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A Needs-Based Model for the Personalized Design of Academic English Teaching Materials in Engineering Education

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Abstract

The advancement of engineering education within English-medium environments underscores the need for tailored English for Academic Purposes (EAP) resources that address the linguistic, communicative, and technical needs of engineering students. This study presents a need-based model for EAP material development, focusing on personalized approaches to enhance learning efficacy and engagement. By analyzing data from surveys, interviews, and classroom observations with both students and instructors, this research identifies specific language skills and knowledge areas necessary for engineering students. The model includes vocabulary selection, genre-specific writing practice, and multimodal learning tools aligned with EAP objectives. Findings demonstrate that need based, personalized EAP resources in engineering contexts can enhance students' academic and professional communication capabilities. Practical recommendations are provided for developing EAP materials suited to engineering disciplines.

Keywords: EAP, teaching materials, need analysis, personalized design, engineering education

1. Introduction

With the internationalization of higher education, engineering programs increasingly require students to demonstrate proficiency in English for Academic Purposes (EAP). However, standard EAP materials often fail to meet the specialized language demands of engineering students, who need both general academic English and technical vocabulary proficiency. This study examines a model for developing personalized EAP materials that address these needs.

The study builds on recent research in needs-based EAP and specialized curriculum design (Borg & Liu, 2013), focusing on multimodal, corpus-based methods for aligning course content with student needs. Integrating a personalized approach aligns with Wette and Furneaux's (2018) observations that academic writing development is improved when tailored to specific student contexts. This model aims to provide practical resources for instructors and insights for academic programs seeking to meet the complex linguistic needs of engineering students in EAP courses.

1.1 Background and Rationale

As global engineering fields expand, English proficiency has become critical in enabling engineering students to access research, participate in international projects, and contribute to interdisciplinary collaboration (Hyland & Hamp-Lyons, 2002). Traditional EAP resources often fail to address the specialized academic and communicative requirements of engineering students, including understanding technical texts, academic writing for technical disciplines, and effective spoken communication in seminars and collaborative projects. While EAP courses aim to equip students for academic success, the curriculum may overlook discipline-specific elements that are integral to engineering education. Despite the availability of general academic English resources, a notable gap exists in materials tailored to the engineering discipline's unique linguistic and technical demands. Consequently, a more targeted approach to academic English textbook design—one that considers specific needs in engineering—is essential.

This study proposes a personalized, needs-based model for designing EAP materials that align with the academic demands of engineering students. By identifying the precise academic English needs of this student group, we develop a model that allows for tailored material design, enhancing the relevance and effectiveness of EAP

instruction.

1.2 Research Problem and Objectives

Engineering students often encounter challenges when using traditional academic English teaching materials, which are generally not tailored to the specific linguistic and contextual demands of their field. These generic materials frequently overlook essential components such as technical terminology, field-specific discourse, and the unique academic writing conventions that engineering students must master. This gap can hinder students' capacity to fully engage with course content and effectively communicate in both academic and professional settings.

Addressing this gap, this study seeks to develop a model for an academic English teaching material designed specifically for engineering students. The model will be based on a comprehensive need analysis, incorporating insights from student-centered pedagogical approaches to create a resource that aligns with the linguistic and contextual requirements of engineering. This needs-based model aims to provide an adaptable and relevant learning tool that will enhance students' ability to understand and produce academic English appropriate to their field, fostering both technical and academic communication skills. And the following are the research questions of this study:

Research questions:

(1) What are the specific academic English needs of engineering students?

(2) How can a needs-based, student-centered approach enhance academic design of EAP teaching resources for engineering students?

1.3 Significance of the Study

Personalizing learning materials has been shown to significantly enhance student engagement, motivation, and overall learning outcomes (Tomlinson, 2014). In the context of EAP, particularly for engineering students, personalized resources can address unique linguistic challenges, including technical vocabulary, specialized discourse structures, and contextually appropriate language use. By designing materials that align closely with students' academic and professional needs, this study aims to bridge the gap between generic academic English resources and the specialized demands of engineering disciplines.

This study holds practical and theoretical significance. Practically, it provides a framework that textbook designers, curriculum developers, and EAP educators can use to tailor academic English materials specifically for engineering students, facilitating more effective communication skills and preparing students for the language demands of their future careers. Theoretically, the study contributes to the broader field of language education by demonstrating the importance of integrating needs-based and student-centered principles in curriculum design, potentially informing future research on personalized learning materials across other fields.

Ultimately, the framework proposed in this study has the potential to not only enhance students' academic performance but also to support their long-term professional language development. By equipping engineering students with more relevant and accessible language resources, this research aims to contribute to a more inclusive and effective EAP curriculum that aligns closely with the evolving requirements of both academic and industry settings.

2. Literature Review

The field of English for Academic Purposes (EAP) has evolved to address the unique academic and professional language needs of students in specialized disciplines, such as engineering. While traditional EAP materials focus on general academic skills, recent research highlights the need for customized resources that address the specific demands of engineering students. This review explores recent studies in EAP, needs analysis, personalized learning, and EAP textbook design, providing a foundation for a needs-based, personalized model for academic English materials in engineering education.

2.1 English for Academic Purposes (EAP) and Engineering Students' Language Needs

EAP instruction has long supported students' academic success by focusing on essential language and communication skills. However, studies emphasize that engineering students face additional challenges that are rarely addressed by traditional EAP materials. Research shows that general academic skills do not sufficiently cover the discipline-specific terminology, technical language functions, and specialized discourse practices required in engineering (Hyland & Jiang, 2017; Wingate & Tribble, 2012). Engineering students often need targeted support for tasks like interpreting complex technical documentation and mastering field-specific genres, such as technical reports and data-based presentations (Flowerdew, 2016).

The shift towards discipline-specific EAP has gained momentum as educators recognize the benefits of materials that integrate engineering-relevant content and contexts. Scholars argue that tailoring EAP materials to reflect the language demands of engineering not only enhances comprehension but also improves students' engagement and motivation (Hyland, 2016; Pecorari & Malmström, 2018). Nonetheless, there remains a shortage of EAP resources that cater explicitly for engineering students, underscoring the need for customized, discipline-focused materials (Casal & Lee, 2013).

2.2 Needs Analysis in EAP for Engineering

Needs analysis is crucial in EAP for identifying the specific language skills and communicative competencies required within various disciplines. Research by Cowling (2007) highlights that EAP materials tailored to the unique needs of learners yield better outcomes in language acquisition and skill application. In engineering education, needs analysis reveals critical insights into language tasks, such as comprehending technical descriptions, analyzing data, and producing discipline-specific reports (Basturkmen, 2010).

Youn (2018) emphasizes that needs analysis should consider the continuously evolving requirements of engineering, reflecting both academic demands and industry expectations. This alignment ensures that students are well-prepared for their academic studies as well as their future professional roles. A study by Yan and Zhang (2018) found that when EAP curricula are developed based on needs analysis, students are better able to acquire essential language skills and confidently apply them in field-specific contexts. Despite these insights, there is a lack of comprehensive needs-based models for designing EAP materials in engineering, pointing to an important area for development (Long, 2005).

2.3 Personalized Learning and Student-Centered Approaches in EAP

The shift towards personalized learning in EAP reflects broader educational trends aimed at enhancing engagement and supporting diverse learner needs. Research supports the effectiveness of student-centered approaches, especially when addressing the unique academic and professional language requirements of students in specialized fields (Tomlinson & Imbeau, 2010). Personalized EAP materials for engineering students allow for differentiated instruction, meeting the diverse proficiency levels, learning preferences, and career aspirations of individual students (Banister, 2021).

For engineering students, personalized EAP materials provide a relevant context that enhances language acquisition, particularly for complex, technical subjects (Gusti, 1999). Personalized learning also aligns with active learning principles, promoting autonomy and engagement through tasks that mirror real-world applications (Huang & Yu, 2023). However, while the benefits of personalization are well-documented, practical models for implementing personalized EAP materials in engineering remain limited, calling for innovative frameworks that can be adapted across different engineering subfields.

2.4 EAP Teaching Material Design for Engineering

Effective EAP teaching material design requires balancing general academic language skills with discipline-specific content, particularly in technical fields like engineering. Recent studies emphasize that EAP materials for engineering should incorporate authentic tasks that mirror the communication demands students will encounter in their field. This includes technical report writing, interpreting data, and engaging with visual information, such as graphs and schematics (Girón-García & Fortanet-Gómez, 2023). Textbooks that integrate such authentic tasks are more likely to foster students' confidence and competence in handling discipline-specific language (Henry, 2007).

Research also highlights the value of multimodal resources in EAP for engineering students, given the visual and data-driven nature of the field. Multimodal elements, such as technical diagrams and tables, facilitate comprehension of complex concepts and enhance students' ability to produce engineering-specific texts (Rahmanu & Molnár, 2024). Yet, few EAP textbooks for engineering integrate multimodal components effectively, and there is a lack of comprehensive frameworks for including these elements in a way that supports

both academic and professional language needs (Lu, 2022).

2.5 Gaps in Existing Literature

Despite growing interest in personalized EAP materials, there is still a lack of resources tailored specifically to the academic and professional language needs of engineering students. Much of the literature underscores the importance of needs analysis and personalized learning in EAP; however, practical applications within textbook design for engineering students are underexplored. Additionally, the integration of multimodal elements, essential in engineering communication, remains limited in current EAP materials, indicating a critical need for more comprehensive, tailored resources. This study aims to fill these gaps by proposing a needs-based model for personalized EAP teaching material design that incorporates multimodal elements tailored to engineering. The model aspires to provide an adaptable framework that enhances engineering students' academic and professional language skills, supporting their success in both educational and professional settings.

3. Research Methodology

3.1 Research Design

This study adopts a mixed-methods approach to explore and develop a needs-based model for designing personalized academic English (EAP) teaching materials tailored to the needs of engineering students. The mixed-methods design combines quantitative data from surveys with qualitative insights from interviews and focus groups, enabling a comprehensive understanding of engineering students' language learning needs and preferences. This approach is grounded in Hoadley-Maidment's (1980) "Needs Analysis Triangle" theory, which posits that the key information for needs analysis comes from three perspectives: the needs perceived by teachers, the needs perceived by students, and the needs perceived by institutions. By integrating these three dimensions, the study ensures a holistic and responsive model that is both evidence-based and tailored to the unique requirements of engineering students. This design is particularly appropriate given the goal of creating a teaching model that integrates both broad trends and individualized insights.

3.2 Data Collection

Data were collected from multiple sources to gain a comprehensive understanding of the language needs and instructional challenges in the context of engineering education. First, a survey was distributed to a sample of 150 engineering students from a university of science and technology in Shanghai, China. The student participants represented various academic levels and disciplines within the field of science and technology, including but not limited to electronic engineering, mechanical engineering, power engineering, and artificial intelligence technology. Among these students, approximately 85% were enrolled in programs spanning a range of academic levels, including undergraduate (both lower and upper years), master’s students. Specifically, the sample included 124 undergraduate students (with 83 in the first two years and 41 in the final two years of their program), 26 master's students. The survey included questions addressing students' self-perceived language needs, specifically focusing on areas such as academic writing, technical vocabulary, oral presentation skills, and the comprehension of discipline-specific texts, such as technical articles, research papers, and manuals. Both closed-ended questions (using a Likert scale) and open-ended questions were included to capture a detailed view of students' language challenges, preferred learning methods, and the specific language skills they felt were essential for their academic success.

Additionally, semi-structured interviews were conducted with 10 instructors who specialize in teaching English for Academic Purposes (EAP) to engineering students. These instructors provided insights into the practical challenges they encounter while teaching academic English within engineering contexts. Interview questions focused on instructors' perceptions of students' common language difficulties, the adequacy of current EAP materials, the relevance of the curriculum to engineering-specific tasks, and the strategies they employ to bridge gaps in students' language abilities. The combination of quantitative data from the student surveys and qualitative insights from instructor interviews ensured a holistic understanding of the existing gaps and provided a foundation for developing a targeted EAP model tailored to engineering students' needs.

3.3 Data Analysis

Data analysis in this study followed a mixed-methods approach, involving both quantitative and qualitative analysis to interpret survey and interview data from engineering students and EAP instructors. The analysis process comprised several stages to systematically examine and integrate insights from the two data sources.

3.3.1 Quantitative Analysis of Student Surveys

Responses from the 150 engineering students' surveys were analyzed using descriptive statistics to provide an overview of their perceived language needs and challenges. Closed-ended survey questions, rated on a Likert scale, were analyzed. These analyses helped to identify the most common language skills that students found challenging.

3.3.2 Qualitative Analysis of Instructor Interviews and Open-Ended Survey Responses

Open-ended responses from the surveys provided more nuanced insights into students' specific language concerns and preferences for learning resources. These responses were coded and analyzed thematically using NVivo software, allowing for the identification of recurring themes such as the need for context-specific vocabulary training, challenges with technical writing conventions, and preferences for visual and interactive learning materials. Instructors' insights into students' common difficulties with academic writing and reading comprehension were cross-referenced with students' survey responses to ensure alignment between perceived needs and instructional challenges.

3.3.3 Development of the Needs-Based Model

Insights from the data analysis process directly informed the development of the needs-based model for personalized EAP materials. The specific language skills and instructional challenges identified in the surveys and interviews were used to define the core components of the model. The model prioritized the most commonly cited needs, such as vocabulary specialization, academic writing tailored to engineering contexts, technical communication skills and multimodal learning materials. By incorporating both quantitative trends and qualitative insights, the model was designed to be flexible and adaptable, allowing instructors to personalize materials to meet varied language needs within diverse engineering disciplines.

4. Results

This section presents the results derived from quantitative and qualitative data analysis. Survey data from engineering students, combined with thematic analysis of open-ended responses and instructor interviews, reveal both students' perceived language needs and instructors' instructional challenges. The findings offer critical insights into the specific language skills and resources required to enhance academic English proficiency for engineering students.

4.1 Student Survey Results

4.1.1 Language Skills and Needs

Quantitative analysis of the survey responses from 150 engineering students indicates several key areas of language need. “Technical vocabulary” received the highest mean score of 4.6 (SD = 0.5) on a Likert scale, with 84% of students identifying it as a high-priority area (Table 1). This was followed by “Academic writing” (M = 4.3, SD = 0.6), where 78% of students reported challenges, particularly in structuring essays and conveying complex engineering concepts. “Oral presentation skills” also emerged as a critical need, with a mean score of 4.0 (SD = 0.8) and 72% of students indicating a need for further development in this area.

Table 1. Descriptive Statistics of Perceived Language Needs

Language Skill	Mean Score (Likert Scale 1-5)	Standard Deviation	Percentage of Students Indicating High Need (4-5)
Academic Writing	4.3	0.6	78%
Technical Vocabulary	4.6	0.5	84%
Oral Presentation Skills	4.0	0.8	72%
Discipline-Specific Reading	3.8	0.7	65%
Listening and Comprehension	3.5	0.9	58%

Cross-tabulations revealed that higher-level students, particularly graduate students, reported a greater need for technical vocabulary enhancement compared to first- and second-year students (Table 2). This trend suggests that as students advance in their studies, their awareness and need for discipline-specific language skills intensify.

Table 2. Cross-Tabulation of Academic Level and High Need for Technical Vocabulary

Academic Level	Percentage Indicating High Need for Technical Vocabulary (Likert 4-5)
Undergraduate (1st–2nd year)	76% (Total 83 Students)
Undergraduate (3rd–4th year)	85% (Total 41 Students)
Graduate Students	92% (Total 26students)

4.1.2 Preferences for Learning Resources

Students expressed a strong preference for multimodal and interactive learning resources. “Visual aids” (e.g., diagrams and charts) were favored by 73% of students, while “interactive digital content” was preferred by 57%, and “task-based activities” by 60% (Table 3). Only 23% of students preferred traditional textbooks, indicating a shift towards more dynamic and visually supported materials that engage multiple learning modalities.

Table 3. Frequency Distribution of Students’ Preferences for Learning Resources

Learning Resource	Frequency(N=150)	Percentage
Interactive Digital Content	85	57%
Discipline-Specific Texts	60	40%
Visual Aids (e.g., diagrams, charts)	110	73%
Task-Based Activities	90	60%
Traditional Textbooks	35	23%

4.2 Instructor Interview Results

4.2.1 Instructional Challenges

Thematic analysis of semi-structured interviews with 10 EAP instructors identified several instructional challenges, notably “students’ limited technical vocabulary”, which 80% of instructors highlighted as a primary obstacle in academic English learning (Table 4). Instructors observed that students often struggle with specialized terminology essential for engineering disciplines, impacting their comprehension of technical texts and their ability to convey precise information in written assignments.

Table 4. Summary of Instructor-Identified Challenges in Academic English Instruction for Engineering Students

Challenge	Frequency of Mention (N=10)	Percentage of Instructors
Students’ Limited Technical Vocabulary	8	80%
Lack of Relevant, Contextualized Examples	7	70%
Need for Multimodal Learning Materials	9	90%
Varied Language Preparedness among Students	6	60%
Insufficient Focus on Academic Writing Skills	5	50%

The “need for multimodal learning materials” was another prominent theme, emphasized by 90% of instructors, who noted that incorporating visual aids, such as diagrams and interactive modules, would make complex engineering content more accessible. Instructors also frequently mentioned the “lack of relevant, context-specific examples” (70%), citing that real-world engineering scenarios would better engage students and enhance the relevance of language instruction.

4.3 Integrated Themes from Student and Instructor Data

4.3.1 Converging Needs and Perspectives

The integrated analysis of student and instructor data highlighted several converging themes (Table 5). Both students and instructors expressed a strong need for “technical vocabulary support”, indicating alignment on the importance of enhancing students' familiarity with discipline-specific language. Additionally, both groups emphasized the value of “multimodal resources”. Instructors suggested that visual aids and interactive exercises facilitate students' understanding, while students indicated that these materials help them retain information more effectively.

Another shared theme was the “desire for context-specific examples and relevant, real-world applications”. Both

students and instructors believe that such examples make language learning more meaningful within the engineering context, suggesting that case studies and practical scenarios could enhance engagement and practical language application.

4.3.2 Diverging Needs and Perspectives

The analysis also uncovered some differences between student and instructor perspectives. “Academic writing support” was a need commonly expressed by students, with 57% citing difficulties in structuring essays and reports (Table 5). Instructors also recognized this need but focused more on the lack of consistency in students’ background knowledge, which they reported as a challenge in delivering a standardized curriculum. “Oral presentation skills” were prioritized by nearly half of the students (47%) but were not a major focus for instructors, suggesting a potential area for curricular emphasis that could better meet students' self-perceived needs. The "Diverse Language Preparedness" theme highlights a gap in perspectives between instructors and students. 60%of instructors view varying English proficiency levels as a major instructional challenge, as it complicates the creation of inclusive materials. However, only 6% of students noted this issue, suggesting limited awareness of its impact. While instructors feel a strong need for differentiated resources, students may not recognize the support available or perceive their language needs as fully addressed. Bridging this gap could involve clearer, targeted language support to help students.

Table 5. Integrated Themes from Instructor Interviews and Student Open-Ended Responses

Integrated Theme	Subthemes	Frequency (Instructors N=10/ Students N=150)	Percentage (Instructors / Students)	Illustrative Quotes
Technical Vocabulary Enhancement	- Specialized Terminology - Industry Jargon	8 / 120	80% / 80%	Instructors: "Students often struggle with the specialized terms we use." Students: "I struggle to remember and use technical terms correctly."
Multimodal and Interactive Materials	- Visual Aids - Interactive Content	9 / 95	90% / 63%	Instructors: "Incorporating diagrams and interactive modules can make complex concepts more accessible." Students: "Visual aids like diagrams and video tutorials help me understand better."
Context-Specific and Relevant Examples	- Engineering Case Studies - Real-World Applications	7 / 80	70% / 53%	Instructors: "Using real-world engineering problems helps students apply their language skills." Students: "Case studies make the language more relevant to my field."
Academic Writing Support	- Structuring Essays - Report Structuring	5 / 85	50% / 57%	Instructors: "Students need more support in structuring their technical reports." Students: "I find it difficult to organize my essays logically."
Oral Communication Skills	- Public Speaking - Technical Explanations	0 / 70	0% / 47%	Instructors: (Not directly addressed) Students: "I need more practice on presenting technical information clearly."
Diverse Language Preparedness	- Varied Proficiency Levels - Inconsistent Backgrounds	6 / 0	60% / 0%	Instructors: "There's a wide range of English proficiency among students." Students: (Not directly addressed)

4.4 The Need-based Model for the Design of EAP Teaching Materials

Grounded in the previous research result, this need-based model for the personalized design of Academic English (EAP) teaching materials in engineering education is formulated. The model addresses the gap between students' specific needs and the available resources. At its core, the model focuses on developing inclusive, content-specific materials that incorporate technical vocabulary and multimodal resources to align with the specialized demands of engineering disciplines. The process involves active collaboration between students and teachers, ensuring the materials are relevant and adaptable to diverse learner profiles and proficiency levels through differentiated resources. Based on dynamic and evidence-based curriculum design, the model emphasizes flexibility and data-driven strategies to meet evolving academic and professional needs. Furthermore, it aims to enhance the dissemination power of courses by ensuring they are disseminable and well-reputed, thereby maximizing their impact and adoption. Enhanced interdisciplinary collaboration is also a key component, fostering integration of expertise to enrich the materials and teaching approaches. Ultimately, this model seeks to deliver efficient personalized instruction, improving student engagement and learning outcomes in technical contexts.

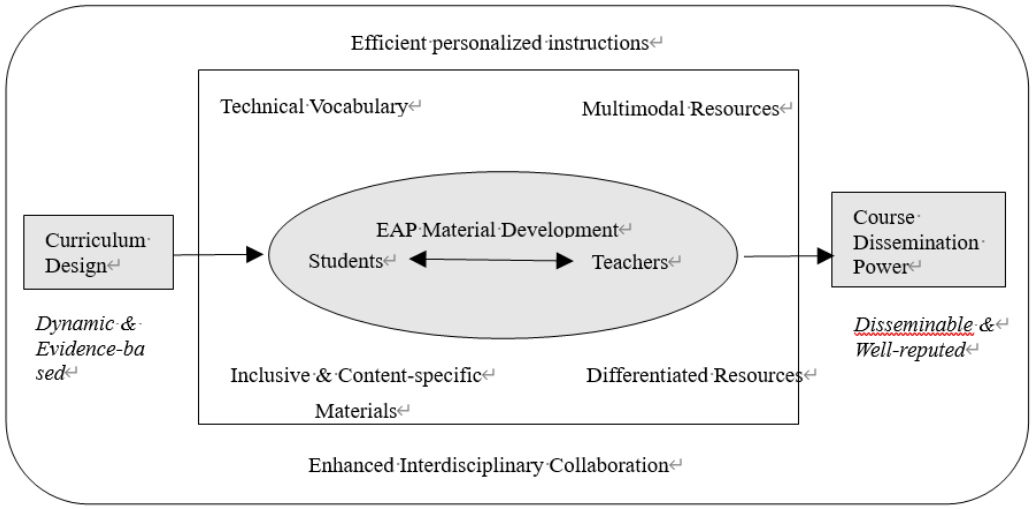

Figure 1.

5. Discussion

The findings from this study highlight significant gaps in existing academic English instruction for engineering students, emphasizing the need for tailored resources that address specific linguistic and professional requirements in engineering contexts. Through both quantitative and qualitative analyses, this research identified four main areas of need: technical vocabulary, multimodal resources, contextualized examples, and targeted support for academic writing and presentation skills. The resulting needs-based model offers a structured approach to addressing these areas, informed by students' self-reported challenges and instructors' insights.

5.1 Addressing Technical Vocabulary

Technical vocabulary emerged as a critical area for improvement, which supports prior research suggesting that discipline-specific terminology is essential for understanding specialized academic content in fields like engineering. By integrating vocabulary development directly into language instruction, this model aligns with findings that vocabulary proficiency can directly enhance comprehension and academic performance in specialized fields.

5.2 Benefits of Multimodal and Contextualized Learning

The preference for multimodal resources reflects a broader trend towards interactive and visually supported learning materials. Multimodal learning not only engages diverse learning styles but also helps make complex engineering concepts more accessible, resonating with studies that highlight the effectiveness of varied instructional methods for technical subjects. Additionally, the emphasis on real-world applications and contextualized examples suggests that when students see the relevance of language learning in real engineering tasks, they are more likely to engage and retain information. This finding reinforces the importance of contextualized instruction in academic English programs.

5.3 Importance of Personalized Support for Writing and Presenting

The need for personalized support in writing and presentation skills underscores the challenge students face in effectively communicating technical information. The model's targeted workshops, templates, and presentation training directly respond to students' needs for structured guidance, which is essential for building confidence and clarity in both written and oral communication. Such support aligns with research advocating for skill-based learning tailored to the practical demands of students' fields.

5.4 Implications for Curriculum Development

This needs-based model has practical implications for academic English curriculum design in engineering education. It suggests that EAP programs should integrate discipline-specific vocabulary, multimodal resources, and contextualized examples into their core materials. Instructors can benefit from the model's structure to better understand and meet the language needs specific to engineering, thus enhancing the learning experience and supporting students' professional readiness. Future research should investigate the effectiveness of this model in different engineering disciplines and evaluate its long-term impact on students' academic and professional success.

5.5 Model Limitations and Challenges

The needs-based model offers a structured approach to improving academic English for engineering students, but several challenges remain. Implementing extensive vocabulary lists and discipline-specific examples requires close collaboration between language and engineering instructors, which can be difficult due to scheduling and resource constraints. The use of multimodal resources also demands technology and digital literacy, which may be limited in some institutions. Additionally, adapting real-world engineering cases for language learning is time-intensive and may not always align with specific student needs. Providing personalized support for writing and presentations is also challenging in large classes and may not fully address varying English proficiency levels. These limitations highlight the need for careful planning, resource allocation, and scalable strategies to optimize the model's effectiveness. Future research should explore solutions for these challenges, including efficient personalized instruction and enhanced interdisciplinary collaboration. Additionally, although the data collected from a single university limits the scope of this study, and its findings may not be broadly generalizable to other institutions, they offer important insights into the unique challenges faced by engineering students in this context. Future research could extend the scope by including multiple institutions to enhance the generalizability of the results. Also, this study could do more in specifying the different academic levels of the participants and offer a clearer picture of the distinct language needs at various stages of engineering education.

6. Conclusion

This study has highlighted the significant language needs of engineering students in academic English instruction, identifying key areas such as technical vocabulary, multimodal resources, real-world contextualization, and personalized writing and speaking support. The needs-based model developed from these findings provides a structured, comprehensive approach to addressing these needs in a way that aligns with the specific demands of engineering education.

By incorporating discipline-specific vocabulary, interactive and visual learning materials, and real-world case studies, this model aims to enhance students' academic English proficiency in both written and oral communication. The personalized support component further ensures that students receive targeted assistance in their areas of greatest need, fostering both language development and confidence in academic settings.

However, the model's implementation faces challenges, including the need for interdisciplinary collaboration, technological resources, and scalable support in large classrooms. Despite these challenges, the model offers valuable insights for curriculum designers and educators aiming to improve English for academic purposes (EAP) in engineering education. Future research should explore the model's application across diverse engineering disciplines and evaluate its impact on students' long-term academic and professional success.

In conclusion, this needs-based approach provides a practical framework for improving academic English instruction in engineering, contributing to the overall goal of preparing students for effective communication in both academic and professional engineering contexts.

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