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Aligning English Language Instruction with Engineering Needs: Comprehensive Needs Analysis Framework for ESP Syllabus Design

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This study aims to align English language instruction with the specialized needs of engineering students at Alamein International University (AIU) through a comprehensive, multi-phase needs analysis. By integrating quantitative surveys with qualitative interviews, the research identifies key linguistic and technical competencies required by engineering students to excel academically and professionally. Findings reveal substantial challenges in students' application of technical terminology, particularly in areas like project documentation, presentations, and collaborative tasks. Faculty insights further highlight the importance of industry-relevant content and up-to-date terminology, underscoring the need for an ESP syllabus that emphasizes both language skills and technical understanding. The proposed syllabus framework includes thematic units covering diverse engineering fields, such as Architectural Design, Mechatronics, Petroleum Engineering, and Biomedical Engineering, offering not only language support but also foundational orientation in various engineering disciplines. This dual-purpose syllabus is designed to equip AIU engineering students with the linguistic and professional competencies essential for global employability and success in their chosen fields.

Keywords: English for specific purposes (ESP), engineering education, needs analysis, technical vocabulary, thematic syllabus, professional readiness

INTRODUCTION

In today's globalized world, English has become crucial in higher education, especially in technical fields like engineering. Engineering students not only need to excel in their technical skills but also must be proficient in English to engage with global knowledge networks and access career opportunities. However, traditional English instruction often fails to meet the specific needs of these students. To address this, English for Specific Purposes (ESP) programs have been developed to better support non-native English-speaking engineering students.

The evolution of English language instruction in higher education has transitioned from general curricula to ESP curricula, which are tailored to meet students' field-specific language needs. Studies indicate that while general English courses have traditionally emphasized everyday communication, ESP courses, particularly in engineering, are designed to address the distinct demands of professional language use (Terauchi, Noguchi, & Tajino, 2019). According to Hutchinson and Waters (1987), ESP emerged in response to the growing necessity for specialized communication skills, extending beyond basic grammar and vocabulary to encompass context-specific discourse in technical fields. This approach ensures that engineering students develop proficiency not only in foundational language skills but also in field-specific terminology and communicative practices essential for professional success (Harmer, 1991)

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An effective ESP syllabus requires detailed needs analysis, a critical process for identifying the linguistic, cognitive, and pragmatic demands of students' future professional contexts. This process includes collecting quantitative and qualitative data on the academic and professional language needs of students, as well as on the language and communication challenges they are likely to encounter. According to Tabrizi and Renani (2016), needs analysis acts as a foundational framework for ESP, shaping the course objectives and content by aligning with the realities of the discipline, thus ensuring relevance and applicability. The approach also emphasizes the importance of adaptability, allowing programs to evolve with industry demands (Popescu, 2012).

A multi-phase approach to needs analysis is essential for capturing the comprehensive and nuanced language needs of engineering students. Multi-phase methods enable researchers to gather data from multiple perspectives, including students, faculty members, and industry professionals, thus creating a holistic view of language requirements (Zughoul & Hussein, 2005). Studies have shown that a single-phase analysis often overlooks important factors, particularly in highly specialized fields like engineering. The use of a layered approach ensures that ESP curricula address not only linguistic requirements but also pedagogical preferences and practical applications in professional contexts (Ahmad & Ahmad, 2012; Ellis, 2012).

In designing ESP curricula, needs analysis must be informed by a clear theoretical framework to effectively identify and prioritize learner requirements. Hutchinson and Waters (1987) propose a tripartite model comprising Target Situation Analysis (TSA), Present Situation Analysis (PSA), and Learning Needs. TSA focuses on the specific communicative tasks and contexts learners are expected to perform in their future academic or professional environments, such as writing technical reports, participating in design presentations, or interpreting engineering data. PSA, by contrast, assesses learners' current proficiency levels and academic preparedness, while the analysis of Learning Needs examines the cognitive and pedagogical preferences that influence how learners best acquire language. This tripartite framework has been widely adopted in ESP research as it provides a structured yet flexible basis for course design (Dudley-Evans & St John, 1998; Hutchinson & Waters, 1987). In this study, the quantitative survey captured elements of PSA by evaluating students' self-assessed proficiency, prior exposure to ESP, and current academic language challenges. Simultaneously, faculty interviews and the focus group explored TSA by identifying the language competencies students are expected to develop for future engineering contexts. Insights into Learning Needs emerged through participants' preferences for instructional strategies and materials. Together, these three dimensions provided a holistic lens for interpreting the data and designing an ESP syllabus that is pedagogically responsive and professionally aligned.

For engineering students, mastering technical English is vital, as it facilitates their engagement with specialized literature, comprehension of complex technical documents, and effective communication in professional settings. However, many ESP programs for engineering students lack the depth and specificity needed to make students truly proficient in field-specific language use (Mckay, 2003). Engineering graduates often struggle with technical communication in English, which can hinder their performance in the global job market (Sharma & Mishra, 2009). Research has demonstrated that ESP programs tailored to engineering contexts significantly enhance students' ability to articulate complex concepts and discuss technical processes in English, contributing to their overall professional competency (Irudayasamy, Souidi, & Hankins, 2020).

ESP for engineering has thus become a critical area within language instruction, as it aligns language learning with the practical, professional demands of the engineering field. ESP courses for engineering students aim to develop students' technical vocabulary, improve their ability to read and interpret specialized texts, and enable them to communicate effectively in field-specific scenarios. As Hutchinson and Waters (1986) argue, ESP enables students to connect language learning with their career paths, making language education more relevant and impactful (Tabrizi & Renani, 2016).

Despite the acknowledged importance of ESP, some programs fail to equip students with the practical skills necessary for real-world application, thus underscoring the need for a structured, needs-based approach in ESP curriculum design (Widdowson, 2011).

The importance of supporting ESP needs in engineering students lies in its potential to bridge the gap between language proficiency and technical knowledge. Engineering students who receive targeted ESP instruction show improved communication skills, greater confidence in professional interactions, and enhanced technical language proficiency (Mudraya, 2006; Terauchi et al., 2019). For example, ESP programs that integrate technical vocabulary and professional communication practices have been shown to increase students' engagement with their field of study and improve employability prospects, as engineering graduates are better equipped to meet the demands of their profession (Zughoul & Hussein, 2005; Kassim & Ali, 2010).

Given the importance of ESP for engineering students, this study aims to address a gap in current instructional approaches by developing an ESP syllabus grounded in a rigorous needs analysis. Although several studies highlight the value of ESP in technical disciplines, there is limited research on tailoring ESP content to the specific requirements of engineering students through comprehensive, multi-phased needs analysis. This research seeks to fill that gap by investigating the unique linguistic and academic needs of engineering students at Alamein International University, thus informing the development of an ESP curriculum that combines both technical and linguistic competencies for academic and professional success.

LITERATURE REVIEW

English proficiency is essential for engineering students, who require both technical expertise and effective communication skills for career success. English for Specific Purposes (ESP) addresses this by developing curricula tailored to specific professional fields, such as engineering. However, designing effective ESP programs remains challenging due to the complex professional and linguistic needs of these students. Research highlights the importance of comprehensive needs analysis to accurately identify these language requirements and support the creation of practical and relevant ESP courses.

ESP in Higher Education

The integration of ESP into higher education is driven by the global shift toward field-specific training, especially in non-native English-speaking countries where language serves as both a tool and a barrier in professional contexts. ESP has emerged as an effective approach to preparing students for industry requirements by equipping them with language skills relevant to their future careers. Terauchi, Noguchi, and Tajino (2019) emphasize that ESP's rise reflects the demand for specialized skills in academic and professional domains, which general English courses cannot adequately address. This shift is particularly significant in the field of engineering, where technical language proficiency is integral to both academic success and employability (Popescu, 2012; Mckay, 2003).

Recent studies in both local and regional contexts support the use of ESP instruction tailored to engineering students. For example, Gürsoy and Sağlam (2020) found that engineering students in Turkish universities often display low motivation toward general English courses but respond more positively to ESP curricula that reflect their professional goals. Similarly, Mohammadi and Mousavi (2020) emphasize the necessity of developing ESP courses grounded in learners' academic and technical needs, demonstrating that a targeted curriculum improves both engagement and language outcomes. Studies reveal that ESP in higher education is both beneficial and necessary for engineering students, yet its success depends on the contextual adaptability of curricula and instruction (Mousavi, Gholami, & Sarkhosh, 2019). For example, the introduction of ESP courses at university levels had a positive impact on engineering students' language proficiency, particularly in technical

communication and specialized vocabulary (Irudayasamy et al., 2020). This aligns with Tabrizi and Renani's (2016) findings that ESP courses, when effectively designed, help students link language learning with their professional realities. However, Mckay (2003) argues that many institutions fail to implement ESP effectively due to lack of practice-oriented methods, which often results in students' low motivation and limited improvement in applied communication skills. This discrepancy highlights the need for ESP curricula that not only focus on vocabulary acquisition but also provide opportunities for practical application, thus underscoring the criticality of ESP for higher education institutions aiming to bridge the gap between technical knowledge and communicative competency.

Needs Analysis in ESP Curriculum Development

Needs analysis serves as the foundation of ESP curriculum development, particularly in engineering, where the ability to communicate complex technical information is essential. Hutchinson and Waters (1987) argue that ESP, unlike general English instruction, must be aligned with the specific linguistic demands of a particular field. The findings of Aliyasin and Pouyan (2014) support this view, illustrating that engineering students benefit significantly from ESP curricula that cater specifically to their linguistic and professional needs. Through surveys and interviews, the authors established that students often feel underserved by general English courses, which fail to address their field-specific needs, leading to a preference for ESP courses taught by instructors with a robust understanding of both language and technical content. Liton (2015) asserts that a pragmatic approach to needs analysis enables the creation of tailored learning experiences that closely align with the workplace, providing learners with relevant skills that enhance employability and professional integration. This perspective is reinforced by Yacoub (2022), who examined the needs of secondary students preparing for medical studies, emphasizing that comprehensive needs assessment is essential to provide students with discipline-specific language skills that can bridge the gap between academic and professional settings.

In a similar study, Tabrizi and Renani (2016) underscored the importance of needs analysis in aligning ESP curricula with students' professional goals, as it allows educators to prioritize relevant language skills, particularly in a field as specialized as engineering. They demonstrated that an analysis-based approach to curriculum design ensures that learning objectives resonate with students anticipated professional demands, fostering greater motivation and engagement. This research complements the findings of Zughoul and Hussein (2005), who noted that a thorough needs analysis mitigates the risk of curriculum misalignment, which often occurs when students' actual communicative needs are neglected. In further research, Yacoub (2023) highlighted that needs-based ESP programs not only improve linguistic competencies but also play a critical role in fostering scientific literacy by integrating field-specific language skills with essential technical knowledge. Aliyasin and Pouyan (2014) similarly argue that neglecting needs analysis can result in ESP courses that are perceived as irrelevant by students, ultimately impeding their academic and professional success.

Language and Communication Needs in Engineering

The communicative demands in engineering are both extensive and specialized, requiring students to possess not only technical vocabulary but also the capacity to communicate complex information clearly and concisely. Mudraya (2006) highlights that engineering students' communicative needs extend beyond vocabulary acquisition to include skills such as technical writing, data interpretation, and problem-solving communication. These skills are indispensable in the engineering field, where professionals must be adept at explaining technical concepts to diverse audiences.

The challenges posed by language deficits in technical communication have been widely documented. Shrestha, Awasthi, and Pahari (2018) found that engineering graduates with high technical proficiency often struggle with workplace communication due to inadequate English language skills, especially in writing and presentation. This finding is corroborated by Kassim and Ali (2010), who observed that poor communicative skills can significantly hinder the professional progress of engineering graduates,

making language competency a decisive factor in employability. By contrast, studies such as Riemer (2007) and Cheremissina and Reimer (2001) underscore the positive impact of ESP programs in improving these critical skills. They argue that ESP courses specifically designed for engineers foster language competencies essential for professional communication, thereby enhancing employability.

However, Irudayasamy et al. (2020) critique the over-reliance on technical vocabulary instruction in some ESP courses, arguing that it may hinder students' ability to effectively use the language in broader communicative contexts. This perspective aligns with the findings of Popescu (2012), who argued that without a balance between vocabulary and communicative practices, ESP instruction may fall short in preparing students for real-world demands. Collectively, these studies highlight that engineering students need both linguistic proficiency and the ability to apply language skills contextually, underscoring the need for ESP syllabus that integrate communicative and technical competencies.

Instructional Strategies and Materials in ESP for Engineering

Effective Pedagogical Approaches

The design and implementation of pedagogical strategies in ESP are crucial, as they determine how effectively students acquire and apply the language skills, they need for their professional fields. Mousavi et al. (2019) argue that ESP success hinges on instructors' abilities to adapt teaching methods and materials based on the specific requirements of their students' professional contexts. Irudayasamy et al. (2018) suggest that integrating technology-based materials and interactive tools into ESP instruction helps bridge the gap between classroom learning and real-world applications, thereby enhancing students' motivation and engagement.

The integration of authentic materials has also been shown to play a significant role in ESP. For example, Terauchi et al. (2019) stress the importance of using industry-relevant texts and case studies to make learning more applicable. This view aligns with Morgan and Regan (2008), who found that students are more motivated to engage with course content when they see a clear connection between their studies and their future professional tasks. However, Kazemi and Ashrafi (2014) argue that many ESP instructors lack the resources or training to create tailored materials, often resulting in a reliance on generic textbooks that fail to meet specific learner needs. This shortfall reinforces the need for resources and training to enable instructors to design course materials that align with the contextual needs of engineering students.

Task-Based Learning

Task-Based Learning (TBL) is recognized as an effective approach in ESP for engineering, enabling students to acquire language skills through problem-solving and hands-on activities that mirror real-world situations. Tabrizi and Renani (2016) highlight that TBL fosters experiential learning, making students more adept at using technical language in practical contexts. This approach aligns with the findings of Mckay (2003), who observed that task-based learning encourages greater student engagement and retention compared to traditional instruction. However, Zughoul and Hussein (2005) caution that TBL requires careful planning and an understanding of the specific tasks that engineers perform in the workplace, as poorly designed tasks may not provide the desired learning outcomes.

Problem-Based and Project-Based Instruction

Problem-Based Learning (PBL) and Project-Based Learning (PjBL) are also frequently cited as successful methods in ESP for engineering, as they encourage students to engage with language in authentic problem-solving scenarios. Riemer (2007) asserts that these approaches align closely with the needs of engineering students, as they develop both language and technical skills through collaborative projects and case studies. Cheremissina and Reimer (2001) support this view, arguing

that PjBL enhances critical thinking and teamwork skills, which are essential for professional success in engineering. However, Basta (2011) contends that implementing these methods can be challenging, as they require instructors to balance language instruction with the technical demands of projects, which is often difficult without adequate resources and support.

Accordingly, the reviewed literature underscores the importance of ESP in equipping engineering students with the language skills required for their field, while also revealing several challenges. The integration of comprehensive needs analysis is vital to ensure that ESP courses align with students' specific professional demands, a point consistently highlighted by Tabrizi and Renani (2016), Aliyasin and Pouyan (2014), and others. Furthermore, while studies support the use of authentic materials and active learning methodologies like TBL and PBL, they also reveal a need for more targeted resources and instructor training. Overall, these findings suggest that effective ESP syllabus for engineering should adopt a multifaceted approach that integrates needs-based design, real-world applications, and collaborative instructional strategies to bridge the gap between academic learning and professional.

Research Problem

As a newly established institution with aspirations for global excellence, Alamein International University (AIU) faces the challenge of developing English language instruction that meets the specific linguistic and professional needs of its engineering students. In engineering, where both technical proficiency and communicative competence in English are essential, traditional English curricula often fail to prepare students adequately for real-world applications. Numerous studies emphasize that ESP curricula should be precisely aligned with the professional contexts of learners (Liton, 2015; Tabrizi & Renani, 2016). However, the absence of a structured needs analysis framework tailored to AIU's context risks leaving its engineering students underprepared for international competitiveness. Existing research, such as that by Irudayasamy et al. (2020), underscores that engineering graduates frequently lack the communicative skills required for the global job market.

AIU's vision for producing highly skilled, globally competent graduates is at odds with the reality that, without a robust ESP syllabus, engineering students may struggle to gain the specific language competencies needed to effectively communicate technical information and collaborate across disciplines. Recommendations from existing studies emphasize that successful ESP programs must be tailored to students' professional contexts and incorporate practical applications that bridge the gap between academic and workplace environments (Aliyasin & Pouyan, 2014; Kassim & Ali, 2010). Without a tailored ESP program, AIU risks its graduates entering the workforce without the requisite English language skills, potentially limiting their employability and professional impact. Consequently, a comprehensive, needs-based ESP curriculum is imperative for AIU to align its English language instruction with the unique demands of engineering. Given these concerns, the following research questions are posed to guide this study:

1. What are the linguistic and academic needs of engineering students at Alamein International University?
2. What specific challenges do engineering students encounter, and what preferences do their faculty members express regarding English language learning within engineering contexts?
3. What instructional strategies and materials are most effective in supporting the ESP needs of engineering students at AIU?
4. What scope, sequence, and framework are most suitable for an ESP syllabus tailored to engineering students?

METHOD

This study utilized a mixed-methods design, integrating quantitative and qualitative approaches to conduct comprehensive needs analysis of the linguistic and academic requirements of engineering students at AIU. By combining statistical insights with interpretive faculty input, this design offered a holistic understanding of students' English for Specific Purposes (ESP) needs, guiding the development of a contextually relevant syllabus. The following subsections present details about the participants, data collection procedures, and data analysis techniques, including post-analysis validation.

Participants

Participants in this study included both students and faculty members from the engineering programs at Alamein International University (AIU). For the quantitative phase, a random sample of 168 students—constituting approximately 40% of the total engineering student population, was selected to ensure broad representation across disciplines. This group provided data on their current linguistic abilities, perceived challenges, and learning preferences.

In the qualitative phase, nine faculty members representing various engineering specializations participated in semi-structured interviews. These faculty members offered insights into students' performance, communication barriers, and the language demands of the academic and professional engineering environment. Following the preliminary analysis of survey and interview data, a focus group consisting of the dean and five faculty members convened to collaboratively identify the core thematic areas to be addressed in the proposed ESP curriculum. This post-analysis validation ensured that the syllabus design was informed by both learner needs and expert pedagogical insights.

Data collection

Data was gathered using three complementary tools: a structured survey for students, semi-structured interviews with faculty, and a focus group session with academic leadership. The student survey consisted of both closed- and open-ended items targeting areas such as language proficiency, use of English in academic contexts, skill-specific challenges, and instructional preferences. Sample items included:

- Rate your proficiency in each of the following skills: reading, writing, listening, and speaking.
- Which aspects of English language learning are most important for your academic and career goals?
- How often do you use English in lectures, presentations, assignments, and exams?
- Which learning tools do you prefer: textbooks, videos, online resources, or assignments?

The semi-structured interviews with faculty members followed a flexible protocol designed to elicit detailed responses regarding the linguistic expectations and observed challenges of engineering students. Example questions included:

- What are the most common English language difficulties that engineering students encounter in your classes?
- Which language skills are most critical for academic and professional success in engineering?
- What types of communication tasks should students master by the time they graduate?

After analyzing these data sets, a focus group discussion was conducted to determine the structure, scope, and sequence of the proposed ESP syllabus. This group reviewed the findings and provided

feedback to ensure curricular alignment with departmental objectives and real-world engineering needs.

Data analysis and post-sort interviews

The data analysis phase was conducted in two distinct strands to accommodate the mixed-methods design. For the quantitative data, responses from the student surveys were analyzed using SPSS (Statistical Package for the Social Sciences), version 27. Descriptive statistical methods, including frequencies, percentages, means, and standard deviations, were applied to examine trends related to proficiency levels, perceived difficulties, and resource preferences. These findings offered a statistical foundation to identify key areas of linguistic and academic need. The qualitative data from interviews were transcribed and analyzed using thematic content analysis. An inductive coding strategy was applied to identify recurring themes, which were then categorized into three overarching domains: language skills and deficiencies, field-specific vocabulary, and instructional strategy recommendations. Coding was done manually by the researcher to allow for close interpretive engagement with the data. Following these analyses, post-sort interviews were conducted with focus group participants to validate the emergent themes and ensure that the proposed syllabus framework was both accurate and actionable. This final step facilitated consensus on curriculum components and helped translate the findings into a structured, needs-driven syllabus. The triangulation of data sources and validation measures enhanced the study's credibility, dependability, and practical relevance.

FINDINGS

The current study aims to align English language instruction with the specific needs of engineering students at AIU through a comprehensive needs analysis framework for ESP syllabus design. Using both quantitative and qualitative approaches, the research addresses four key questions: the linguistic and academic needs of AIU engineering students, the challenges they face, faculty preferences for English language learning in engineering, effective instructional strategies and materials for ESP, and the optimal scope, sequence, and framework for an engineering-focused ESP syllabus.

Students' Surveys based Needs Analysis:

Language Proficiency, Background, and Academic Context

Survey results reveal that a significant portion of AIU engineering students (60%) attended Arabic-language schools, suggesting a limited prior experience with English as the medium of instruction. When asked to assess their English proficiency, the majority (61%) rated themselves at an intermediate level, with only (17%) identifying as beginners and (23%) identifying as advanced. This proficiency distribution highlights a moderate baseline in English, suggesting a need for foundational ESP support to strengthen students' academic and professional language skills. Moreover, only (12%) of students had previously studied ESP, indicating a gap in familiarity with industry-relevant terminology and communication strategies, which the proposed syllabus aims to address. English usage within the academic context at AIU is notably high, with (95%) of students primarily using English during lectures and (72%) in presentations, emphasizing the importance of comprehensive English support tailored to academic and technical contexts.

Table 1
Student linguistic and academic needs and preferences

Dimension	Percentage	Key Insights
Primary Language Background (Arabic)	60%	Indicates limited prior English exposure, underscoring a need for foundational ESP support.
Self-rated Proficiency (Intermediate)	61%	Majority feel moderately proficient, with fewer reporting advanced proficiency (23%).
ESP Background	12%	High percentage unfamiliar with ESP, highlighting a need for targeted vocabulary and communication skills.
English Usage in Lectures	95%	Dominant use of English in lectures reflects the necessity for syllabus alignment with lecture comprehension.
English for Presentations	72%	Emphasizes need for presenting skills, given the academic reliance on English for oral tasks.
Importance of English for Technical Documentation	75%	Critical for reading and writing proficiency, especially with technical papers and manuals.
English for Career-related Tasks	62%	Strong interest in learning English for interviews and job applications, reinforcing employability focus.

Challenges in Language Skills and Areas for Improvement

The results revealed that students face varied challenges across the four primary language skills. Speaking is reported as the most challenging skill, with an average self-rated proficiency of (2.97 out of 5) and (49%) identifying it as their primary area of difficulty. Listening also posed challenges despite higher comfort levels, with (41%) of students citing it as a secondary area of difficulty, underscoring a need for focused listening practice. In contrast, students expressed relatively higher comfort with receptive skills, rating reading at (3.49) and writing at (3.21), though both areas still presented obstacles. These findings suggest that the ESP curriculum should prioritize speaking exercises and listening activities alongside reading and writing tasks to balance and enhance students' language skill development.

Technical Vocabulary, Terminology, and Communication Needs

In the realm of technical language, a notable (84%) of students indicated the importance of understanding engineering-specific terminology for success in lectures and seminars, underscoring the need for targeted vocabulary instruction within the ESP curriculum. Textbooks and research papers (57%) are also key areas where students encounter technical language, while collaboration and communication (51%) and technical interviews and job applications (47%) further highlight the necessity for vocabulary and concept familiarization. Lower but significant percentages of students also reported encountering engineering terminology in presentations and reports (27%), online learning and MOOCs (24%), conferences and workshops (17%), and research presentations and publications (27%), suggesting the need for a curriculum that incorporates both academic and professional contexts for comprehensive language skill development.

Writing and Documentation Requirements

Writing tasks frequently encountered by students include university assignments (82%), Students expressed a strong desire to improve various aspects of their writing skills, with (58%) indicating a need for enhanced grammar and spelling, and (56%) focusing on writing professional emails, which are essential in technical and professional communication. Additionally, (44%) of students highlighted the importance of learning new vocabulary, while (39%) emphasized the need for accurate terminology to improve clarity and precision in their work. Skills like editing techniques and blog writing were also significant, with (38%) of students in each area seeking improvement, underscoring a need for exercises that support versatility and accuracy in both formal and informal writing contexts.

Preferred Learning Resources and Instructional Methods

Students expressed a strong preference for multimedia-based learning, with (72%) favoring textbooks as an effective instructional tool. Homework assignments were also valued (38%), reflecting the importance of practice-oriented tasks for reinforcement. Additionally, PowerPoint presentations (28%) and videos (26%) were among other favored materials, suggesting that a blended approach incorporating both digital and traditional resources would best support varied learning preferences. These insights suggest that the ESP syllabus should integrate multimedia resources and practical assignments to engage students effectively and reinforce their language acquisition in meaningful contexts.

Thematic Analysis of Faculty Members' Interviews Insights:

The qualitative results from the semi-structured interviews with nine AIU faculty members provided valuable insights into the integration of English proficiency within engineering and the importance of aligning ESP content with industry-relevant topics. Faculty members shared their perceptions on students' language abilities, essential topics, and terminology use within the engineering curriculum. These insights are organized into two main themes.

Theme 1: English Proficiency and Integration in Engineering

Faculty members collectively highlighted the critical need to enhance English proficiency within the engineering curriculum, particularly in the context of terminology use. They rated their students as generally poor in using technical terms accurately across engineering disciplines, noting that this limitation affected students' comprehension of course material and their ability to participate fully in discussions. Faculty observed that students often struggled to apply the correct terminology when explaining technical concepts, emphasizing that this gap impacts not only their academic performance but also their preparedness for professional environments.

In response to these language challenges, the faculty recommended integrating focused terminology instruction within the ESP syllabus. Specifically, they stressed the importance of equipping students with vocabulary skills relevant to specialized fields in engineering. By improving English language skills and terminology application within engineering contexts, faculty members believed students could bridge the gap between academic knowledge and practical application, thereby better preparing for both local and international career opportunities.

Theme 2: Real-World Application and Industry Relevance

The second theme emphasized the faculty's strong recommendation for incorporating real-world and industry-relevant topics into the ESP curriculum. They advocated for the inclusion of specialized areas such as Architectural Design & Digital Architecture, Engineering & Construction Management, Electronics Engineering & Communications, Mechatronics Engineering, Petroleum and Gas Engineering, and Biomedical Engineering. Faculty members stressed that these topics not only align with the current demands of the industry but also offer students essential insights into the practical applications of their studies.

The faculty members further recommended updating the course content to reflect the latest advancements and terminology within these fields, ensuring that students remain current with industry trends. They expressed a strong need for curriculum components that provide students with practical exposure to these topics, emphasizing the importance of understanding the language used in the field. This alignment, they suggested, would enhance students' competency in technical language and foster better career readiness. By focusing on both up-to-date topics and precise terminology, faculty members believe students will develop a deeper understanding of the language and concepts central to modern engineering practices.

The ESP Syllabus framework, and key components

After analyzing quantitative and qualitative data, a focus group with AIU's Dean of Engineering and five faculty members refined the primary ESP syllabus topics. They recommended that these topics serve as both English instruction and program orientation for first-year students, helping them choose their specialization by the second year. The syllabus framework integrates content across engineering disciplines, aligning with faculty recommendations and the outlined scope and sequence.

Key Components

The proposed ESP syllabus integrates thematic units focused on language skills, technical vocabulary, practical applications, and real-world scenarios. Each unit is tailored to introduce students to specific fields in engineering, providing both linguistic and technical insights.

Language Skills Focus

The syllabus emphasizes developing reading, writing, listening, and speaking skills through technical content. Reading materials include engineering-focused essays, while writing exercises involve project proposals, technical reports, and evaluations relevant to engineering disciplines. Listening tasks center around academic transcripts, and speaking activities are designed to boost students' confidence in discussing technical subjects, enhancing their overall communication abilities within engineering contexts.

Technical Vocabulary and Concepts

Each unit includes specialized vocabulary relevant to fields such as Architectural Design, Construction Management, Electronics, Mechatronics, Petroleum Engineering, and Biomedical Engineering. Faculty recommended prioritizing up-to-date terminology across these domains, as they observed low proficiency among students in using accurate terms. To address this, the curriculum provides vocabulary-building exercises alongside practical applications, ensuring that students gain familiarity with industry-standard language.

Practical Applications and Real-World Scenarios

To enhance relevance, each unit incorporates real-world applications through tasks such as report writing, proposal drafting, and project planning. These exercises reflect scenarios students will encounter in their future careers, allowing them to apply both technical and language skills in realistic settings. Practical tasks, such as creating engineering project reports or writing feasibility assessments, bridge academic knowledge with professional expectations, reinforcing their industry readiness.

Syllabus Scope and Sequence

The syllabus is organized into thematic units covering key engineering fields. Beginning with Architecture & Digital Design, which emphasizes project reporting and terminology, the syllabus moves through areas like Project Management & Construction for proposal writing and presentation skills, and Electronics & Communication for technical specifications and vocabulary. Other units include Mechatronics & Robotics for operations manuals, Oil, Gas & Renewables focusing on feasibility reports, and Biomedical Engineering with a focus on device evaluations and medical terminology. The syllabus concludes with Materials & Mechanics for case study writing and Emerging Engineering Trends to prepare students for advanced, innovative concepts and project proposal drafting.

Table 2
ESP syllabus scope and sequence

Unit	Topic	Content Focus	Language Skills	Key Skills and Concepts
Shaping Spaces	Architecture & Digital Design	Project report writing	Tenses timeline	BIM, sustainable design, project critique
Building Big	Project Management & Construction	Timeline proposals, presentations	Present simple & continuous	Gantt Charts, risk management, project planning
Connected Worlds	Electronics and Communication	Technical specifications	Past simple & present perfect	Circuit design, signal processing, tech documentation
Smart Machines	Mechatronics & Robotics	Operations manuals	Past continuous & perfect	Automation, safety protocols, robotics terms
Powering the Future	Oil, Gas & Renewables	Feasibility reports	Future forms	Drilling techniques, sustainability metrics, environmental impact
Life Tech	Biomedical Engineering	Device evaluations	Active & passive voice	Biocompatibility, medical devices, research reporting
Strong Foundations	Materials & Mechanics	Case studies	Conditional statements	Stress analysis, material properties, problem-solving
Future Frontiers	Emerging Engineering Trends	Project proposals	Time conjunctions & connectives	AI, smart materials, trend analysis

DISCUSSION

The findings from the current study underscore the critical need for a specialized ESP syllabus to meet the linguistic and technical demands of AIU engineering students. Through surveys, interviews, and focus groups, essential areas for enhancing students' communicative and technical skills were identified, particularly in using engineering terminology and expressing technical concepts in English. Faculty observations confirmed significant gaps in students' vocabulary application, recommending a curriculum that combines foundational language instruction with industry-relevant content. The proposed syllabus, organized around thematic units like Architecture & Digital Design and Project Management, serves a dual purpose: offering linguistic support while guiding students through various engineering fields. With practical tasks such as report writing and project proposals, the syllabus bridges academic and professional needs, preparing students with real-world skills and terminology essential for the global workforce. This structured approach aligns with best practices in ESP, supporting both academic and career readiness. These findings align with prior research (e.g., Gürsoy & Sağlam, 2020; Mohammadi & Mousavi, 2020), which suggests that ESP courses tailored to students' disciplinary and professional contexts significantly enhance their communicative competence and motivation. The inclusion of technical vocabulary, authentic tasks, and industry-aligned themes is particularly effective in promoting skill transfer and learner engagement in engineering disciplines.

CONCLUSION

This study highlights the importance of aligning English language instruction with the specific needs of engineering students, demonstrating that a targeted, thematic ESP syllabus can effectively address students' linguistic challenges while introducing them to essential concepts in their field. By

emphasizing specialized vocabulary, practical communication skills, and discipline-focused content, the proposed ESP syllabus provides a robust framework for supporting students in both their academic and professional journeys. The integration of faculty recommendations ensures that the curriculum remains current with industry trends and offers students valuable orientation to potential career paths within engineering. This approach underscores AIU's commitment to equipping students with the language proficiency and technical understanding required to thrive in their chosen fields, setting a strong foundation for their success as future engineers.

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