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THE NEEDS OF STUDENTS FOR LEARNING FOREIGN LANGUAGES WHO ARE STUDYING IN THE FIELD OF EXACT SCIENCES

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ABSTRACT : This article describes the foreign language learning needs of students in exact sciences such as mathematics, engineering, and information technology. With the increasing role of English in global academia and professional communication, students in these fields require specialized language skills for academic success and career development. The study analyzes recent research in English for Specific Purposes (ESP), Content and Language Integrated Learning (CLIL), and English-Medium Instruction (EMI) to identify key learner needs, including terminology acquisition, academic reading, technical writing, and professional communication.

Keywords: foreign language learning, exact sciences, ESP, EAP, CLIL, EMI, academic English, technical vocabulary, needs analysis, STEM education.

Introduction

In the modern system of higher education, foreign language competence has become one of the key factors determining students' academic and professional success. This is especially important for students studying exact sciences, such as mathematics, physics, engineering, computer science, information technology, and related technical disciplines. These fields are strongly connected with international research, digital technologies, academic publications, global innovation, and cross-border professional cooperation. As a result, students in exact sciences need foreign languages not only for everyday communication but also for reading scientific articles, understanding technical documentation, preparing research reports, writing abstracts, participating in conferences, and communicating with international specialists.

English has a particularly important role because it is widely used as the language of science, technology, and international academic communication. Many scientific databases, journals, conference proceedings, software manuals, programming resources, and technical standards are available mainly in English. Therefore, students who lack sufficient foreign language competence may face difficulties in accessing current scientific knowledge and participating in global academic exchange. Recent ESP research emphasizes that language teaching should address learners' study-related and profession-related needs rather than remain limited to general language instruction.

The needs of exact science students differ from those of students in humanities or social sciences. They often require a strong command of terminology, formulas in verbal explanation, technical description, problem-solving discourse, data interpretation, and academic writing. For example, engineering students need to describe mechanisms, processes, systems, and designs. Computer science students need to understand programming documentation, software instructions, and technical reports. Mathematics and physics students need to explain abstract concepts, interpret graphs, and present research findings logically.

However, in many higher education contexts, foreign language courses for non-philological students are still organized through general English textbooks and traditional grammar-based methods. Such approaches may improve basic language knowledge but often fail to prepare students for real academic and professional tasks. This creates a gap between what students learn in language classes and what they actually need in their disciplinary studies.

The theoretical foundation of foreign language instruction for exact science students is closely connected with English for Specific Purposes, English for Academic Purposes, Content

and Language Integrated Learning, and English-Medium Instruction. ESP is based on the principle that language teaching should be designed according to learners' specific academic, professional, and communicative needs. Unlike general English, ESP focuses on the language, genres, skills, and communicative situations that learners are likely to encounter in their future field.

Recent studies show that ESP remains one of the most relevant approaches in higher education because it connects language learning with students' disciplinary knowledge and professional goals. A recent Cambridge publication on ESP highlights two central principles of the field: instruction should address learners' work- or study-related language needs, and it should target specialized English. This idea is highly relevant to students in exact sciences because their language needs are shaped by their academic disciplines.

Needs analysis is considered the starting point of ESP course design. It allows teachers to identify students' present language level, target needs, learning difficulties, preferred learning styles, and future professional tasks. In exact sciences, needs analysis usually reveals the importance of reading scientific texts, understanding terminology, writing laboratory reports, preparing presentations, and communicating in international academic contexts. A recent systematic review of needs analysis in higher education notes that misalignment between learners' language needs and existing curricula can weaken learning outcomes.

EAP is another important direction because students in exact sciences frequently work with academic texts. They need to read research articles, understand abstracts, analyze literature, write reports, and prepare academic presentations. EAP develops skills such as summarizing, paraphrasing, citing sources, interpreting data, and structuring academic arguments. A 2025 review on academic English in higher education emphasizes that academic English proficiency is increasingly important due to the expansion of global academic communication.

CLIL is also useful for exact science students because it integrates language learning with subject content. Through CLIL, students learn foreign language structures while studying scientific topics. This approach helps students acquire terminology in context and develop both linguistic and conceptual understanding. Recent work on CLIL in STEM education reports that language integration can support disciplinary vocabulary and scientific literacy, although successful implementation requires careful planning and teacher preparation.

EMI has become another significant trend in higher education. Many universities introduce courses taught in English to improve internationalization and academic competitiveness. However, EMI may create challenges for both students and teachers if language support is insufficient. Recent research on STEM lecturers' English communication needs notes that teachers in EMI contexts face difficulties related to language barriers, classroom interaction, and the integration of language and content. Recent scientific literature demonstrates a growing interest in the language needs of STEM and exact science students. Scholars increasingly argue that foreign language instruction for these students should not be separated from their academic and professional disciplines. Anthony (2025) states that ESP is unified by two major concepts: attention to learners' specific study or work needs and focus on specialized English. This position is important because students in exact sciences do not need only conversational English; they need English for reading formulas, explaining processes, writing technical texts, and communicating scientific results. Li (2025) emphasizes that academic English instruction in higher education must prepare students for real academic communication, including reading scholarly texts, writing research papers, and presenting academic information. This is especially relevant for exact science students because they often use English to access international journals, conference materials, and digital resources. De Costa et al. (2025) discuss the integration of CLIL approaches in EMI settings and note that STEM teachers face challenges when combining content instruction with language development. Their work suggests that exact science students need structured linguistic support even when subject courses are taught in English.

Abdel Latif (2025) analyzes STEM lecturers' English communication needs and highlights that EMI contexts require not only content knowledge but also the ability to explain concepts, manage interaction, and support students' comprehension in English. This finding shows that foreign language competence is important for both students and teachers in exact science education.

A recent systematic review of ESP implementation in higher education reports that common challenges include insufficient needs analysis, lack of specialized materials, limited teacher training, and weak connection between language courses and students' professional fields. These problems are also visible in language education for exact science students, where general textbooks may not provide enough field-specific content.

Discussion and Analysis

The foreign language learning needs of students in exact sciences can be divided into several major categories. The first category is academic reading. Students need to read scientific articles, textbooks, conference papers, manuals, and online resources. In exact sciences, reading is often complicated by specialized terminology, abbreviations, formulas, symbols, diagrams, and complex sentence structures. Therefore, students should be trained to identify main ideas, understand definitions, interpret graphs, follow logical argumentation, and extract useful information from scientific texts.

The second important need is technical vocabulary acquisition. Exact science students must learn terms related to their field, such as algorithm, derivative, vector, circuit, resistance, database, equation, frequency, acceleration, and simulation. However, vocabulary should not be memorized in isolation. It should be taught through authentic contexts, problem-based tasks, technical descriptions, and subject-related texts. For example, computer science students can learn vocabulary through software documentation, while engineering students can study terminology through manuals and design descriptions.

The third need is academic and technical writing. Students should be able to write abstracts, summaries, laboratory reports, project descriptions, research articles, and technical explanations. Writing in exact sciences requires clarity, accuracy, logical organization, and correct use of terminology. Students should also learn how to describe data, compare results, explain methods, and present conclusions. In this regard, EAP-based writing tasks are very useful.

The fourth need is oral communication. Exact science students often need to present projects, explain solutions, participate in discussions, defend research results, and communicate with international colleagues. Therefore, foreign language classes should include presentations, poster sessions, group discussions, scientific debates, and problem-solving tasks.

The fifth need is digital communication. Modern exact science education is closely connected with online platforms, virtual laboratories, programming environments, international webinars, and digital databases. Students need foreign language skills to use software tools, follow online courses, participate in academic forums, and work with digital documentation.

Another important need is intercultural competence. Scientific cooperation often takes place in international teams. Students should understand not only language structures but also academic etiquette, politeness strategies, communication norms, and cultural differences in professional interaction.

Traditional grammar-translation methods are not sufficient to meet these needs. A more effective approach should include ESP materials, authentic scientific texts, CLIL tasks, project-based learning, digital platforms, and cooperation between language teachers and subject teachers. For example, a language course for engineering students may include reading technical manuals, writing project reports, describing mechanisms, and presenting design solutions. A course for mathematics students may focus on explaining formulas, interpreting graphs, and presenting problem-solving steps.

Assessment should also be needs-based. Instead of only testing grammar, teachers should assess students' ability to perform real academic and professional tasks. These may include writing an abstract, presenting a scientific topic, summarizing an article, explaining a diagram, or preparing a technical report.

Conclusion

Foreign language learning is an essential component of higher education for students in exact sciences. In the modern academic and professional environment, students of mathematics, physics, engineering, computer science, and technology need foreign languages to access scientific information, understand technical materials, write academic texts, present research results, and communicate internationally. The analysis shows that their needs are specific and cannot be fully met through traditional general English courses.

The most important needs include academic reading, technical vocabulary, scientific writing, oral presentation, digital communication, and intercultural competence. ESP, EAP, CLIL, and EMI approaches provide effective methodological foundations for designing foreign language courses for exact science students. However, successful implementation requires systematic needs analysis, authentic materials, collaboration between language and subject teachers, and appropriate assessment methods.

Therefore, foreign language instruction for exact science students should be practical, discipline-based, and connected with students' future professional activities. Such an approach can improve students' academic performance, research capacity, professional readiness, and participation in international scientific communication.

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