

A Qualitative Needs Analysis of English for Biology Students in Academic and Research Contexts

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Abstract

English plays an increasingly important role in biology education as students are required to access international scientific literature, conduct research, and communicate scientific findings. However, English courses offered in many Biology Education programs continue to emphasize General English, which may not adequately address students' academic and disciplinary needs. This study aimed to explore the English language needs of Biology Education students within academic and research contexts through the lens of English for Specific Purposes (ESP). A qualitative descriptive design was employed, involving semi-structured interviews with six undergraduate Biology Education students and one Biology lecturer at State Islamic College of Mandailing Natal (STAIN Mandailing Natal), who were selected using purposive sampling based on their direct involvement in biology teaching, learning, and academic research. The collected data were analyzed using Braun and Clarke's thematic analysis. Four major themes emerged from the analysis: (1) English as an essential tool for accessing scientific literature and laboratory resources, (2) challenges in understanding scientific terminology and producing academic English, (3) the mismatch between General English instruction and Biology students' disciplinary needs, and (4) expectations for an English for Biology curriculum emphasizing academic reading, scientific writing, oral presentation, and research communication. The findings demonstrate that Biology Education students require English not merely for everyday communication but primarily for developing academic literacy and research competence. The study suggests that English courses in Biology Education should be redesigned based on systematic needs analysis and aligned with authentic disciplinary communication. Such curriculum development is expected to better prepare students for undergraduate research, scientific publication, and participation in international academic communities.

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INTRODUCTION

The rapid internationalization of higher education has significantly increased the importance of English proficiency for students across scientific disciplines. In biology education, English is no longer regarded merely as a foreign language subject but has become an indispensable medium for accessing scientific knowledge, conducting research, communicating research findings, and participating in global academic communities. Most high-impact biology journals, laboratory manuals, conference proceedings, and scientific databases are published in English, making English proficiency an essential competence for undergraduate students who aspire to succeed academically and professionally. Consequently, English instruction for biology students should extend beyond general language competence and focus on the communicative demands of academic learning and scientific research.

Within the framework of English for Specific Purposes (ESP), language instruction is expected to address learners' specific academic and professional needs rather than providing

generalized language instruction. ESP recognizes that language learning is most effective when it is tailored to the communicative situations in which learners are expected to perform. Hutchinson and Waters argue that ESP is not defined by particular teaching materials or methodologies but by its emphasis on learners' needs as the starting point for curriculum development (Hutchinson & Waters, 2010). Likewise, Dudley-Evans and St. John maintain that effective ESP courses should reflect the discourse, genres, methodologies, and communication practices of the disciplines they serve (Dudley-Evans & St John, 1998). These perspectives suggest that English courses for biology students should be designed around authentic biological communication, including reading scientific articles, writing laboratory reports, presenting research findings, and discussing scientific issues.

Needs analysis therefore occupies a central position in ESP curriculum development. Basturkmen (2010) explains that needs analysis provides systematic information regarding learners' target situations, current language competence, learning preferences, and communicative requirements, enabling educators to develop courses that are relevant to students' actual academic and professional contexts (Basturkmen, 2010). Similarly, Long emphasizes that comprehensive needs analysis should incorporate information from multiple stakeholders—including students, teachers, graduates, and employers—to ensure that ESP curricula accurately represent real communicative demands (Long, 2005). Rather than relying on assumptions, needs analysis provides empirical evidence for developing learner-centered and context-sensitive English courses.

Recent empirical studies continue to confirm that needs analysis remains the cornerstone of effective ESP curriculum development. Hidayati and Meisani, for example, found that Indonesian university students required English primarily to comprehend discipline-specific literature, participate in academic communication, and prepare for future professional responsibilities (Hidayati & Meisani, 2023). Their findings indicate that English instruction should be designed around authentic communicative tasks rather than emphasizing general language knowledge alone. Similarly, Dwisusila et al. reported that students expected English courses to prioritize academic communication, discipline-related vocabulary, and authentic learning activities over traditional grammar-oriented instruction (Dwisusila et al., 2023). These studies collectively demonstrate that learners increasingly expect English courses to support their disciplinary studies rather than merely improving general language proficiency.

More specifically, recent research has highlighted the growing importance of English within biology education. Halim, Dollah, and Alam reported that biology students expected English learning materials to integrate scientific terminology, academic reading strategies, oral presentation skills, scientific writing, and research communication (Halim et al., 2024). Their findings suggest that biology students require English competencies that directly support their academic learning and research activities. Furthermore, recent discussions in ESP have shifted from identifying learners' linguistic deficiencies toward understanding learners' disciplinary practices, academic identities, and future professional aspirations. Poedjiastutie and Oliver emphasized that comprehensive ESP needs analysis should incorporate the perspectives of multiple stakeholders, including learners, teachers, and employers, to produce curricula that are relevant to academic and professional contexts (Poedjiastutie & Oliver, 2017). Such perspectives indicate that English learning should prepare biology students not only to understand scientific information but also to participate actively in scientific discourse.

The increasing integration of undergraduate research into higher education further strengthens the need for discipline-specific English instruction. Biology students are increasingly expected to review international journal articles, interpret scientific data, prepare laboratory reports, write undergraduate theses, present research findings at seminars, and communicate scientific ideas to broader academic audiences. These academic activities require a combination of reading, writing, speaking, and critical thinking skills that extend far beyond those typically developed through general English courses. Consequently, English instruction for biology students should emphasize academic literacy, scientific communication, and research competence

as integral components of the curriculum.

Despite the growing recognition of English as an essential academic tool, English instruction in many biology education programs continues to rely predominantly on General English syllabi. Such courses often emphasize grammar exercises, everyday communication, and general reading comprehension while providing limited opportunities for students to engage with authentic biological texts, scientific genres, and research communication tasks. As a result, many biology students experience difficulties in understanding research articles, interpreting scientific terminology, writing academic papers, and presenting scientific findings in English. This mismatch between curriculum content and students' disciplinary needs suggests that English instruction requires a stronger empirical foundation derived from systematic needs analysis.

Although numerous studies have investigated ESP needs analysis in disciplines such as medicine, engineering, nursing, and business, relatively limited attention has been given to biology education, particularly within Indonesian higher education. Existing studies generally focus on identifying target language skills or developing instructional materials through quantitative survey methods. While these studies provide valuable information regarding students' perceived language needs, they often offer limited understanding of how students actually experience English in their academic learning and research activities. In addition, qualitative investigations that explore students' perspectives, challenges, and expectations regarding English use throughout their academic and research experiences remain scarce.

Addressing these gaps, the present study employs a qualitative needs analysis to explore the English language needs of biology students in academic and research contexts. Rather than merely identifying preferred language skills, this study seeks to understand how biology students use English when reading scientific literature, participating in classroom discussions, conducting research, writing academic reports, and preparing for future scientific careers. Through in-depth qualitative inquiry, the study aims to identify the communicative situations in which English is required, the language skills perceived as essential, the challenges encountered by students, and their expectations for future English instruction. By emphasizing learners' lived experiences, the study provides richer insights into the complex language demands faced by biology students throughout their academic journey.

The findings of this study are expected to contribute both theoretically and practically. Theoretically, the study extends the growing body of literature on English for Specific Purposes by providing empirical evidence regarding English language needs within biology education from a qualitative perspective. Practically, the findings may serve as a foundation for designing English for Biology curricula, developing discipline-specific instructional materials, and improving English teaching practices that better support students' academic achievement, research competence, scientific literacy, and participation in international academic communities. Ultimately, the study seeks to contribute to the development of English instruction that is more responsive to the evolving academic and research demands of biology students in Indonesian higher education.

RESEARCH METHOD

This study employed a qualitative descriptive design to explore the English language needs of Biology Education students in academic and research contexts. A qualitative approach was appropriate because the study sought an in-depth understanding of students' experiences, perceptions, and expectations regarding the use of English rather than the measurement of predetermined variables, allowing participants' perspectives to be examined within their natural settings and rendered as rich descriptions of the phenomenon. As Creswell and Poth explain, qualitative inquiry seeks to understand the meanings that individuals or groups attribute to social or human problems, which makes it well suited to studies exploring participants' lived experiences (Creswell & Poth, 2023). The study was framed by English for Specific Purposes (ESP) needs analysis, which identifies learners' target needs, present situation needs, learning needs, and target situation requirements. Long argues that needs analysis supplies the empirical basis for designing

language curricula that genuinely reflect learners' communicative requirements rather than resting on teachers' assumptions, and that incorporating multiple stakeholders yields a more comprehensive account of those needs (Long, 2005). Accordingly, purposive sampling was used to recruit information-rich participants, comprising six undergraduate Biology Education students and one Biology lecturer at STAIN Mandailing Natal, all selected for their direct experience with English in biology learning, academic communication, and undergraduate research. The students represented learners' perspectives, while the lecturer offered insight into instructional practices and students' language needs; interviews continued until data saturation, the point at which no substantially new information or themes emerged.

Data were collected through semi-structured interviews, chosen because they allow researchers to explore participants' perceptions while retaining the flexibility to probe issues that arise during the conversation. As Magaldi and Berler note, semi-structured interviews enable rich and detailed information to be obtained while maintaining consistency across participants (Magaldi & Berler, 2020). The interview questions addressed participants' experiences of using English in biology learning, the challenges they encountered in academic and research contexts, their perceived language needs, and their expectations for future English instruction. Before data collection, all participants voluntarily agreed to take part and provided informed consent, and their identities were protected through the use of pseudonyms throughout the reporting of the findings.

The interview data were analyzed using Braun and Clarke's six-phase thematic analysis, comprising familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report (Braun & Clarke, 2006). Codes were generated inductively from participants' responses and then organized into broader themes representing the students' English language needs in academic and research contexts, after which the themes were interpreted through the ESP needs-analysis framework to show how target needs, learning needs, and academic communication requirements shaped participants' expectations for English instruction. To strengthen trustworthiness, data triangulation, member checking, and peer debriefing were employed: information from the six students and the lecturer was compared to identify consistent patterns, interview summaries were returned to participants to confirm accuracy, and the coding process and thematic interpretations were reviewed with colleagues experienced in qualitative research. These procedures enhanced the credibility, dependability, and confirmability of the findings by reducing potential researcher bias and reinforcing the consistency of data interpretation.

RESULT AND DISCUSSION

Result

The data obtained from semi-structured interviews with Biology Education students (MHS) and one biology lecturer (DSN) were analyzed using thematic analysis following Braun and Clarke's (2006) six-phase procedure. The analysis produced four interrelated themes concerning the English language needs of biology students: (1) English as a tool for accessing scientific literature, (2) challenges in academic English and scientific communication, (3) the mismatch between General English and biology-specific needs, and (4) expectations for an English for Biology curriculum. Table 1 summarizes these themes together with the representative codes and the participants who voiced them.

Table 1. Summary of Themes Emerging from the Interview Data

Theme	Representative Code	Sources
English as a tool for accessing scientific literature	Reading international journals, Scopus-indexed articles, laboratory manuals, research references	MHS-01, MHS-02, DSN
Challenges in academic English and scientific communication	Scientific terminology, passive constructions, academic writing, lack of confidence in speaking	MHS-03, DSN
Mismatch between General English and disciplinary needs	General English not relevant to biology, absence of scientific communication practice	MHS-04

Expectations for English for Biology	Journal reading, scientific writing, presentation skills, research communication	MHS-05, MHS-06, DSN
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English as an Essential Tool for Accessing Scientific Literature

Across the interviews, the most consistently voiced perception was that English operates less as a school subject than as the working language of scientific knowledge itself. Students did not describe English as something studied for its own sake; they described it as the medium standing between them and the material their courses required. This framing matters because it relocates English from the periphery of the curriculum, where a language elective usually sits, to the center of disciplinary learning, where the ability to read determines whether a student can follow the course at all. The distinction becomes concrete in the way students narrated their advanced coursework, in which lecturers assigned international journal articles not as supplementary enrichment but as the primary basis for assessment.

MHS-01 explained that from the fifth semester onward, English-language journal articles became inseparable from ordinary classroom work:

"Sering banget... dosen itu hampir selalu kasih referensi jurnal internasional yang terindeks Scopus. Mau nggak mau harus dibaca karena bahan ujian atau tugas presentasi diambil dari situ semua."

("Very often... the lecturer almost always gives Scopus-indexed international journal references. We have no choice but to read them, because the exam material and the presentation assignments are all taken from there.")

The phrase "mau nggak mau" — roughly, "whether we like it or not" — is revealing. It signals that reading English is experienced not as an option students may exercise but as a precondition for participating in the course. English comprehension here is bound directly to academic survival: examinations and graded presentations draw their content from sources the student can access only through English, so a reading gap translates immediately into an assessment gap. Where MHS-01 located English at the point of assessment, MHS-02 located it at the point of practice, in the laboratory. According to this participant, most equipment manuals and experimental protocols are produced by international manufacturers and circulate only in English:

"Manual book alat-alat lab... semuanya pakai bahasa Inggris. Kalau kita salah menerjemahkan instruksinya, bisa-bisa alat mahalnya rusak atau hasil eksperimen kita gagal total."

("The lab equipment manuals... are all in English. If we mistranslate the instructions, the expensive equipment could break or our experiment could fail completely.")

This account raises the stakes of reading beyond the cognitive to the material and procedural. A misread instruction is not merely a comprehension error to be corrected on a later draft; it carries consequences for equipment worth far more than a student can replace and for experimental results that cannot be recovered once compromised. English reading accuracy, on this account, is inseparable from laboratory competence and safety, which situates the language demand inside the practical core of the discipline rather than at its verbal surface.

The lecturer (DSN) placed these student experiences within an institutional frame. In the lecturer's account, consulting international literature before designing a study and writing an undergraduate thesis has become an expectation the program holds of its students, not a personal preference some students happen to pursue. Taken together, the three accounts show English functioning across three distinct academic sites — assessed coursework, laboratory practice, and supervised research — rather than in a single classroom context. This convergence indicates that the reading demand is systemic within the program: it recurs at every stage where students engage with disciplinary knowledge, and it intensifies as they move toward independent research.

Difficulties in Understanding Scientific Terminology and Academic English

Recognizing English as indispensable did not mean students found it manageable. Alongside their acknowledgment of its importance, participants described sustained difficulty on two fronts: comprehending scientific texts and producing academic writing of their own. The difficulties clustered around features specific to scientific discourse rather than around general language ability, which is itself an analytically important distinction, because it suggests that the obstacle is disciplinary literacy rather than basic proficiency.

The difficulty raised most often was technical vocabulary. MHS-03 drew a sharp line between ordinary sentences, which translation tools could usually handle, and specialized biological terminology, which they could not:

"Yang bikin pusing itu kosakata teknisnya... istilah anatomi tumbuhan, nama enzim, atau proses kimia di mikrobiologi."

("What makes it confusing is the technical vocabulary... plant anatomy terms, enzyme names, or chemical processes in microbiology.")

The same participant added that machine translation frequently rendered these terms inaccurately, so that reliance on such tools introduced new errors rather than resolving the original difficulty. The problem, in other words, is not simply that students lack the words but that the automated support they turn to is unreliable precisely where the vocabulary is most specialized — the point at which help is most needed is the point at which it fails. A second obstacle concerned the grammar of scientific prose itself. MHS-03 reported particular trouble with the extended passive constructions that dominate the Methods and Results sections of research articles:

"...bahasanya formal banget dan banyak grafik yang penjelasannya pakai kalimat pasif yang panjang-panjang."

("...the language is very formal and there are many graphics whose explanations use long passive sentences.")

Difficulty then extended from reading into writing. Preparing a thesis proposal, the same student expressed uncertainty about constructing formal academic sentences at all:

"Jujur saya bingung cara bikin kalimat akademik yang formal... takut grammarnya berantakan."

("Honestly, I am confused about how to make formal academic sentences... I am afraid the grammar will be a mess.")

The lecturer corroborated and deepened this picture from the assessment side. DSN observed that students commonly translated word by word from Indonesian, producing sentences that were grammatically defensible yet rhetorically unnatural:

"Mereka cenderung menulis dengan cara menerjemahkan langsung kata-per-kata... akibatnya struktur kalimatnya tidak alami."

("They tend to write by translating directly, word for word... as a result, the sentence structure is unnatural.")

The lecturer further noted that students had little command of disciplinary conventions such as hedging, academic stance, and citation practice. Read together, the student and lecturer accounts locate the difficulty at three levels that compound one another: the lexical (specialized terms machine translation mishandles), the syntactic (the dense passive constructions of scientific reporting), and the rhetorical (the genre conventions that make writing read as academic rather than merely correct). The problem is therefore not reducible to grammar in the narrow sense. Students must simultaneously acquire disciplinary vocabulary, learn to parse how scientific knowledge is packaged linguistically, and internalize conventions that no general grammar lesson makes visible — a combined demand that a General English course is not structured to meet.

Mismatch Between General English Courses and Biology Students' Academic Needs

A distinct theme surfaced not from what students struggled to do but from how they judged the instruction they had already received. Here the participant did not report a deficit in their own ability; they identified a misalignment between the English course they were given and the English their discipline actually demands. MHS-04 recalled that the first-semester General English course concentrated on grammar drills and everyday interaction:

"Belajarnya General English kayak tenses dasar, teks naratif, atau percakapan sehari-hari di bandara atau hotel."

("We learned General English like basic tenses, narrative texts, or everyday conversations at the airport or hotel.")

The student then set that content directly against the tasks their studies required, and found it largely beside the point:

"Kita nggak butuh tahu cara mesen kamar hotel, tapi kita butuh tahu cara membaca prosedur eksperimen."

("We do not need to know how to book a hotel room, but we do need to know how to read an experimental procedure.")

What makes this account analytically significant is that the critique is not a complaint about difficulty but a diagnosis of relevance. The student is not asking for easier material or more grammar support; they are arguing that the course targeted the wrong communicative situations altogether. The contrast they draw — booking a hotel room versus reading an experimental procedure — maps precisely onto the distinction between general survival English and disciplinary academic English, and the student articulates it without prompting. This suggests that learners themselves already perceive the gap that needs analysis is designed to surface, and that they locate the solution not in more of the same instruction but in instruction reoriented toward interpreting scientific graphs, following laboratory protocols, and writing research reports. The theme rests on a single participant, and that limitation should be read plainly rather than obscured; its value lies in how sharply this student articulated a mismatch that the other themes corroborate from adjacent angles.

Expectations Toward an English for Biology Curriculum

The interviews closed on a forward-looking note, with participants describing the English instruction they wished they had. Students and lecturer alike converged on a single orientation: future courses should be built around biology itself rather than around general language content. MHS-05 framed this in terms of concrete classroom activity:

"Kita butuh kelas yang isinya langsung bedah jurnal Biologi, diajarin cara nulis laporan ilmiah yang formal, sama gimana cara presentasi hasil riset."

("We need a class that directly dissects biology journals, that teaches how to write formal scientific reports, and how to present research results.")

MHS-06 narrowed the focus toward writing in particular, emphasizing the abstract writing and formal scientific expression that thesis preparation demands. The lecturer then consolidated these expectations into a pair of priorities:

"Fokusnya harus pada dua hal: Academic Reading untuk riset dan Academic Writing."

("The focus must be on two things: Academic Reading for research and Academic Writing.")

According to DSN, the aim of such a course would be to enable students to evaluate international journal articles critically and to produce research reports independently, without leaning on machine translation as a crutch. Read against the previous three themes, these expectations are notable for how precisely they answer the difficulties the same participants

reported earlier. The reading demand identified in the first theme, the terminological and rhetorical struggles named in the second, and the relevance gap diagnosed in the third all reappear here as the very competencies students want a redesigned course to build. What participants describe is therefore not a wish list assembled at random but a coherent response to their own lived experience of English in the program: a curriculum integrating scientific reading, academic writing, oral presentation, laboratory communication, and research literacy, in which English functions as a working instrument of disciplinary study rather than as an isolated body of grammatical knowledge.

Discussion

This study explored the English language needs of biology students within academic and research contexts through qualitative interviews with biology students and a biology lecturer. The findings reveal that English is no longer perceived merely as a compulsory university subject but as an academic instrument that supports knowledge acquisition, laboratory practice, scientific communication, and undergraduate research. Four interrelated themes emerged from the analysis: English as a gateway to scientific knowledge, the difficulty of academic English and scientific communication, the mismatch between General English and biology-specific needs, and the expectation of a discipline-specific English curriculum. Read together, these themes reinforce the central premise of English for Specific Purposes (ESP), namely that language instruction should be developed from learners' authentic communicative needs rather than from generalized language objectives (Basturkmen, 2010; Dudley-Evans & St John, 1998; Hutchinson & Waters, 2010). What the present data add to that premise is a portrait of English functioning not at the margins of biology education but at its operational core, where the ability to read, interpret, and produce scientific text determines whether a student can participate in the discipline at all.

The first and most prominent finding is that students regard English primarily as the language through which scientific knowledge is accessed. Both student participants described reading international journal articles as a routine academic activity, particularly in advanced courses and during research preparation, while laboratory manuals and equipment protocols made English indispensable at the bench as well as in the classroom. These accounts confirm the foundational claim of Hutchinson and Waters that language learning should be designed around learners' target situations rather than around general communication (Hutchinson & Waters, 2010). The pattern also aligns closely with recent disciplinary evidence: Halim, Dollah, and Alam reported that biology students expected instruction to prioritize scientific terminology, journal reading, academic presentation, and research communication over general language skills (Halim et al., 2024), and Hermawan found that reading scientific literature was the single most important English competence perceived by biology students because it underpins their engagement with textbooks, modules, and international journals (Hermawan, 2022). Taken together, these findings indicate that English has become an integral component of scientific literacy, and that instruction should therefore be positioned as academic support for scientific inquiry rather than as language study pursued for its own sake.

The second theme complicates any assumption that access alone is sufficient. Although participants could use machine translation to grasp general meaning, they consistently struggled with biological terminology, the dense passive constructions of scientific reporting, and the conventions of academic writing. The lecturer's observation that students translate word for word from Indonesian, producing text that is grammatically defensible yet rhetorically unnatural, points to a gap that grammar instruction alone cannot close. This interpretation corresponds directly to Hyland's argument that academic writing is a socially situated practice demanding mastery of disciplinary conventions rather than grammatical accuracy alone, including audience awareness, argument construction, evidence presentation, and the calibrated expression of certainty through hedging (Hyland, 2006). The difficulty students describe is therefore not lexical scarcity in isolation but the compounded demand of vocabulary, syntax, and genre operating at once. The present

findings consequently suggest that an English for Biology course must teach scientific vocabulary, genre awareness, academic writing conventions, and research communication explicitly, rather than assuming these competencies will develop incidentally through General English exposure.

The third theme moves from what students struggle to do toward how they judge the instruction they have received. One participant contrasted the everyday scenarios of the General English syllabus, such as conversations at airports and hotels, with the authentic tasks of biology study, including interpreting laboratory protocols, reading experimental procedures, analyzing scientific graphs, and writing laboratory reports. This perceived mismatch echoes one of the founding assumptions of the field. Dudley-Evans and St. John hold that ESP courses should reflect the disciplinary communication of the learners they serve rather than following a standardized General English syllabus (Dudley-Evans & St John, 1998), while Basturkmen argues that effective ESP development must begin with systematic needs analysis so that learning outcomes correspond to students' actual academic and professional contexts (Basturkmen, 2010). The finding likewise supports Long's proposition that curriculum decisions should rest on empirical evidence gathered from learners and disciplinary stakeholders rather than on institutional assumptions about language needs (Long, 2005). General English retains value for establishing a basic linguistic foundation, but the present evidence indicates it becomes progressively insufficient as students advance into discipline-specific academic work.

The fourth theme, participants' expectations for a redesigned curriculum, can be synthesized into a coherent structure rather than a list of separate wishes, and Figure 1 presents that synthesis. The model organizes the study's findings as four ascending layers of disciplinary literacy resting on a foundation of ESP needs analysis. At the base lies access to scientific literature, the entry-level competence every participant treated as unavoidable; above it sits disciplinary discourse, where terminology, passive constructions, and genre stance are negotiated; higher still is academic production, encompassing scientific writing, laboratory reports, and thesis preparation; and at the apex is research communication, where students present, publish, and engage with the wider scholarly community. The layers are cumulative rather than discrete, since each higher competence depends on those beneath it, and the ascending demand intensifies as students move toward independent research. This layered framing aligns with contemporary needs-analysis scholarship: Damayanti and colleagues argue that modern needs analysis should integrate students' perceptions, teachers' expectations, disciplinary practices, and future professional requirements to yield curricula that answer real communicative demands (Damayanti et al., 2024). The model translates that principle into a design logic, showing that a biology-specific English curriculum should scaffold learners upward through reading, discourse, production, and communication rather than treating these as unrelated skills.

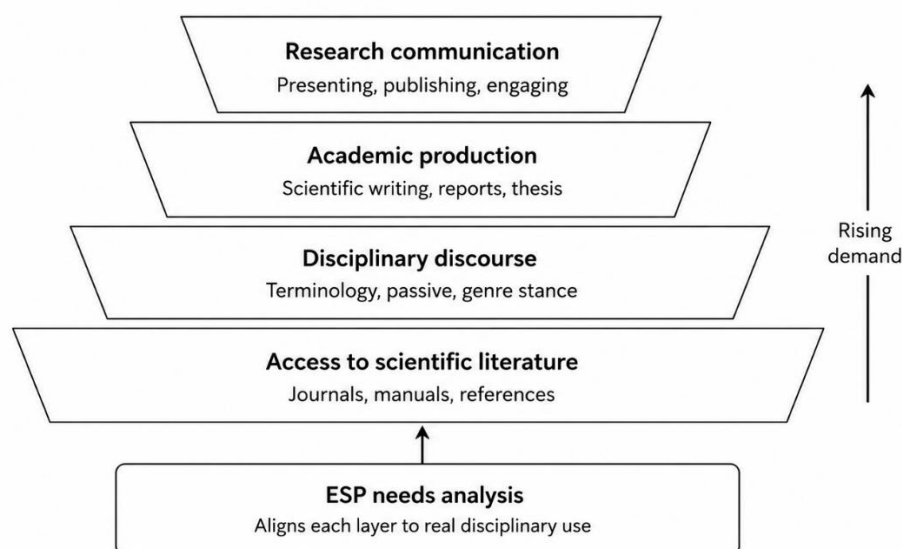


Figure 1. English for Biology as a Layered Model of Disciplinary Literacy

The central contribution of this study is therefore both theoretical and practical, and it is captured by the framework in Figure 1. Theoretically, the study extends needs-analysis scholarship by demonstrating that, for biology students, ESP is not a single target competence but a stratified literacy in which access, discourse, production, and communication build upon one another, a structure that the classic formulations of Hutchinson and Waters, Dudley-Evans and St. John, Basturkmen, and Long anticipate in principle but do not render as an integrated developmental model (Basturkmen, 2010; Dudley-Evans & St John, 1998; Hutchinson & Waters, 2010; Long, 2005). Practically, the framework offers curriculum designers a sequence for building an English for Biology course that scaffolds students from reading toward research dissemination, complementing the initial foundation that General English provides during the first year. Beyond curriculum design, this reframing carries a transformative implication for teaching and learning: when English is repositioned from a peripheral subject into the connective tissue of disciplinary inquiry, language instruction ceases to be an add-on and becomes a lever for deeper scientific participation, enabling students to move from passive consumers of translated knowledge toward active contributors to international scholarly communities. In this sense, English for Biology should be conceptualized not as language instruction alone but as an essential component of the academic literacy through which biology students learn, investigate, and ultimately produce scientific knowledge.

CONCLUSION

This study examined the English language needs of Biology Education students in academic and research contexts through the lens of English for Specific Purposes. The findings show that English has become an indispensable academic instrument rather than a general subject, functioning as the means by which students access scientific literature, interpret laboratory procedures, conduct undergraduate research, and communicate scientific knowledge. Four themes emerged: English as a gateway to scientific knowledge, the difficulty of academic terminology and scientific discourse, the mismatch between General English and disciplinary needs, and the expectation of a discipline-specific curriculum. Synthesized into a layered model of disciplinary literacy, these findings position access, discourse, production, and research communication as cumulative competencies built upon systematic needs analysis. The study therefore contributes both a conceptual framework extending needs-analysis scholarship and a practical sequence for designing an English for Biology curriculum that scaffolds learners from reading toward research dissemination. Its limitations lie in the small, single-site sample, which constrains generalizability. Future research should involve larger and more varied participants, incorporate additional stakeholders such as curriculum developers and alumni, and evaluate whether curricula designed from needs analysis measurably improve students' academic literacy, scientific communication, and research productivity across diverse institutional settings.

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