

Bridging the Gap between ESP Training and Scientific Communication Needs: Evidence from Biotechnology Researchers

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Abstract

As English remains the dominant language of scientific communication, researchers are increasingly expected to communicate effectively in international academic settings, placing growing demands on English for Specific Purposes training. However, such training is still limited in many Algerian universities, where doctoral researchers receive general English instruction rather than discipline-specific communication training. The present mixed-method, small-scale exploratory study investigates the effectiveness of ESP training in preparing biotechnology researchers for scientific communication. Data were collected using a structured questionnaire completed by 15 doctoral students, postdoctoral researchers, and professionals who had previously participated in ESP training delivered through short workshops at the Higher National School of Biotechnology. Findings revealed a gap between perceived receptive and productive competencies, with participants reporting confidence in reading scientific literature while continuing to experience challenges in article writing and oral communication. The study also showed that AI tools have become an integral part of researchers' writing practices, mainly to support language use, although concerns about overreliance and originality were also expressed. The findings indicate a need for longer, sustained, balanced, and needs-based ESP training that also addresses the responsible use of AI to support effective scientific communication.

Keywords: Artificial Intelligence, English for Specific Purposes, Needs Analysis, Scientific Communication

ملخص

بما أن اللغة الإنجليزية لا تزال اللغة المهيمنة على التواصل العلمي، يُتوقع من الباحثين بشكل متزايد التواصل بفعالية في المحافل الأكاديمية الدولية، مما يفرض طلباً متزايداً على التدريب في مجال الإنجليزية لأغراض خاصة. ومع ذلك، لا يزال هذا التدريب محدوداً في العديد من الجامعات الجزائرية، حيث يتلقى باحثو الدكتوراه تعليمًا في اللغة الإنجليزية العامة بدلاً من التدريب على التواصل الخاص بتخصصاتهم. تقصّي هذه الدراسة الاستكشافية الحالية، صغيرة النطاق وذات المنهج المختلط، مدى فعالية التدريب على الإنجليزية لأغراض خاصة في إعداد باحثي البيوتكنولوجيا للتواصل العلمي. وقد جُمعت البيانات باستخدام استبيان مهيكّل استكمّله خمسة عشر من طلبة الدكتوراه وباحثي ما بعد الدكتوراه والمهنيين الذين تم اختيارهم لمشاركتهم السابقة في تدريب الإنجليزية لأغراض خاصة، والذي قُدّم من خلال ورش عمل قصيرة في المدرسة الوطنية العليا للبيوتكنولوجيا. وأظهرت النتائج وجود فجوة بين الكفاءات الاستيعابية والإنتاجية المتصورة، حيث أبدى المشاركون ثقة في قراءة الأدبيات العلمية مع استمرار مواجهتهم لتحديات في كتابة المقالات والتواصل الشفهي. كما أظهرت الدراسة أن أدوات الذكاء الاصطناعي أصبحت جزءاً لا يتجزأ من ممارسات الكتابة لدى الباحثين، لا سيما لدعم استخدام اللغة، على الرغم من الإغراب عن مخاوف بشأن الإفراط في الاعتماد عليها والأصالة العلمية. وتشير النتائج إلى الحاجة إلى تدريب في مجال الإنجليزية لأغراض خاصة يكون أطول زمنياً، ومستداماً، ومتوازناً، ومبنياً على الاحتياجات، مع معالجة الاستخدام المسؤول للذكاء الاصطناعي لدعم التواصل العلمي الفعال.

الكلمات المفتاحية: التواصل العلمي، الذكاء الاصطناعي، تحليل الاحتياجات، اللغة الإنجليزية لأغراض خاصة.

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Introduction

English has become the dominant language of science, accounting for up to 98% of scientific literature and serving as the primary language of international conferences. With the growing internationalization of science, researchers are expected to communicate scientific knowledge effectively in English to enhance their visibility, increase publication opportunities, and participate in international conferences. As a result, scientific communication has become a key research competency that extends beyond language proficiency to include international networking, discipline-specific writing skills, and oral communication. Globally, doctoral programs prepare researchers for these demands by equipping them with the necessary theoretical knowledge and research methodologies. In Algeria, recent reforms introduced by the Ministry of Higher Education have strengthened English language education by mandating online general English courses across disciplines. Despite this important step toward the internationalization of Algerian higher education, the discipline-specific communicative needs of doctoral researchers are not adequately addressed, as the reforms remain largely focused on general English instruction. To address this pedagogical gap, the Higher National School of Biotechnology, Constantine, introduced targeted ESP workshops for its doctoral researchers to help them cope with publication pressure and English-medium scientific exchanges. Therefore, the present study seeks to evaluate the effectiveness of these workshops in preparing biotechnology researchers for the communicative demands of their discipline. Moreover, the increasing integration of AI tools into academic practice has introduced several opportunities to assist researchers in their scientific communication. The present paper also explores the emerging role of AI tools beyond linguistic support in helping researchers overcome communication challenges and compensate for training shortcomings. Based on these considerations, this study addresses the following research questions:

1. How do biotechnology researchers perceive the effectiveness of ESP training in developing scientific communication competence?
2. What mismatches exist between ESP training and actual professional demands?
3. To what extent do researchers rely on AI tools to compensate for gaps in ESP training?

Review of Literature

English for Specific Purposes (ESP) refers to the teaching and learning of English as a second or foreign language for domain-specific purposes, where English is considered a means to an end. It reflects the targeted reasons and objectives for learning English. That is to say, people can learn English “not because they are interested in the English Language or English culture as such, but because they need English for study or work purposes” (Robinson, 1991, p. 2). While General English (GE) treats English as a separate subject for all age groups and proficiency levels, focusing on general communicative competences transferred across contexts, ESP focuses strictly on adults who are aware of their objectives and needs, targeting language use within specific contexts (Hutchinson & Waters, 1987). ESP addresses the communicative demands of various disciplines and professions, such as medicine, accounting, marketing, and biotechnology. According to Dudley-Evans & St. John (1998, p.4), ESP has three absolute defining characteristics and three variable characteristics:

Absolute Characteristics:

1. ESP is defined to meet specific needs of the learners;
2. ESP makes use of underlying methodology and activities of the discipline it serves;
3. ESP is centred on the language (grammar, lexis, register), skills, discourse and genre appropriate to these activities.

Variable Characteristics:

1. ESP may be related to or designed for specific disciplines;
2. ESP may use, in specific teaching situations, a different methodology from that of General English;
3. ESP is likely to be designed for adult learners, either at a tertiary level institution or in a professional work situation. It could, however, be for learners at secondary school level;
4. ESP is generally designed for intermediate or advanced students. Most ESP courses assume some basic knowledge of the language systems, but it can be used with beginners.

Language teaching for specific purposes (LSP) can be traced back to the Greek and Roman empires (Dudley-Evans & St. John, 1998); however, ESP emerged as a distinct field of applied linguistics, in general, and Teaching English as a Foreign Language (TEFL), in particular, in the 1960s. The emergence of ESP resulted from several factors, such as the rapid and massive development that the New World has witnessed in economics, science, and technology after the Second World War, the dominant use of English as an international language, and the rise of a new generation of learners with clear and goal-oriented motivations for learning a language (Hutchinson and Waters, 1987). After these global changes in language use, linguists shifted their attention from one-size-fits-all grammatical rules and language structures to focus their studies on individuals' specific communicative needs and professional contexts. In the same period, educational psychologists began examining why individuals would want to learn a language, focusing on learners' attitudes, motivations, and interests, which gave rise to the guiding principle of ESP: "Tell me what you need English for and I will tell you the English you need" (Hutchinson & Waters, 1987, p. 8). ESP redirected the focus of education from the teacher to the learner, contributing to the emergence of learner-centered teaching (Strevens, 1977).

The learner-centered orientation of ESP made the identification of learners' needs a central component of course design. Dudley-Evans and Johns (1998, p.121) emphasize that "The key stages in ESP are needs analysis, course (and syllabus) design, materials selection (and production), teaching and learning, and evaluation." The elements of the ESP teaching process are not separate but interact in a dynamic, interconnected, and cyclical manner, where "the simplicity and clarity of figure 1 is in reality more like figure 2" (ibid, p.121).

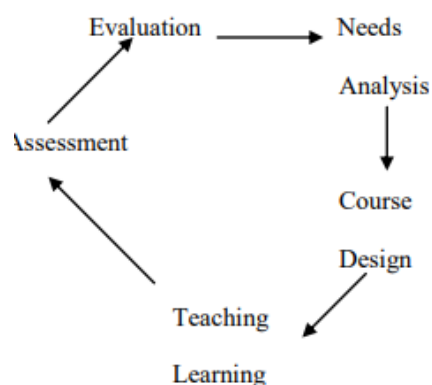


Figure 1. Stages in the ESP process: Theory

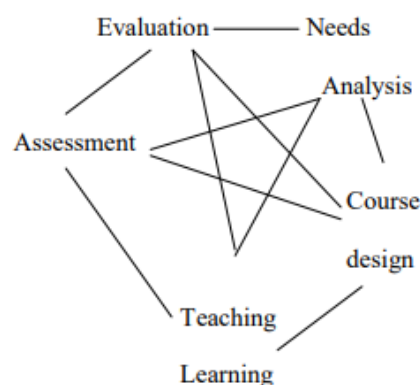


Figure 2. Stages in the ESP process: Reality

Needs analysis identifies and evaluates students' specific linguistic requirements, and it is the first step in ESP curriculum design. While needs assessment compares the current situation with the desired one to identify what needs improvement, needs analysis investigates the reasons underlying this gap and examines solutions to address it (Brown, 1995). This diagnostic process distinguishes between two types of needs: target needs, which examine what learners need to do and learn to communicate effectively in the target situation, and learning needs, which focus on how learners learn what they need to learn, taking into consideration their learning styles and preferred strategies (Robinson, 1991). Within target needs, Hutchinson and Waters (1987) distinguish three subdivisions: necessities, which are the skills that learners must master to function effectively in the target situation; lacks, which are what learners do not know how to or cannot perform; and wants, which are what learners expect to achieve by the end of the training. Consequently, an effective needs analysis must collect information regarding the target situation and its requirements, learners and their language needs, lacks, and wants, and the learning environment, including teaching materials, setting, and course duration (All Wright, 1982, qtd in West, 1994).

These variables ensure that training is both practical and contextually relevant. However, the transition from curriculum theory to actual pedagogical practice often creates a mismatch between academic training and real-world demands. In scientific communication, for example, this gap is best seen in the lack of authentic teaching tasks and insufficient exposure to real publishing practices and oral communication (Flowerdew, 2013; Hyland, 2009). Instead of preparing them for conference presentations, article writing, and reviewers' expectations, researchers are taught using generic classroom-based materials and language tests, resulting in struggles with real-time interactions and other discipline-specific needs (Swales, 2004). These hurdles extend beyond a single skill and cause multidimensional barriers for researchers. In written communication, researchers face challenges transforming raw data into evidence-based, persuasive scientific discourse and writing compelling abstracts to meet the expectations of high-impact journals (Flowerdew, 2013). At the same time, in oral communication, researchers struggle to present their research to an international peer audience and navigate spontaneous inquiries in Q&A sessions (Hood & Forey, 2005). In a globalized and high-pressure environment, these barriers can trigger profound performance anxiety, low self-confidence, insecurities, and linguistic inequalities felt by non-native researchers (MacIntyre, 1999; Flowerdew, 2019; Amano et al., 2023).

Faced with these challenges, researchers witnessed a massive academic shift in late 2022 with the introduction of Large Language Models (LLMs), making AI accessible to all. Current literature highlights that researchers are using ChatGPT, Claude, and other generative AI tools to revise the rhetoric and structure of their texts and decode the jargon and requirements of scholarly peer-reviewed journals (Gao et al., 2023). Researchers are also using AI pronunciation and presentation coaches to rehearse and simulate real-time oral communications. These digital platforms are no longer optional, for they not only help researchers navigate international communicative demands, but also provide safe and non-judgmental environments to reduce the different socio-psychological barriers that hinder academic performance (MacIntyre & Wang, 2024).

Methods and Materials

This study adopts a small-scale exploratory needs analysis to investigate biotechnology researchers' perceptions of their scientific communication skills and challenges. It employed a mixed-methods approach, combining quantitative (closed-ended) and qualitative (open-ended) questionnaire items to generate context-specific insights into the role of ESP training. The study was conducted within a specific institution in Algeria, where doctoral students in biotechnology receive targeted training in scientific writing. Such training is not systematically implemented across all Algerian universities, where English instruction at the doctoral level often focuses primarily on general English. This context provides a relevant setting for examining whether exposure to ESP training, despite its relatively limited scope and duration, effectively prepares researchers for the communicative demands of scientific practice.

Participants

The target population consisted of doctoral students enrolled at the Higher National School of Biotechnology and postdoctoral researchers and professionals who were former students of the same institution. The questionnaire was administered online using Google Forms to 44 students, selected for their prior participation in ESP training delivered through short workshops. A total of 15 responses were received. The study, therefore, relied on convenience sampling and self-selection, as participation was voluntary. These sampling techniques were deemed appropriate given the targeted nature of the population. The relatively small sample size reflects the inherently limited number of students accepted into biotechnology doctoral programs, making large-scale data collection challenging. While such a sample size is not suitable for inferential statistics and generalizations, it provides valuable context-specific insights and is consistent with exploratory research and needs analysis. Furthermore, the use of qualitative data adds depth and enables a better interpretation of the gap between ESP training and the demands of scientific communication.

Research Instruments and Procedure

Data were collected using a structured questionnaire covering the use of English in professional contexts (frequency of reading, writing, presenting, etc.), perceived competence and training effectiveness (self-assessment of confidence and preparedness), challenges, training needs, and AI use. The questionnaire included closed-ended questions and open-ended questions. It included multiple-choice questions and frequency-based items resembling Likert-type scales

(e.g., daily, weekly, monthly, rarely, never). Responses to closed-ended questions were analyzed using descriptive statistics, including frequencies and percentages, to identify general trends and provide quantitative insights into the participants' experiences and perceptions. Responses to open-ended questions were analyzed thematically by grouping recurring themes across participants' responses to provide a more nuanced interpretation of the quantitative findings.

Results

Of the 15 participants, 10 (66.7%) were PhD students in biotechnology, while 5 (33.3%) were postdoctoral researchers or biotechnology professionals. Participants represented diverse specializations within biotechnology, including microbiology, plant biotechnology, genetics, renewable energy, nanotechnology, and molecular biology. Regarding English language training, the majority of participants (73.3%, $n = 11$) had received their training more than three years ago, whereas 4 participants (26.7%) had received training within the past one to three years.

Table 1. *Frequency of English use in research and professional activities*

	Frequency				
	Daily	Weekly	Monthly	Rarely	Never
1. Reading scientific articles	53.33%	46.7%	0%	0%	0%
2. Writing scientific articles	20%	0%	66.7%	13.3%	0%
3. Presenting at conferences	13.3%	0%	66.7%	20%	0%
4. Writing Project Proposals / Grant Applications	6.7%	0%	60%	26.7%	6.7%
5. Communicating with International Colleagues	40%	13.3%	33.3%	13.3%	0%
6. Writing Patents or Technical Reports	20%	20%	33.3%	26.7%	%

The data in Table 1 shows that English plays a central role in the professional and academic activities of biotechnology researchers in our context. 53.33% of participants read scientific articles daily, while 100% do so at least weekly. While consuming information in English is a daily habit, writing articles (66.7%), project proposals (60%), and technical reports (33.3%), as well as presenting at conferences (66.7%), peak at a monthly frequency, suggesting that researchers spend weeks collecting data before communicating it. Furthermore, the high rate of daily international communication (40%) highlights that English is not merely for formal publications but is essential for global scientific networking.

Table 2. *Primary focus of ESP training*

Response	Frequency	Percentage
Scientific writing (e.g., research articles, lab reports)	8	53.3
General academic English	5	33.3
Oral communication (e.g., conference presentations, discussions)	2	13.3

Table 2 highlights the dominance of scientific writing as the primary focus of the ESP training. According to the participants, 53.3% of the training focused on scientific writing, including research articles and lab reports. In contrast, oral communication, the skill required for frequent conference presentations and international networking, identified in Table 1, accounted for only 13.3% of the training focus.

Thematic analysis of participants' responses regarding the most valuable outcomes of ESP training revealed three major recurring themes. The overwhelming majority of participants (14 out of 15) identified scientific writing skills as the most valuable outcomes of ESP training. Several participants also highlighted skills related to professional communication, including: presenting at conferences, writing professional emails, communicating with international researchers, and engaging in scientific discussions. One participant explained: "The most valuable skill I gained from my ESP training is the ability to effectively communicate scientific concepts in English." They stressed that ESP training enhanced their confidence, fluency, and ability to communicate in professional contexts.

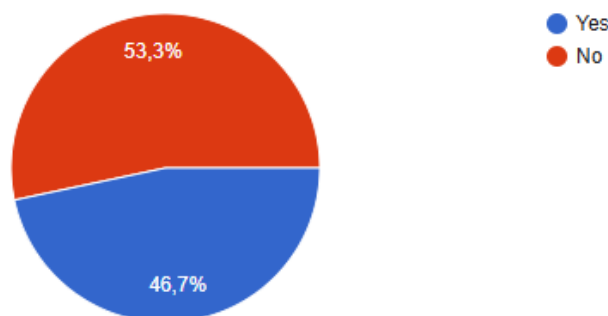


Figure 3. Participants' perceptions of ESP training sufficiency

Perceptions of ESP training sufficiency are nearly split. 53.3% of the participants reported that the training did not prepare them for the demands of their academic and professional roles. The participants (n=7) were also asked to describe situations where the training was perceived as insufficient. Many reported challenges related to: structuring research articles, writing research proposals, responding to reviewers, and adapting to journal requirements. Another recurring theme concerned difficulties in oral communication, particularly conference discussions, spontaneous scientific interaction, and speaking outside one's specialization. One participant noted: "My ESP training did not fully equip me for the spontaneity and complexity of live discussions with experts." Another participant explained: "At a job interview, I was asked to give a short scientific course in English outside of my field of study." Some participants emphasized limitations in vocabulary breadth and lexical precision.

Participants (n=8) who reported feeling adequately prepared attributed their confidence mainly to continuous exposure to English communication tasks and repeated practice. One participant explained: "Consistent practice and exposure helped me become more comfortable using English in real-life situations." Participants associated their confidence with independent learning, previous knowledge, and personal effort.

Table 3. *Areas of confidence*

Response	Frequency	Percentage
Reading and understanding scientific articles	14	93.3
Writing funding or grant proposals	1	6.7

Table 4. *Areas requiring additional support*

Response	Frequency	Percentage
Giving oral presentations at international conferences	7	46.7
Writing funding applications or research proposals	4	26.7
Writing scientific papers for publication	1	6.7
Communicating with international research teams	1	6.7
Understanding and applying journal submission guidelines	1	6.7
Writing and responding to peer review comments	1	6.7

Tables 3 and 4 compare the current and the desired state. Participants expressed near-unanimous confidence in reading and understanding scientific articles (93.3%), likely resulting from daily practice and the perceived focus of ESP training. However, this confidence does not extend to other communicative and professional skills. Table 4 shows that "giving oral presentations at international conferences" is the area of highest need for additional support (46.7%), mirroring the 13.3% of training focus in Table 2. 26.7% demanded additional support in writing funding and grant proposals.

Table 5. *Preparation for writing scientific articles and conference presentation*

	Somewhat prepared		Very well-prepared		Neutral		Poorly prepared		Not prepared at all	
Writing Scientific Articles	8	53.3%	5	33.3%	1	6.7%	0	0%	1	6.7%
Conference Presentation	6	40%	1	6.7%	5	33.3%	2	13.3%	1	6.7%

The results regarding participants' subjective readiness suggest that they feel only partially prepared for key academic tasks. Just over half (53.3%) felt somewhat prepared for writing scientific articles, suggesting a lack of the skills required for high-impact journals. Similarly,

40% felt somewhat ready for conference presentations. The neutral and poorly prepared categories total nearly 50%, reinforcing the idea that oral expression is the most challenging and stressful aspect of their professional and academic English use.

Table 6. *Main scientific communication difficulties*

Response	Frequency	Percentage
Writing discussion sections with strong arguments	5	33.3
Communicating research findings at conferences	4	26.7
Explaining complex concepts in simple terms	2	13.3
Other	2	13.3
Adapting my writing for different journals/audiences	1	6.7
Making my research sound compelling in abstracts	1	6.7

Table 6 provides deeper insights into the specific challenges researchers face during the communication process. The most frequently reported difficulty is "writing the discussion of the results sections with strong arguments" (33.3%). This indicates that researchers struggle less with the basic vocabulary and grammar and more with complex rhetorical logic. Additionally, communicating research findings at conferences (26.7%) and simplifying complex concepts (13.3%) are major obstacles.

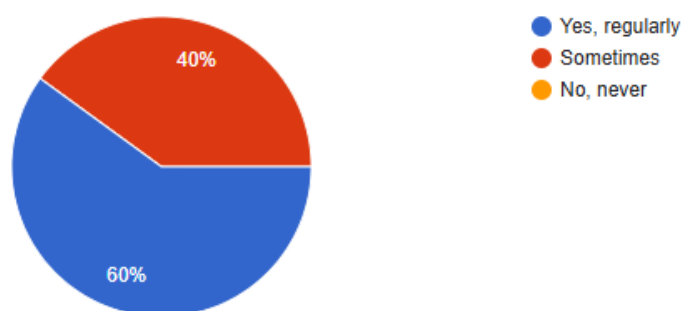


Figure 4. AI Use frequency

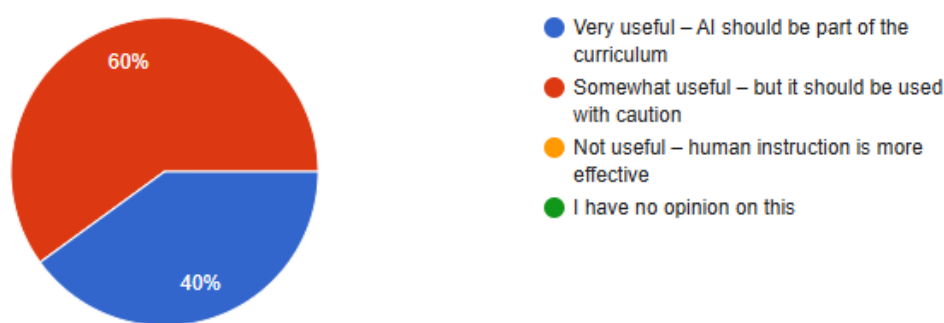


Figure 5. Attitudes toward integrating AI into ESP training

The data presented in Figure 3 suggest that AI tools have become an integral part of researchers' scientific communication practices. All participants reported using AI to some extent, with a 60% majority using these tools regularly. Despite the high level of AI use, Figure 4 highlights a cautious attitude toward AI's role in academic training. A majority of participants (60%) considered AI to be "somewhat useful," while emphasizing the need to use it with caution. The 40% who believe AI should be a formal part of the curriculum suggests a growing recognition that the future of ESP training must include the "ethical and responsible use" of these tools rather than ignoring their growing presence in academic practices.

Participants reported primarily using AI tools to support linguistic accuracy and facilitate scientific writing. Representative responses included: "correcting grammar", "reformulating phrases, and "providing synonyms." Several participants also reported using AI for improving textual organization and coherence. One participant described AI as a brainstorming tool, a source of feedback, and a substitute for mentorship.

Despite recognizing the benefits of AI, several ethical concerns also emerged from the responses to the open-ended questions. The most recurrent concern involved over-reliance on AI. They feared that excessive use could weaken their creativity and limit critical thinking. Participants also had concerns about plagiarism and questioned the credibility of AI-generated information, especially in scientific contexts. Many participants emphasized that AI should support writing by refining language and improving clarity, rather than generating content entirely. One participant explained: "AI-based tools should enhance and not generate from scratch."

Recommendations for improving ESP training identified three main pedagogical priorities: more practical, continuous training; greater focus on oral communication; and teaching the ethical and responsible use of AI tools in scientific writing. These priorities are further reflected in the participants' strong support for extending ESP training beyond doctoral studies. Participants highlighted the continuing importance of scientific communication skills in academic and professional contexts and emphasized the need for ongoing support throughout their careers.

Discussion

The primary aim of this study was to investigate the effectiveness of ESP training in preparing biotechnology researchers for the communicative demands of scientific practice. The findings show that communication challenges persist even after the participants have received targeted ESP workshops, raising concerns about the efficiency and scope of such training. This indicates that short-term workshop-based interventions develop foundational skills and basic awareness and are insufficient for high-level skill development, such as transforming raw data into well-supported scientific claims and synthesizing findings into convincing arguments in English (Ciortescu & Cecal, 2015). This limitation is more evident when considering that the development of complex competencies often requires more than 100 hours of specialized training to be effectively acquired (Schneider, 1985). The persistence of communication-related difficulties among our participants also raises important questions about the situation of doctoral students at other Algerian universities where such specialized training is not provided and where instruction is limited to general English taught online.

Another key finding concerns the noticeable difference in participants' reported linguistic confidence, indicating a gap between receptive and productive competencies. While 93.3% of participants reported confidence in reading scientific literature, they experienced considerably more difficulties with productive tasks, particularly writing discussion sections with strong arguments (33.3%) and speaking at conferences, where 46.7% expressed a need for additional support. This imbalance highlights a gap in ESP instruction that appears to prepare learners more to consume scientific knowledge than to produce it, as simply reading scientific texts and learning their mechanics does not necessarily enable researchers to write in a similar academic style or communicate effectively before an audience.

This lack of proficiency becomes even more critical in contemporary academia, where biotechnology researchers work under increasing socio-institutional pressure to publish in English or perish to gain international recognition. In practice, researchers are expected not only to generate quality scientific content but also to defend it effectively in English-language journals and conferences. For Algerian researchers and other foreign language users of English, this creates an additional linguistic tax. The fact that participants reported being somewhat prepared for article writing (53.3%) and communicating research findings in conferences (40%) due to insufficient specialized English training suggests that the issue extends beyond language proficiency. It points to a need for ESP training that equips researchers with stronger rhetorical, argumentative, and publication-oriented skills.

Indeed, ESP instruction is not expected to focus equally on the four language macro-skills as general English instruction, which lacks an immediate professional purpose (Rahman, 2015). Instead, ESP is needs-based, and learners' communicative requirements determine its content. Nevertheless, receptive and productive skills should be developed together for several reasons. According to the input–processing–output model, learners can confidently manipulate and transfer language only after assimilating field-specific terminology and genre conventions (Raikhel & Feltsan, 2025). Output tasks were also found indispensable for processing input and converting declarative knowledge into procedural knowledge (de Bot, 1996; Suzuki et al., 2009). Moreover, real-world professional situations require a combination of skills and not only one,

such as reading reports, listening to instructions, discussing findings, and providing verbal feedback within the same event. Research also suggests that prioritizing receptive skills at the expense of productive ones may hinder overall language development and language internalization (Schmidt, 1990; Swain & Lapkin, 1995). The strong receptive confidence but limited productive readiness reported by participants may therefore reflect a broader issue: ESP programs are sometimes treated as subjects to be completed rather than as active professional tools to be used. This contrasts with the core principles of ESP, which stress the importance of adapting training to meet their evolving communication needs.

Under publication pressure and insufficient preparation, researchers turn to different coping strategies for professional survival (Johann et al., 2004; Mertkan et al., 2022; Sayad et al., 2025, among others). Another key finding of the present study is the emerging role of AI tools in scientific writing. The fact that 100% of participants reported using AI tools and 60% doing so regularly indicates that these tools have become vital in compensating for the lack of targeted ESP training. As described by one of the researchers under study, AI tools are “the mentor I’m lacking” (verbatim). Participants reported using ChatGPT, Grammarly, and DeepL for tasks including paraphrasing, grammar correction, and textual organization. Using AI mainly for language support reinforces the communication challenges already reported by the participants. At the same time, participants’ cautious attitude toward the use of AI tools may reveal deep anxiety (Brown, 2026), exemplified by concerns over losing authorship authenticity and the ability to think critically. These concerns may influence their self-perception and academic confidence (Domingo, 2025). When asked to give recommendations for improving ESP training, the study participants highlighted the continuing importance of scientific communication skills in academic and professional contexts and the need for ongoing support throughout their careers. Participants’ need for extending ESP training beyond doctoral studies further explains their cautious attitudes toward the use of AI tools. Many studies document that these cautious users of AI fear losing human mentorship and traditional interactions with teachers and peers (Gurion et al., 2025; Kaçar, 2025; Kang, 2025), and therefore advocate for a balanced integration of AI supported by human pedagogical oversight (Shafiq & Shah, 2025).

Conclusion

This study tried to shed some light on the effectiveness of ESP training delivered through short workshops in preparing biotechnology researchers for the communicative demands of scientific practice. Despite demonstrating confidence in receptive skills, participants continued to face challenges in oral communication, scientific writing, and publication-related tasks, indicating that short ESP interventions may not be sufficient to prepare researchers for the complex needs of contemporary scientific communication. The study further revealed that AI has become an established part of researchers’ writing practices and that ignoring its existence or excluding it from academic training risks disconnecting researchers from academic and professional realities. Ultimately, preparing researchers for effective scientific communication requires longer, more sustained, and needs-based ESP interventions that address both oral and written communication as well as the ethical and responsible use of AI.

Recommendations

Drawing on the findings of this study, four recommendations are proposed:

1. Discipline-specific English Language training should be standardized and supported across all doctoral programs in Algeria to move beyond passive general English online modules to more active and research-oriented ESP instructions tailored to the communicative needs of specific disciplines. ESP training should not be limited to short workshops; it should extend over longer periods to meet the diverse demands of researchers and allow for the recycling and reinforcement of learned skills.
2. On-campus writing centers and peer-review clinics should be established to ensure continuous and real-time feedback to faculty members and doctoral students.
3. Existing ESP training must be redesigned to meet the actual communicative needs of researchers. It must prioritize the rhetorical logic, argumentation strategies, and structural conventions needed to develop the discussion and conclusion sections of scientific papers. ESP instruction must also explicitly teach the ethical boundaries of AI use without sacrificing academic honesty and original thought.
4. Doctoral and post-doctoral researchers should actively be involved in the elaboration of ESP programs, as their perceptions can help align training objectives with actual research practices and disciplinary requirements.

About the Author

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Declaration of AI

This research paper has undergone language correction using AI-powered tools (Grammarly) to address grammatical, spelling, and language errors. It is acknowledged that the use of such tools may introduce standardized patterns typical of AI-generated content. Consequently, a certain percentage of content may reflect AI-generated language structures. Yet, the intellectual content and the analysis remain entirely the author's work.

Statement of Absence of Conflict of Interest

The author declares that there are no conflicts of interest related to the research, findings, or recommendations presented in this paper. All conclusions drawn are independent and unbiased.

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