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RESEARCH ARTICLE

Addressing Language Barriers in English-Medium Engineering Instruction: Support Strategies for Non-Fluent Instructors

Ahlem Salhi
Dr.
Biskra University
Algeria
Email: ahlem.salhi@univ-biskra.dz

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Abstract

he adoption of English as a Medium of Instruction (EMI) in engineering education has gained momentum in Algeria as part of broader higher education internationalization initiatives. However, EMI implementation continues to pose pedagogical and linguistic challenges, particularly for engineering instructors operating in non-English-dominant contexts. This study examines EMI related challenges and support mechanisms among engineering faculty members at Biskra University, Algeria. Data were collected through a structured questionnaire administered to a purposive sample of 30 instructors from the Faculty of Sciences and Technology. The findings indicate that although most instructors report intermediate to advanced English proficiency, effective EMI teaching is constrained by limited discipline specific language competence, difficulties in explaining complex technical concepts, and challenges in sustaining classroom interaction. Instructors frequently rely on self-developed strategies, including language simplification, visual scaffolding, and bilingual resources, which are perceived as useful but inconsistently applied in the absence of systematic EMI training. The study further highlights the role of institutional support, as access to targeted professional development, mentoring, and technology-enhanced resources is associated with higher instructor confidence and more positive perceptions of student learning. The findings suggest that EMI effectiveness in Algerian engineering education depends on the integration of individual instructional practices with structured institutional support rather than language proficiency alone.

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1. Introduction

English as a Medium of Instruction (EMI) has become a central component of higher education internationalization, particularly in science and engineering disciplines where access to research, innovation, and professional communication is largely mediated through English. Across non-English-speaking contexts, EMI is often introduced to enhance students' academic mobility, improve institutional visibility, and align curricula with global disciplinary standards. However, growing evidence suggests that the success of EMI depends less on policy adoption than on how instruction is enacted at the classroom level, where language proficiency, pedagogical practice, and disciplinary knowledge intersect.

In engineering education, effective teaching requires precise explanation, conceptual accuracy, and sustained interaction to support students' understanding of abstract and technical content. Delivering such instruction through English places additional cognitive and pedagogical demands on instructors, particularly when English is not their primary language of academic training. Even instructors with intermediate to advanced general English proficiency may experience difficulties using discipline-specific terminology accurately, explaining complex concepts spontaneously, and managing interactive classroom discourse. These challenges can influence instructional clarity, reduce opportunities for student participation, and ultimately affect learning outcomes.

Within the Algerian higher education context, the expansion of EMI has been relatively recent and uneven, especially in engineering programs traditionally delivered in French or Arabic. While English is increasingly recognized as essential for scientific communication and employability, many instructors have had limited formal preparation for teaching technical content through English. Institutional support for EMI, including ESP-oriented professional development, mentoring, and pedagogical guidance, remains inconsistent across institutions. As a result, instructors often rely on individual coping strategies to manage EMI demands, highlighting structural gaps in EMI implementation rather than isolated language limitations.

Recent research in EMI and English for Specific Purposes (ESP) emphasizes that instructional effectiveness cannot be explained by language proficiency alone. Instead, effective EMI emerges from the interaction between instructors' discipline-specific language competence, pedagogical adaptation, and the availability of institutional support mechanisms. Without coordinated support structures, EMI practices risk becoming fragmented, placing disproportionate responsibility on individual instructors and leading to variability in teaching quality and student engagement.

Against this backdrop, the present study examines EMI practices in engineering education within an Algerian university context. Focusing on instructors from the Faculty of Sciences and Technology, Biskra University, the study explores how language-related challenges, instructional practices, and institutional conditions shape EMI delivery. By analyzing instructors' experiences and perceptions, the study aims to provide contextually grounded insights into more effective and equitable approaches to EMI implementation in Algerian engineering programs with particular attention to the role of pedagogical and institutional support in enhancing instructional clarity, instructor confidence, and student engagement.

2. Research Objectives

The main goal of this study is to explore approaches for combining language support with technical teaching in engineering programs where English serves as the instructional medium. Specifically, the research seeks to:

a. Examine pedagogical and institutional measures such as ESP focused language training, collaborative teaching approaches, and bilingual or digital instructional tools that help overcome language challenges faced by instructors with limited English proficiency.

b. Investigate how these strategies influence instructors' confidence, clarity in delivering technical content, and teaching effectiveness.

c. Determine the effects of these interventions on student understanding, engagement, and participation in EMI engineering classrooms.

Ultimately, the study aims to generate evidence-based recommendations for fostering more inclusive and effective learning environments within engineering education.

3. Literature Review

Research on EMI in engineering education has consistently highlighted language related challenges faced by instructors who are not fully proficient in English. These challenges extend beyond general communication difficulties and directly influence instructional clarity, student comprehension, and classroom interaction (Airey, 2012; Kling & Stæhr, 2012). In engineering contexts, where precision and conceptual accuracy are essential, limited command of academic and technical English can constrain instructors' ability to explain complex concepts, manage discussions, and assess student performance effectively.

Previous studies report divergent perspectives on how instructors respond to these challenges. Some scholars argue that adaptive practices such as simplifying linguistic input, relying on visual materials, or alternating between languages can facilitate comprehension in EMI classrooms (Costa & Coleman, 2013). In contrast, other research cautions that excessive simplification or code-switching may limit conceptual depth, reduce opportunities for meaningful interaction, and restrict the development of students' disciplinary language skills (Macaro et al., 2018). These

contrasting views suggest that while coping strategies may offer short-term support, they do not necessarily address the underlying linguistic demands of EMI teaching.

Theoretical models increasingly emphasize the integration of language support with disciplinary instruction, particularly through English for Specific Purposes (ESP) and language sensitive pedagogy (Hyland, 2007; Dafouz & Smit, 2016). However, studies reveal that institutions vary widely in how effectively these strategies are implemented. Professional development initiatives often prioritize general English proficiency rather than the discipline-specific linguistic competencies required in engineering education (Dearden, 2014). As a result, instructors are frequently left to develop their own strategies without systematic guidance or sustained support.

Another limitation in the existing literature is the predominant focus on student learning outcomes as indicators of EMI effectiveness (Smit & Dafouz, 2012). Although student learning outcomes have received considerable focus, research examining instructors' experiences particularly how structured supports like ESP programs, collaborative teaching strategies, bilingual resources, and peer mentoring shape their instructional confidence and practices remains limited. Moreover, findings on the effectiveness of these interventions remain mixed, especially in resource-constrained contexts (Macaro et al., 2018).

The identified gaps highlight the critical need for research that centers on instructors in their local contexts and evaluates practical approaches to integrating language support within technical instruction. The present study responds to this need by empirically examining how selected language-sensitive strategies influence instructors' teaching experiences and student engagement in engineering EMI classrooms.

4. Study Rationale and Contribution

Building on the identified gaps and contradictions in the literature, this study adopts an empirical, instructor-centered approach to examine how language-sensitive strategies can enhance teaching effectiveness in engineering EMI contexts. This study focuses on approaches that strengthen instructors' capacity while simultaneously fostering better student comprehension and participation in EMI engineering classrooms. The methodology is designed to systematically evaluate the effectiveness of these strategies, linking the implementation of targeted language support to measurable outcomes in instructor confidence, instructional clarity, and technical content delivery. In doing so, the study not only fills the empirical gap in EMI research but also provides actionable insights for institutional policy and professional development initiatives aimed at creating more inclusive and effective engineering learning environments.

5. Methodology

5.1 Research Design

This study employs a quantitative descriptive research design using a structured questionnaire to examine language-related challenges encountered by non-fluent English-speaking instructors in engineering EMI contexts. The survey approach was selected to capture a broad range of instructor experiences while enabling systematic comparison across variables such as English proficiency, teaching experience, and access to institutional support. This design allows for the identification of prevailing patterns in instructional challenges and perceptions of support strategies without manipulating classroom conditions.

5.2 Participants

The study involved 30 engineering instructors from the Faculty of Sciences and Technology at Biskra University, with a primary focus on the Mechanical Engineering Department. Participants were selected based on their direct involvement in teaching engineering courses delivered in English. The sample included instructors with varying levels of teaching experience and English proficiency, classified according to the Common European Framework of Reference for Languages (CEFR). Additional background information related to prior training in English for Specific Purposes (ESP) was collected to contextualize instructors' preparedness for EMI instruction.

5.3 Instrument

A structured questionnaire was developed to gather detailed information on three key areas: (1) demographic and professional characteristics of instructors, (2) challenges associated with teaching technical content in English, and (3) perceptions of strategies and institutional support to overcome language barriers. The instrument consisted of 15 questions divided into four sections:

- **Demographics**: capturing teaching discipline, English proficiency, years of teaching experience, and prior ESP training.
- **Challenges in Teaching Due to Language Barriers**: examining instructors' difficulties in explaining technical concepts, limited vocabulary, miscommunication, assessment practices, and the impact on student learning, including comprehension and engagement.
- **Training, Resources, and Strategies**: identifying the types of professional development, teaching resources, and institutional support that instructors perceive as helpful in overcoming language barriers, including ESP-specific training, team teaching, bilingual materials, technology, and mentoring programs.
- **Feedback on Confidence and Effectiveness**: evaluating instructors' self-reported confidence in delivering technical content and the perceived impact of institutional support programs on student learning outcomes.

Most questions employed multiple-choice formats with multiple selections allowed, ensuring participants could accurately reflect their experiences. Several items used Likert-type scales to assess the perceived effectiveness of institutional support and self-confidence in teaching.

5.4 Data Collection

The questionnaire was administered online over a two-week period to facilitate participation and ensure accessibility. Prior to participation, instructors were informed of the study's purpose and assured that their responses would remain confidential and anonymous. Participation was voluntary, and informed consent was obtained electronically.

5.5 Data Analysis

Questionnaire responses were analyzed using descriptive statistical techniques, including frequencies and percentages, to summarize trends across key variables. Cross-tabulations were employed to explore relationships between instructors' English proficiency, teaching experience, and perceptions of EMI support. Responses to optional comments were analyzed thematically to supplement quantitative findings and provide contextual insight into instructors' experiences. This combined analytical approach enabled a comprehensive interpretation of both the challenges faced by instructors and the perceived effectiveness of proposed support strategies.

6. Results of the Questionnaire

This section presents the results of the survey conducted among 30 engineering instructors in the Faculty of Sciences and Technology at Biskra University. The tables below summarize the demographic characteristics of the participants, the language challenges they face, their teaching strategies, and the perceived impact of language support programs on student learning.

4.1 Demographic Characteristics

Table 1 shows the primary teaching subjects of the respondents. The majority selected "Other," indicating that the survey reached instructors across a variety of disciplines beyond the core engineering fields.

Table 1
Primary Teaching Subject of Respondents (N = 30)

Subject	Frequency	Percentage (%)
Mechanical Engineering	5	16.7
Electrical Engineering	3	10.0
Civil Engineering	2	6.7
Other	20	66.6
Total	30	100

Table 2 presents the English proficiency levels of the participating instructors. The majority of respondents reported a B2 (Upper-Intermediate) level, indicating a solid command of English sufficient for general academic communication. A smaller proportion demonstrated C1 (Advanced) proficiency, while a few instructors were at lower levels, suggesting variability in language readiness that could influence instructional effectiveness and interaction in EMI classrooms.

Table 2
English Proficiency Levels of Respondents (N = 30)

Proficiency Level	Frequency	Percentage (%)
A1 (Beginner)	1	3.3
A2 (Elementary)	1	3.3
B1 (Intermediate)	3	10.0
B2 (Upper Int.)	15	50.0
C1 (Advanced)	5	16.7
C2 (Proficient)	0	0.0
Total	30	100

As shown in **Table 3**, most instructors have over 10 years of teaching experience, reflecting a cohort with substantial familiarity with curriculum design, classroom management, and student engagement. The presence of a few less experienced instructors, with fewer than 10 years of service, highlights potential variability in instructional approaches and adaptation to EMI challenges.

Table 3
Teaching Experience in Higher Education (N = 30)

Experience	Frequency	Percentage (%)
<2 years	2	6.7
2–5 years	3	10.0
6–10 years	5	16.7
>10 years	20	66.6
Total	30	100

Table 4 summarizes the formal EMI training received by the instructors. While 43% of participants reported having undergone structured EMI training, the majority (over half of the sample) had not participated in any formal preparation programs. This finding highlights a significant gap in institutional support and underscores the need for targeted professional development initiatives to equip instructors with the language and pedagogical skills necessary for effective EMI teaching.

Table 4
Formal EMI Training of Respondents (N = 30)

Received EMI Training	Frequency	Percentage (%)
Yes	13	43.3
No	17	56.7
Total	30	100

4.2 Language Challenges

Table 5 presents the specific language challenges reported by instructors in EMI classrooms. The most frequently cited difficulties were miscommunication and student comprehension problems, reported by 83% and 73% of respondents, respectively. Other common challenges included explaining complex technical terms and limited vocabulary. These results suggest that language barriers not only affect instructors' ability to convey content accurately but also impede students' understanding, highlighting the importance of targeted support strategies to enhance classroom communication.

Table 5
Specific Language Challenges Faced by Instructors (N = 30)

Challenge	Frequency	Percentage (%)
Miscommunication	25	83.3
Explaining Complex Technical Terms	20	66.7
Limited Vocabulary	18	60.0
Student Comprehension Difficulties	22	73.3

Table 6 illustrates the frequency with which students struggle to understand technical content in English. The majority of students were reported to experience difficulties either *"Always"* (40%) or *"Frequently"* (33.3%), demonstrating that language barriers represent a persistent challenge in EMI engineering classrooms. A smaller proportion of students encountered difficulties occasionally, rarely, or not at all, highlighting variability in comprehension that may reflect differences in individual English proficiency or prior exposure to technical terminology.These findings underscore the need for targeted instructional strategies that scaffold technical language and enhance student understanding.

Table 6
Frequency of Student Challenges in Understanding Technical Content (N = 30)

Frequency	Frequency Count	Percentage (%)
Always	12	40.0
Frequently	10	33.3
Occasionally	5	16.7
Rarely	2	6.7
Never	1	3.3
Total	30	100

Table 7 highlights the areas of student learning most affected by language barriers. According to instructor reports, engagement in classroom discussions and comprehension of written materials were the most significantly impacted, indicating that language difficulties hinder both interactive and independent learning activities. Other areas, such as completing assignments and preparing for exams, were also affected to a lesser extent, suggesting that language barriers can influence multiple dimensions of student performance in EMI engineering courses.

Table 7
Areas of Student Learning Affected by Language Barriers (N = 30)

Area of Learning	Frequency	Percentage (%)
Engaging in Discussions	25	83.3
Understanding Materials	20	66.7
Completing Assignments/Projects	18	60.0
Preparing for Exams	15	50.0

4.3 Training and Resources

Table 8 presents instructors' preferred training and resources for supporting EMI instruction. Among the options, translation tools and digital resources were rated most highly, reflecting instructors' interest in tools that can facilitate content preparation, explanation, and student comprehension. ESP-focused training and peer mentoring were also

valued, though to a lesser extent, indicating that instructors prioritize practical, technology-assisted solutions while recognizing the potential benefits of structured professional development and collaborative support.

Table 8
Preferred Training and Resources for EMI Teaching (N = 30)

Training/Resource	Frequency	Percentage (%)
Translation Tools	20	66.7
Digital Resources	18	60.0
ESP Training	15	50.0
Peer Mentoring	10	33.3

Table 9 shows the frequency of institutional language support provided to instructors. Most participants reported that such support was offered only *occasionally* (50%) or *rarely (*26.7%), with very few experiencing *regular support* (16.7%). These findings suggest that institutional backing for EMI instruction is inconsistent, potentially limiting instructors' ability to effectively address language challenges and implement best practices in the classroom.

Table 9
Frequency of Institutional Language Support (N = 30)

Frequency	Frequency Count	Percentage (%)
Regularly	5	16.7
Occasionally	15	50.0
Rarely	8	26.7
Never	2	6.7
Total	30	100

4.4 Strategies and Effectiveness

Table 10 lists the strategies instructors employ to overcome language barriers in EMI classrooms. The most commonly used approaches were *simplifying language* (83.3%) and *interactive teaching techniques* (66.7%), followed by the use of *visual aids and bilingual resources.* These findings indicate that instructors actively adapt their teaching methods to facilitate student comprehension, combining linguistic simplification with engagement-focused strategies to mitigate the challenges posed by limited English proficiency.

Table 10
Strategies to Overcome Language Barriers (N = 30)

Strategy	Frequency	Percentage (%)
Simplified Language	25	83.3
Interactive Techniques	20	66.7
Visual Aids	18	60.0
Bilingual Resources	15	50.0

Table 11 presents instructors' self-reported confidence in teaching technical content despite language barriers. The majority of respondents indicated they were *very confident* (50%), while others reported being *somewhat confident* (26.7%) or neutral (13.3%). A smaller proportion expressed lower levels of confidence. These results suggest that, despite challenges related to English proficiency, many instructors feel capable of delivering technical content

effectively, although confidence levels vary and may be influenced by teaching experience, access to resources, and prior EMI training.

Table 11
Instructor Confidence Despite Language Barriers (N = 30)

Confidence Level	Frequency	Percentage (%)
Very Confident	15	50.0
Somewhat Confident	8	26.7
Neutral	4	13.3
Not Very Confident	2	6.7
Not Confident at All	1	3.3
Total	30	100

Table 12 illustrates instructors' perceptions of the impact of language support programs on student learning outcomes. The majority of participants reported a *significant impact* (50%), while others noted *moderate* (26.7%) or *transformative* (10%) effects. Only a small number perceived minimal or some impact. These findings suggest that structured language support programs can meaningfully enhance student comprehension and engagement in EMI engineering courses, reinforcing the importance of institutional initiatives that provide targeted linguistic and pedagogical support.

Table 12
Perceived Impact of Language Support on Student Learning (N = 30)

Impact Level	Frequency	Percentage (%)
Minimal	1	3.3
Some	3	10.0
Moderate	8	26.7
Significant	15	50.0
Transformative	3	10.0
Total	30	100

4.5 Summary of Findings

The survey of 30 engineering instructors at Biskra University revealed diverse teaching contexts, language proficiency levels, and experiences with EMI instruction. In terms of teaching disciplines, most respondents indicated "Other" subjects, while fewer taught Mechanical, Electrical, or Civil Engineering (Table 1). English proficiency ranged from A1 (Beginner) to C1 (Advanced), with the majority reporting B2 (Upper Intermediate) (Table 2). Most instructors had more than ten years of teaching experience (Table 3).

Formal EMI training was reported by 43% of respondents, with considerable variation in the type and format of training received (Table 4). Instructors identified several language challenges, including miscommunication with students, difficulty explaining complex technical concepts, and limited technical vocabulary (Table 5). Students were reported to struggle frequently with understanding technical content in English (Table 6), particularly in engaging in discussions, understanding written materials, and completing assignments or projects (Table 7).

Preferred training and resources included translation tools, digital resources, and ESP-specific instruction (Table 8). Institutional support was generally irregular, with most respondents receiving language assistance only occasionally or rarely (Table 9). Commonly adopted strategies to overcome language barriers were simplifying technical language, using interactive teaching methods, employing visual aids, and providing bilingual resources (Table 10). Instructors' confidence in teaching technical content despite language barriers varied, with 50% reporting being very confident

(Table 11). Finally, language support programs were perceived to have a predominantly significant impact on student learning, with some reporting moderate or transformative effects (Table 12).

These findings deliver a comprehensive characterization of instructors' demographic profiles, English proficiency, EMI preparation, pedagogical challenges, adopted strategies, and perceptions of institutional support, thereby establishing a robust foundation for subsequent discussion and interpretive analysis..

7. Discussion

The survey findings reveal significant challenges and opportunities associated with implementing English-Medium Instruction (EMI) in higher education. While many instructors report intermediate to advanced English proficiency, substantial difficulties persist in teaching technical content effectively. These challenges are influenced by linguistic, pedagogical, and institutional factors, which collectively shape how EMI is experienced by both instructors and students (Pun & Thomas, 2020; Curle et al., 2024).

7.1 Reconsidering the Relationship between Language Proficiency and Teaching Effectiveness

A notable observation is the gap between instructors' English proficiency and their effectiveness in teaching technical content. Although most instructors self-reported B2 (Upper-Intermediate) or higher proficiency, they still encounter difficulties explaining complex technical concepts, responding to student questions, and facilitating classroom discussions. This indicates that general language competence is insufficient for effective EMI; teaching technical subjects in English requires discipline-specific language skills**,** including precise technical vocabulary, mastery of academic discourse, and strategies for maintaining student engagement (Hyland, 2007; Airey, 2012; Bukhari, 2021). Miscommunication commonly occurs due to several factors: instructors' limited subject-specific vocabulary restricts precise explanations of technical content; difficulties in simplifying complex concepts without compromising accuracy make conveying nuanced ideas challenging; and students' own language limitations hinder comprehension of lectures and active participation. These findings align with prior research emphasizing the need for ESP-focused training and structured support to enable instructors to bridge the gap between language ability and teaching effectiveness (Macaro et al., 2018). Many instructors reported relying on self-developed strategies, highlighting that EMI proficiency is often achieved through informal, experience-based learning rather than systematic institutional guidance.

These results align with prior research emphasizing the need for ESP-focused training over generic English courses (Pun & Thomas, 2020; Curle et al., 2024). Many instructors reported relying on self-developed strategies rather than structured institutional guidance, suggesting that EMI proficiency is often achieved through informal, experience-based learning rather than systematic support (Monica, Arsyad, & Waluyo, 2025; Pun, Thomas, & Bowen, 2022).

7.1 Reconsidering the Relationship Between Language Proficiency and Teaching Effectiveness

One of the most significant outcomes of this study is the observed disconnect between instructors' self-reported English proficiency and their perceived instructional effectiveness. Despite a predominance of B2-level proficiency among participants, instructors continued to report difficulties in explaining complex technical concepts, sustaining classroom interaction, and addressing spontaneous student questions. This suggests that general communicative competence does not adequately prepare instructors for the specialized linguistic demands of engineering instruction in English.

Engineering EMI requires mastery of discipline-specific discourse, precision in terminology, and the ability to reformulate abstract concepts without compromising technical accuracy. Instructors' challenges therefore appear to stem less from basic grammatical limitations and more from restricted access to specialized academic language and pedagogical strategies tailored to EMI contexts. These findings reinforce arguments in the literature that emphasize the inadequacy of generic English training for EMI instructors and highlight the importance of English for Specific Purposes (ESP) approaches that align language development with disciplinary teaching needs (Hyland, 2007; Airey, 2012; Macaro et al., 2018).

Furthermore, many instructors reported developing coping mechanisms independently, such as simplifying explanations or relying on visual representations. While these strategies can be effective, their informal and individualized nature points to the absence of systematic institutional guidance, placing the burden of adaptation largely on instructors themselves.

7.2 Institutional Support as a Determining Factor in EMI Effectiveness

The findings clearly indicate that the availability and consistency of institutional support play a decisive role in shaping EMI teaching practices. A majority of instructors reported limited or irregular access to EMI training, which contributes to uneven implementation of EMI across departments and individual classrooms. In contexts where training was available, it often focused on general English improvement rather than on pedagogical strategies or technical language use relevant to engineering disciplines.

This lack of targeted professional development may explain why instructors with similar language proficiency levels reported markedly different levels of confidence and effectiveness. Instructors who had access to ESP-oriented training, mentoring, or digital tools consistently reported higher confidence and improved classroom interaction. These results support previous research emphasizing that EMI success depends not only on instructor competence but also on institutional commitment to sustained, context-sensitive support (Pun & Thomas, 2020; Curle et al., 2024).

The findings highlight that EMI should be approached as a comprehensive institutional initiative rather than an isolated responsibility of instructors, because without formal policies, uniform resources, and continuous training opportunities, the quality of EMI instruction can become uneven, leading to disparities in both teaching effectiveness and student learning outcomes.

7.3 Student Comprehension and Participation in EMI Classrooms

Instructors reported that students frequently struggle to follow technical explanations, engage in discussions, and interpret written materials in English. These challenges were particularly pronounced in activities requiring active participation, such as problem-solving discussions and project-based work. Language barriers thus appear to influence not only comprehension but also classroom dynamics, often resulting in reduced interaction and passive learning behaviors.

The results indicate that student difficulties cannot be attributed solely to instructors' language use. Instead, they reflect a broader lack of linguistic scaffolding within EMI courses. When course materials, assessments, and classroom tasks are not adapted to students' language levels, cognitive overload may occur, limiting both engagement and learning outcomes. These findings align with prior studies advocating a dual-focus EMI model that supports both instructor delivery and student language development (Tanoli et al., 2021).

7.4 Effectiveness and Limitations of Instructor-Adopted Strategies

Despite structural constraints, instructors reported employing a range of strategies to mitigate language-related challenges. Simplified language, visual aids, real-world examples, and interactive techniques were among the most frequently used approaches. These strategies were perceived as beneficial in enhancing student comprehension and reducing communication breakdowns.

However, the effectiveness of these practices appears to depend on instructors' experience, confidence, and access to resources. Because such strategies are often self-developed rather than institutionally supported, their application varies considerably across instructors. While experienced instructors may successfully balance simplification with technical precision, less experienced instructors may struggle to maintain conceptual depth. This variability underscores the need for structured training that translates effective individual practices into shared pedagogical standards (Bukhari, 2021; Pun & Thomas, 2020).

7.5 Role of Digital Tools in Reducing Linguistic Barriers

Digital and technological resources have emerged as a highly promising means of supporting EMI instruction. Instructors in the study reported considerable interest in tools such as translation software (e.g., Google Translate or DeepL), bilingual glossaries, and AI-assisted applications that can aid in lecture preparation, real-time explanation, and student comprehension. For example, a bilingual glossary can help students quickly reference technical terms in both English and their native language, reducing misunderstandings during complex topics like thermodynamics or circuit analysis. Similarly, AI-based tools can generate simplified explanations or practice exercises tailored to students' language proficiency, allowing instructors to focus more on delivering content rather than on constant translation. By providing immediate linguistic support and scaffolding, these resources help reduce cognitive load for instructors, who might otherwise struggle to explain specialized engineering concepts in English, and they enable students to engage more confidently with terminology-heavy material. Overall, technology can act as both a teaching aid and a bridge for overcoming language barriers in highly technical EMI courses..

Nevertheless, the findings also reveal limited access to these tools and insufficient training in their pedagogical integration. Without institutional investment in infrastructure and digital literacy, the potential benefits of technology remain underutilized. These results support calls for strategic integration of digital tools into EMI policy and training frameworks to enhance instructional efficiency and inclusivity (Huang, 2024; Simbolon, 2023).

7.6 Implications for Sustainable EMI Implementation

The findings demonstrate that effective EMI implementation requires a systemic, multi-level approach. Instructor adaptation alone is insufficient to address the linguistic and pedagogical demands of EMI. Sustainable EMI practices depend on continuous professional development, clear institutional guidelines, access to pedagogically relevant digital tools, and parallel language support for students.

By linking instructor confidence, teaching strategies, and student engagement to institutional structures, this study reinforces the argument that EMI quality is shaped by both individual competence and organizational support. Addressing these dimensions collectively is essential to ensuring that EMI functions as a tool for educational enhancement rather than a barrier to equitable learning opportunities (MDPI Sustainability, 2022; Curle et al., 2024).

The questionnaire findings provide robust evidence that aligns closely with the research objectives, offering critical insights into how language support can be integrated with technical instruction in EMI engineering courses.

Objective 1 (Identifying Strategies): Participants emphasized the importance of simplified language, visual aids, bilingual resources, interactive teaching methods, ESP-focused training, and collaborative teaching models**.** These preferences align with the literature, which stresses the necessity of discipline-specific language competence for effective EMI (Hyland, 2007; Airey, 2012; Macaro et al., 2018).

Objective 2 (Evaluating Effectiveness): Instructors with access to training, digital tools, or bilingual resources reported higher confidence and noted improvements in student comprehension and engagement. Conversely, instructors without support reported lower confidence, highlighting that strategy effectiveness depends on institutional backing, access to resources, and consistent implementation**.**

The findings further demonstrate the reciprocal relationship between instructor preparedness and student learning outcomes**,** indicating that effective EMI strategies must be teacher-centered and learner-centered**.** While instructors adapt strategies informally, a systematic, evidence-based approach would enhance both teaching quality and student performance.

Finally, the study addresses the research gap regarding practical, context-specific interventions for non-fluent EMI instructors in engineering education**,** providing actionable recommendations for creating inclusive and effective learning environments. It shows that integrating language support with technical instruction, combined with institutional commitment and technological resources can significantly enhance instructor confidence, teaching effectiveness, and student engagement.

8. Conclusions and Recommendations

This study examined the challenges associated with English-Medium Instruction (EMI) in engineering education, with particular attention to instructors who are not fully fluent in English. The findings indicate that while many instructors possess intermediate to advanced levels of English proficiency, effective EMI teaching requires more than general language competence. Discipline-specific language skills, pedagogical adaptation, and institutional support emerged as critical factors influencing instructors' ability to deliver technical content clearly and support student engagement.

The results demonstrate that language-related challenges persist across multiple dimensions of EMI instruction, including explaining complex concepts, facilitating classroom interaction, and supporting student comprehension. These challenges are compounded by inconsistent access to formal EMI training and limited institutional support structures. Instructors frequently rely on self-developed strategies, such as simplifying language, using visual aids, and incorporating bilingual resources, which are perceived as beneficial but unevenly applied across courses and departments.

The study further highlights the importance of institutional commitment in ensuring sustainable and equitable EMI implementation. Access to targeted professional development alongside mentoring opportunities and technology-enhanced resources, was associated with higher instructor confidence and improved perceptions of student learning outcomes. These findings suggest that EMI effectiveness is shaped by the interaction between individual instructor practices and broader institutional frameworks rather than by language proficiency alone.

Based on these findings, several recommendations can be proposed. Higher education institutions implementing EMI in engineering programs should prioritize continuous, discipline-specific professional development for instructors, rather than relying on generic English language training. Institutional policies should also support the systematic integration of bilingual and digital resources, including translation tools and terminology support, to reduce linguistic barriers for both instructors and students. In parallel, structured language scaffolding for students should be incorporated into EMI curricula to promote active participation and equitable access to technical content.

While the study provides empirical insight into EMI practices within a specific institutional context, it is not without limitations. The reliance on self-reported questionnaire data and the focus on a single faculty may limit the generalizability of the findings. Future research could adopt mixed-methods or longitudinal designs to explore how EMI training and support mechanisms influence teaching practices and student outcomes over time. Comparative studies across disciplines and institutions would also contribute to a more comprehensive understanding of EMI implementation in diverse educational settings.

In summary, the study contributes to the growing body of EMI research by foregrounding instructors' experiences and by emphasizing the need for integrated, context-sensitive approaches to language support in engineering education. By aligning instructor development, institutional policy, and student support, EMI can support effective teaching while upholding academic excellence and inclusive practices.

Ethical Considerations

This study was conducted in accordance with established ethical standards for educational research. Participation in the study was entirely voluntary, and all respondents were informed about the purpose of the research prior to data collection. Informed consent was obtained from all participants, and confidentiality and anonymity were strictly maintained throughout the research process. No personal identifiers were collected, and the data were used exclusively for academic and research purposes. The study did not involve vulnerable populations, experimental interventions, or sensitive personal data; therefore, formal ethical committee approval was not required.

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Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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