysyllabic Latin nomenclature, and long nominal compounds, which often trigger communication anxiety and hinder both reading comprehension and oral fluency (Amrianto, Rohman et al., 2025; Hermawan & Norani, 2022; Jakobi et al., 2025).

A review of recent literature highlights the growing recognition of these specialized needs across various disciplines. Pranoto and Suprayogi (2020) identified speaking and writing as crucial professional skills for non-science learners, specifically physical education students. Focusing on the biology department, Nurpahmi and Hasriani (2021) utilized a quantitative questionnaire to statistically rank students' material preferences, revealing the exact content desired for biology education. Hermawan (2022) examined similar cohorts using qualitative classroom observations, concluding that reading comprehension is the dominant academic need for biology students. More recently, Wahyuni et al. (2024) found that phonetic mastery is an essential linguistic feature for ESP learners in biology, who prefer biotechnology as their primary topic of interest. Consolidating these trends, a systematic review by Mansor et al. (2025) affirmed that General English curricula create a disconnect with industry standards, and methodologically sound needs analyses are crucial for accurately capturing learner requirements.

Despite these foundational contributions, a significant empirical and theoretical gap remains in the literature. Previous studies have heavily relied on large-scale quantitative questionnaires that yield surface-level statistical rankings (Nurpahmi & Hasriani, 2021) or broad qualitative observations that merely articulate needed language proficiencies without examining the underlying psychological barriers (Hermawan, 2022). There is an absence of multi-dimensional, in-depth investigations that systematically map the complex contextual realities of biology students—such as the explicit psychological anxiety linked to pronouncing polysyllabic scientific terms or the specific mechanisms students use to cope with dense international journals.

This article addresses these methodological and empirical shortcomings by moving beyond surface percentiles to comprehensively capture the lived experiences of language learners in the biological sciences. By employing an in-depth descriptive qualitative method, this study bridges the existing gap by intertwining objective linguistic deficits with subjective academic realities. Ultimately, this literature review confirms that uncovering these nuanced psychological and contextual dimensions is vital, providing a rigorously triangulated empirical foundation for the development of an effective,

data-driven ESP syllabus tailored for modern biology students.

METHODS

This research employed a descriptive qualitative design to deeply investigate the English language needs and contextual linguistic barriers faced by science students. Regarding the time and location of the research, the study was conducted at Hamzanwadi University, located in Pancor, East Lombok, with the data collection period taking place from May 19 to May 29, 2026.

The population and sample of this study were meticulously structured to capture both objective and subjective needs. The population comprised undergraduate students of the Biology Education Study Program at Hamzanwadi University. From this population, the sample was selected purposively; 31 students were involved in completing a digital questionnaire, and subsequently, 10 of these students were selected to participate in structured in-depth interviews to obtain richer, multidimensional qualitative data.

The research procedure involved systematic stages of data collection utilizing two primary instruments. First, a structured questionnaire was distributed directly in the classroom using a Google Form link. This instrument adopted a four-point Likert scale consisting of 15 items designed to measure Target and Present Situation Needs. Second, in-depth interviews were conducted using a guideline containing 10 open-ended questions to explore the students' psychological barriers and independent coping strategies. Furthermore, to guarantee data trustworthiness, the procedure implemented a rigorous credibility assessment system through methodological and data source triangulation.

Finally, the data analysis technique was interactively conducted using the cyclical qualitative data analysis model by Miles, Huberman, and Saldaña (2020). This analysis process ran simultaneously through three main stages: (1) data condensation, where raw data was filtered and strictly focused on needs analysis parameters; (2) data display, which organized the condensed data into narrative texts and conceptual matrices; and (3) drawing and verifying conclusions, where meanings were extracted and repeatedly confronted with the interview transcripts and questionnaire tabulations to ensure final objectivity.

FINDINGS AND DISCUSSION

Findings

The empirical data reveals a critical intersection between the students' foundational language deficiencies and their specialized academic requirements. The Present Situation Analysis (presented in Table 1) indicates that students suffer from a compounding difficulty where baseline General English weaknesses—notably speaking anxiety and writing or spelling inaccuracies—escalate into severe communicative paralysis within scientific contexts.

Tabel 1. Present Situation Analysis: Linguistic Barriers of Biology Students

No.	Linguistic Barriers (Present Situation)	Percentage (%)
1.	Difficulties speaking English fluently (presenting biological concepts)	90.3
2.	General speaking anxiety	87.1
3.	Writing or spelling inaccuracies	87.1
4.	Heavy reliance on translation tools and Artificial Intelligence	83.9
5.	Struggle with pronouncing Latin nomenclature and complex terms	64.5

When forced to process and present complex biological concepts, an overwhelming majority of students experience profound difficulties speaking English fluently. This barrier is directly tied to the morphological complexities of the discipline, as a significant portion of students explicitly struggle with pronouncing Latin nomenclature and complex biological terms. Consequently, this lack of a dedicated technical lexicon forces most of the students to rely heavily on translation tools and Artificial Intelligence to comprehend English biology journals. Interview narratives further confirm this phenomenon, with students expressing that their severe lack of vocabulary, inability to translate texts independently, and the confusing discrepancies between spelling and pronunciation paralyze their active participation in class discussions.

Conversely, the Target Situation Analysis (Table 2) demonstrates a highly motivated demographic with precise academic and professional demands.

Tabel 2. Target Situation Analysis: Academic & Professional Needs

No.	Target Needs (Academic & Professional)	Percentage (%)
1.	Demand for tailored materials focused on specific branches (e.g., biotechnology, ecology)	96.8
2.	Sharp listening skills for understanding international science seminars	93.5
3.	Ability to accurately translate scientific journal abstracts	87.1

To survive within the university ecosystem, students identified sharp listening skills as an absolute necessity for understanding international science seminars, while also urgently requiring the ability to accurately translate scientific journal abstracts for their assignments. From a professional orientation, there is an absolute consensus demanding that English language materials be immediately pivoted toward specific scientific branches, such as biotechnology, ecology, and plant cultivation. Students recognize that high English proficiency is an indispensable prerequisite for securing employment in the modern science industry. Furthermore, interview data highlights a strong pedagogical friction; students react with confusion, shock, and detachment when assigned General English reading texts unrelated to their major, explicitly preferring interactive, major-specific learning environments characterized by active dialogues, vocabulary memorization, and practical application.

Discussion

The compounding nature of the students' linguistic difficulties provides a profound insight into the psychological and cognitive barriers present in science education. The data points to a two-tier hindrance structure where foundational language anxieties are severely exacerbated by the target science context. The severe communicative paralysis reported by the vast majority of students (as indicated in Table 1) is triggered by the unique morphological and phonological features of scientific discourse. This directly corroborates the findings of Amrianto et al. (2025), who asserted that Latin nomenclature and polysyllabic vocabulary severely impair reading and speaking abilities, creating immediate barriers to clear understanding. Furthermore, the students' intense struggle with pronunciation validates the research of Wahyuni et al. (2024), which identified phonetics as an essential linguistic feature for ESP learners in biology. Critically, the high dependency on translation tools signifies that students are not merely struggling with generic reading comprehension; rather, the absence of a discipline-based lexicon creates a massive cognitive load, forcing them to use digital translation as an immediate survival mechanism in the academic field.

Regarding academic survival and professional orientation, the students' reliance on receptive text-processing skills aligns seamlessly with the Target Needs framework of English for Specific Purposes (ESP). The urgent need for translating abstracts and comprehending seminars (Table 2) supports the findings of Hermawan (2022), who concluded that reading comprehension is the dominant academic need for biology students. However, the most definitive finding is the overwhelming demand for curriculum integration with biotechnology and ecology, empirically mirroring Wahyuni et al. (2024). The pedagogical friction observed when students reject General English texts strongly supports the systemic issue highlighted by Mansor et al. (2025), arguing that generic curricula create a massive disconnect between basic academic instruction and actual industry needs. This real-world phenomenon dictates that General English is fundamentally inadequate for preparing students for the global scientific landscape.

This study offers significant theoretical and practical contributions to the field of applied linguistics and science pedagogy. Theoretically, it advances ESP literature by addressing methodological gaps left by previous researchers, such as Nurpahmi and Hasriani (2021) who primarily assessed material preferences through statistical rankings, or Hermawan (2022) who relied on qualitative observations without deeply probing psychological barriers. By capturing the explicit psychological anxiety linked to technical pronunciation and the independent coping strategies utilizing digital platforms, this study intertwines objective linguistic deficits with subjective academic realities. Practically, the empirical evidence provides a robust blueprint proving the absolute necessity for university stakeholders to immediately shift toward a tailored ESP syllabus that integrates authentic scientific tasks.

Despite its comprehensive insights, this study is limited by its scope, as it remains exclusively at the diagnostic needs analysis stage. The current research identifies the precise linguistic gaps but does not test pedagogical interventions. Therefore, future research is strongly encouraged to conduct Research and Development (R&D) studies to design, develop, and validate an actual ESP textbook or syllabus based on these empirical findings. Subsequent experimental studies should test the effectiveness of these customized learning materials on the academic performance, reading comprehension, and communication fluency of biology students in authentic classroom settings.

CONCLUSION

This study concludes that a fundamental pedagogical mismatch exists between standard General English curricula and the specialized academic demands of undergraduate biology students. Empirically, foundational language weaknesses, such as general speaking anxiety and vocabulary deficits, critically escalate into a severe communication barrier, with a critical majority of students struggling to articulate biological concepts. The immense cognitive load of processing complex Latin nomenclature forces most students into a heavy dependency on machine translation tools to navigate English-language academic literature. Consequently, their academic survival and professional readiness depend entirely on mastering specialized receptive skills, particularly translating scientific journal abstracts, and acquiring a targeted lexicon in fields like biotechnology and ecology.

Theoretically, these findings contribute to the English for Specific Purposes (ESP) literature by demonstrating how discipline-specific morphology and scientific jargon directly exacerbate psychological language barriers, thereby emphasizing the necessity of contextualized language acquisition. Practically, this research provides a robust empirical blueprint for university stakeholders and curriculum designers. It confirms that General English is pedagogically inadequate for science majors, mandating an immediate institutional pivot toward a tailored ESP curriculum. This specialized approach must integrate authentic scientific materials and interactive, task-based speaking activities to effectively lower students' affective filters and align classroom instruction with the precision required by the global science community.

While this study successfully diagnoses the precise linguistic gaps and professional requirements of biology students, its scope is limited to the foundational needs analysis stage. Therefore, future research must advance from diagnosis to pedagogical intervention through Research and Development (R&D) methodologies to design, develop, and scientifically validate actual ESP syllabi and textbooks based on these empirical findings. Furthermore, subsequent experimental studies are highly recommended to evaluate the practical efficacy of these customized learning materials in actively reducing students' speaking anxiety, improving reading comprehension, and enhancing overall communication fluency within authentic scientific environments.

ACKNOWLEDGMENT

The author acknowledges the grace of Almighty God for the completion of this research. Special appreciation is given to my beloved parents, Sahabudin and Suriati, for their unwavering prayers and encouragement. The author also expresses deep gratitude to Ari Prasetyaningrum, M.Pd., and Siti Maysuroh, M.Pd., for their invaluable mentorship, scholarly guidance, and patience throughout this academic journey. Furthermore, sincere thanks are extended to the Biology Education Study Program at Hamzanwadi University and all research participants for their essential contributions. Finally, I would like to extend my deepest appreciation to myself for the persistence, resilience, and quiet strength demonstrated while overcoming every obstacle throughout this research process.

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