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Hands-on Pulse of English-Medium Instruction Practices in STEM

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Abstract
The present study explores the veracity of English-Medium Instruction (EMI) in Algerian higher education, with particular emphasis on STEM disciplines. The study draws on data collected from 100 participants, including 8 STEM teachers and 92 STEM students from various higher education institutions across the Algerian Republic. Using a quantitative survey design, the research examines perceptions of EMI adoption, institutional readiness, personal linguistic preparedness, willingness to participate, and the need for pedagogical support.
The findings indicate generally positive attitudes toward EMI, reflecting recognition of the growing importance of English in scientific and technological fields. However, this support is accompanied by caution, as participants express concerns regarding institutional preparedness, linguistic readiness, and the potential challenges associated with abrupt implementation. Many respondents favor a gradual and structured transition to EMI and highlight the importance of adequate support systems to ensure effective adaptation.
The study concludes that while EMI in Algerian STEM education is broadly welcomed, its success depends on systematic planning and pedagogically responsible implementation. Key implications include the need for phased adoption, targeted language support programs, comprehensive teacher training, adapted assessment practices, and equity-focused policies to ensure that content mastery and language development advance concurrently. By offering empirical insight into current perceptions and practices, this study contributes to ongoing discussions about sustainable EMI implementation in Algerian higher education.
Keywords: English-Medium Instruction (EMI); STEM Education; EFL in Higher Education; Language Pedagogical Practices; Institutional Readiness

1. Introduction

In recent years, English as a Medium of Instruction (EMI) has expanded in Algerian higher education, particularly in STEM disciplines, as part of broader reforms aimed at increasing global academic competitiveness and access to international research. Given the dominance of English in scientific publication and technological innovation, EMI is viewed as a strategic means to improve students' access to knowledge, mobility, and employability (Crystal, 2003; Dearden, 2014).

However, the shift from Arabic and/or French to English-medium teaching presents linguistic and pedagogical challenges. Students may struggle with technical vocabulary and

academic communication, while instructors often face difficulties related to materials adaptation, classroom interaction, and assessment practices (Macaro et al., 2018; Airey, 2011). Attitudes toward EMI in STEM contexts are therefore mixed, shaped by prior language exposure and disciplinary demands. While some stakeholders see EMI as a pathway to modernization and internationalization, others express concerns about content comprehension and equity (Wilkinson, 2013).

Examining these perceptions and challenges is essential to assessing the effectiveness of EMI in Algerian STEM higher education and to informing context-sensitive implementation strategies. Given the major points scrutinized the following research queries were extracted:

1. How is the effectiveness of EMI perceived by students and teachers in Algerian STEM programs?
2. What pedagogical and linguistic challenges are reported by stakeholders during the implementation of EMI in STEM disciplines?
3. What are students' and teachers' attitudes toward EMI in STEM, and what improvements do they suggest to enhance its implementation?

2. Literature Review

2.1 Overview and Global Context

English-Medium Instruction (EMI) refers to the use of English for teaching academic subjects in settings where English is not the dominant local language (Pecorari & Shaw, 2010). Globally, EMI has expanded rapidly within STEM (Science, Technology, Engineering, Mathematics) education due to its perceived alignment with globalization, research dissemination, and international labor demand (Macaro, Curle, Pun, An, & Dearden, 2018). Despite these global drivers, the implementation and outcomes of EMI vary significantly across linguistic, cultural, and policy contexts.

2.2 Incentives for EMI Adoption in STEM

Across many higher-education systems, the adoption of EMI in STEM disciplines is rarely accidental or purely pedagogical. Rather, it is strategically embedded within broader institutional, economic, and geopolitical agendas. The literature consistently identifies three central incentives driving this shift: internationalization, employability enhancement, and research visibility.

2.2.1 Internationalization Agendas

One of the most prominent motivations for EMI adoption is the internationalization of higher education. Universities increasingly position themselves within global academic markets, seeking to attract international students, establish cross-border partnerships, and improve global rankings. As argued by Ernesto Macaro et al. (2018), EMI has become a central instrument in institutional internationalization strategies, particularly in non-Anglophone contexts.

In STEM fields, internationalization is closely linked to mobility and collaboration. Scientific research is inherently transnational, requiring participation in international conferences, research consortia, and exchange programs. Offering STEM programs in

English facilitates student and faculty mobility by aligning curricula with global standards. It also enables universities to integrate more easily into international research networks.

However, the literature also cautions that internationalization through EMI may be more symbolic than substantive in some contexts. The mere use of English does not automatically guarantee intercultural engagement or academic integration. Instead, meaningful internationalization requires structural support, including language training, curriculum adaptation, and intercultural competence development.

2.2.2 Improved Employability and Labor Market Alignment

Another powerful incentive for EMI implementation in STEM is the perceived link between English proficiency and employability. In an increasingly globalized labor market, English functions as a lingua franca in science, engineering, information technology, and multinational industries. According to Jennifer Jenkins (2014), English in higher education is often framed as a form of linguistic capital that enhances graduates' competitiveness in international job markets.

In STEM careers specifically, English is often required for:

- ✓ Accessing technical documentation and manuals
- ✓ Participating in multinational projects
- ✓ Communicating with global teams
- ✓ Pursuing postgraduate study abroad

As a result, policymakers and university administrators frequently present EMI as a strategic investment in students' professional futures. In many contexts, students themselves express strong support for EMI precisely because they associate it with career mobility and higher income potential.

Nevertheless, research indicates that improved employability is not automatically guaranteed by EMI. Without explicit integration of disciplinary language development, students may struggle to achieve the level of academic English proficiency required in professional STEM settings. Thus, while EMI may create exposure, structured language support remains crucial to transform exposure into employable competence.

2.2.3 Research Visibility and Academic Prestige

A third major incentive relates to the dominance of English in global scientific communication. As noted by Robert Phillipson (2009), English occupies a hegemonic position in academic publishing, particularly in STEM fields. The majority of high-impact journals, international conferences, and citation indexes operate primarily in English.

For universities, adopting EMI in STEM aligns teaching with the language of research production. This alignment serves several purposes:

1. It prepares students for participation in international research communities.
2. It facilitates publication in indexed journals.
3. It enhances institutional prestige and global ranking performance.

In many non-Anglophone countries, policymakers view EMI as a mechanism to increase citation impact and global academic visibility. By training students and researchers

in English from early stages of higher education, institutions aim to strengthen their integration into the global knowledge economy.

However, critical scholarship warns that this dynamic may reinforce linguistic hierarchies. Phillipson (2009) argues that the dominance of English can marginalize local languages and knowledge systems, potentially narrowing epistemological diversity. Thus, while EMI may increase research visibility, it also raises important questions about linguistic equity and cultural sustainability.

Importantly, these three incentives: internationalization, employability, and research visibility, are deeply interconnected. Internationalization enhances employability; employability strengthens institutional attractiveness; and research visibility contributes to global ranking and partnership opportunities. EMI in STEM therefore functions not merely as a pedagogical shift, but as a strategic institutional tool operating at the intersection of education, economics, and global policy.

In North Africa, including Algeria, similar motivations exist. Algerian universities have increasingly emphasized English in STEM curricula to align with global academic expectations and to support graduates' mobility. English is also associated with access to cutting-edge scientific resources and collaboration networks (Bouguerra & Ammar, 2013).

2. 3 Key Themes in EMI STEM Practices

2.3.1 Language Proficiency of Teachers and Students

One major theme in EMI research is the **impact of language proficiency on instructional quality and learning outcomes**. In global EMI studies, lecturers often lack specialized training in second-language pedagogy, which limits their ability to scaffold content for students with varying English proficiency levels (Pecorari & Shaw, 2010; Macaro et al., 2018).

In Algeria, this theme is particularly salient. English proficiency among STEM faculty and students varies widely due in part to historical language dynamics (French and Arabic predominance in education) (Bouguerra & Ammar, 2013). Research indicates:

- Many Algerian STEM instructors report *limited confidence* in using English for complex disciplinary explanations, leading to dominance of French or code-switching in practice (Bouguerra & Ammar, 2013).
- Students often enter university with strong French and Arabic academic skills but comparatively low English proficiency, which can hamper comprehension and participation in EMI classes (Ait-Moussa et al., 2021).

These findings mirror global research emphasizing that without targeted language support, EMI can reinforce inequalities in access to content knowledge (Macaro et al., 2018).

2. 3.2 Pedagogical Strategies in EMI STEM

A recurring finding in EMI literature is the importance of **strategic pedagogical support**. Effective EMI teachers frequently use explicit vocabulary instruction, paraphrasing, visual aids, and interactional scaffolding to support student comprehension (Lasagabaster, 2018).

In Algerian EMI classrooms, lecturers often adapt their language use informally — resorting to translanguaging between Arabic and French as a student-support strategy. While

translanguaging can facilitate immediate understanding, it may also mask the need for structured English support programs (Ait-Moussa et al., 2021). This complex interplay between languages highlights the need for:

- Deliberate EMI methodology training that acknowledges multilingual realities.
- Materials that integrate English language development with discipline-specific goals.

2.3.3 Attitudes and Perceptions toward EMI

Internationally, student attitudes toward EMI are often positive due to perceived advantages for future employment and global engagement (Jenkins, 2014). However, students also report challenges deriving from cognitive overload and language barriers.

In Algeria, learners commonly view English as essential for STEM success, particularly for graduate studies and access to scientific literature in global journals (Ait-Moussa et al., 2021). Nonetheless, students also express anxiety about participating in lectures conducted wholly in English without adequate support, echoing international findings about affective barriers in EMI learning environments.

2.4 Challenges in EMI STEM Implementation

2.4.1 Teacher Training and Professional Development

Across contexts, one widely recognized challenge is the lack of tailored professional development for EMI instructors (Pecorari & Shaw, 2010). Faculty members are typically experts in their STEM fields but receive little guidance on language facilitation or second-language pedagogical techniques.

In Algeria, this gap is intensified by historic curricular structures that privileged French as the language of higher education. Consequently, many STEM lecturers have extensive disciplinary expertise but limited preparation in teaching through English, contributing to inconsistent EMI implementation and a reliance on traditional lecture methods.

2.4.2 Curriculum and Resource Limitations

EMI effectiveness depends on instructional materials designed or adapted for learners navigating content and language demands simultaneously. While English-medium textbooks are common in STEM, they are often not tailored to the linguistic needs of Algerian learners, resulting in comprehension challenges and reliance on translation strategies.

2.4.3 Policy-Practice Discrepancies

Institutional policy mandates sometimes outpace readiness. Some Algerian universities have declared EMI policies for STEM programs without establishing systematic support structures (e.g., pre-semester English courses or integrated language modules). This policy-practice gap reflects global patterns whereby institutional rhetoric supports EMI, but pedagogical infrastructure lags behind (Macaro et al., 2018).

2.5 Emerging Trends and Future Directions

Recent research highlights several promising directions:

- **Translanguaging frameworks** that leverage students' full linguistic repertoires :Arabic, French, and English to support learning more holistically (Garcia & Wei, 2014).

- **Longitudinal outcome studies** assessing how EMI affects STEM learning, retention, and career trajectories.
- **Cross-regional comparative research**, particularly between North African and other multilingual settings.

In Algeria, translanguaging has been framed not as a hindrance, but as a resource that, if formally integrated into pedagogy, could support deeper learning while respecting linguistic realities (Ait-Moussa et al., 2021).

3. Methodology

This study aims to investigate the current pulse of English-Medium Instruction (EMI) practices in STEM disciplines through an empirical inquiry involving both teachers and students. The methodology adopted seeks to generate both measurable trends and in-depth perceptions regarding EMI implementation.

3.1 Research Design

The study employed a mixed-methods descriptive research design, integrating quantitative and qualitative approaches. This design was selected to provide a comprehensive understanding of EMI practices in STEM settings by combining statistical trends with participants' subjective experiences.

The quantitative component consisted of closed-ended questionnaire items designed to measure:

- ✓ Frequency of EMI use
- ✓ Perceived effectiveness of EMI
- ✓ Reported linguistic challenges
- ✓ Attitudes toward EMI implementation

The qualitative component included open-ended questions allowing participants to elaborate on:

- ✓ Personal experiences with EMI
- ✓ Perceived strengths and weaknesses
- ✓ Pedagogical challenges
- ✓ Suggestions for improvement

The mixed-methods approach was considered appropriate because EMI practices involve both observable patterns (e.g., frequency of English use, reported comprehension levels) and nuanced contextual perceptions (e.g., anxiety, confidence, institutional readiness). By triangulating numerical trends with narrative responses, the study aimed to construct an evidence-based "pulse" of EMI implementation across STEM disciplines.

3.2 Population and Sampling Procedures

The target population consisted of teachers and students in STEM disciplines, specifically: science, technology, engineering, mathematics, and pharmacy. These disciplines were selected due to their strong association with English-dominated scientific communication and increasing EMI adoption.

The study involved 100 participants, comprising both faculty members, named in eight (08) teachers, and ninety-two (92) students from different higher education

establishments around the Algerian republic. The inclusion of both groups was deliberate, as EMI practices affect instructional delivery and learning processes simultaneously.

- ✓ Teachers provided insight into instructional strategies, language confidence, and policy implementation.
- ✓ Students provided perspectives on comprehension, participation, and perceived academic impact.

As for the sampling technique, a non-probability convenience sampling method was employed. Participants were selected based on accessibility and their direct involvement in STEM courses where English was used partially or fully as the medium of instruction.

Although convenience sampling limits generalizability, it was deemed appropriate for an exploratory study aimed at capturing current EMI tendencies within a specific institutional context. The goal was not broad statistical generalization, but rather an indicative and context-sensitive assessment of EMI practices.

3.3 Data Collection and Research Instruments

3.3.1 Instrument Design

Data were collected through a **structured questionnaire** composed of both closed-ended and open-ended questions.

The questionnaire was divided into four main sections:

1. **Demographic Information**
   - Discipline
   - Academic level (student/teacher)
   - Years of experience (for teachers)
2. **EMI Usage and Practices** (Closed-ended)
   - Frequency of English use in lectures
   - Degree of code-switching
   - Use of English instructional materials
   - Self-reported language proficiency
3. **Perceptions and Attitudes Toward EMI** (Closed-ended + Likert scale)
   - Perceived effectiveness of EMI
   - Impact on comprehension
   - Impact on academic performance
   - Professional relevance
4. **Open-Ended Questions**
   - Main challenges encountered in EMI
   - Advantages of EMI in STEM
   - Suggested improvements
   - Reflections on institutional readiness

The combination of item types enabled both quantifiable measurement and interpretive depth.

3.3.2 Validity Considerations

To enhance **content validity**, questionnaire items were constructed based on recurring themes in EMI literature, including:

- ✓ Language proficiency
- ✓ Pedagogical strategies
- ✓ Institutional support
- ✓ Attitudinal factors

The instrument was reviewed for clarity and coherence before distribution to ensure that questions were understandable for participants with varying English proficiency levels.

3.3.3 Data Collection Procedure

The questionnaire was administered to 100 STEM teachers and students through direct distribution (online or paper-based, depending on your context). Participants were informed about:

- ✓ The purpose of the study
- ✓ Voluntary participation
- ✓ Confidentiality and anonymity

Responses were collected within a specified timeframe and compiled for analysis.

3.3.4 Data Analysis

Quantitative data from closed-ended questions were analyzed using descriptive statistics, including frequencies, percentages and comparative trends between teachers and students

Qualitative responses from open-ended questions were analyzed through **thematic analysis**, allowing recurring patterns, concerns, and perceptions to be identified. Themes were categorized according to major EMI dimensions (e.g., linguistic challenges, pedagogical adaptation and institutional policy).

Through the integration of statistical tendencies and thematic interpretation, the study generated an evidential "pulse" of EMI practices across STEM disciplines.

3.4 Ethical Considerations

The study adhered to standard research ethics principles:

- ✓ Participation was voluntary.
- ✓ Responses were anonymous.
- ✓ Data were used exclusively for academic purposes.
- ✓ Participants had the right to withdraw at any stage.

4. Discussion of the Findings

The findings of this study indicate that English as a Medium of Instruction (EMI) is widely perceived as efficient in Algerian STEM programs (mainly questions 10 and 15), particularly in relation to employability, academic development, research access, and international integration.

4.1 Perceived Efficiency in Enhancing Employability

The statistical results show that **70% of respondents believe EMI improves employability**, while only 3% disagree and 28% remain uncertain. This strong majority suggests that students associate EMI with improved labor market competitiveness.

Qualitative responses reinforce this perception. Students explicitly linked EMI to:

- ✓ "Increase employment opportunities locally and internationally" (27)
- ✓ "Better chances to find a job" (32)
- ✓ "Increase graduates' employability in the global job market" (39)
- ✓ "Preparing them for the global job market" (98)
- ✓ "Work in international companies" (100)

These perceptions align with global EMI research. Ernesto Macaro et al. (2018) argue that EMI is often implemented to enhance international competitiveness and graduate employability. Similarly, David Lasagabaster (2018) notes that EMI is commonly justified by its perceived economic and professional benefits.

In STEM disciplines specifically, English dominates scientific publication and multinational industry communication, reinforcing the belief that EMI increases employment prospects.

4.2 Perceived Efficiency in Improving English Proficiency

The most dominant theme in the qualitative responses concerns language development. Numerous participants emphasized that EMI:

- ✓ "Improves English and increases academic and professional opportunities internationally" (15)
- ✓ "Improve students' English proficiency" (38, 43, 54, 88)
- ✓ "EMI improves students' English skills" (58, 83, 97)
- ✓ "Learn how to write and speak" (93)

This strong emphasis indicates that students view EMI as an effective language acquisition mechanism.

According to Diane Belcher (2006), integrating disciplinary content with English exposure can enhance academic literacy development. Likewise, Aintzane Doiz, David Lasagabaster, and Juan Manuel Sierra (2013) argue that EMI environments increase meaningful exposure to English, which can strengthen proficiency, particularly in academic registers.

In STEM contexts, where technical vocabulary and international collaboration are central, this linguistic efficiency is perceived as particularly valuable.

4.3 Perceived Efficiency in Facilitating Access to International Knowledge

Another major theme concerns access to global scientific resources:

- ✓ "Facilitates access to international scientific resources" (23)
- ✓ "Finding more resources" (37)
- ✓ "Access to international knowledge" (51, 83, 97)
- ✓ "All recent researchs are in English" (92)
- ✓ "Keeping up with global developments in knowledge" (71)

Students recognize that English dominates global scientific production. Philip G. Altbach (2013) explains that English functions as the global language of science and higher education, shaping research dissemination and academic prestige. Therefore, EMI is perceived as efficient in enabling Algerian STEM students to access cutting-edge research.

This perception is especially relevant in STEM fields, where most high-impact journals and technological documentation are published in English.

4.4 Perceived Efficiency in Promoting Internationalization and Global Integration

Many responses framed EMI as a tool for globalization:

- ✓ "The most used language in the world" (3)
- ✓ "International common language" (61)
- ✓ "Keeping pace with the world's advanced education" (31)
- ✓ "Strenghtening the international visibility of Algerian universities" (76)
- ✓ "Better academic collaboration and exchange programs" (76)
- ✓ "Be like the rest of the world" (90)

These views align with Robert Phillipson (2009), who discusses the global spread of English in higher education as part of internationalization processes. EMI is frequently introduced as a strategy to align national universities with global academic standards.

In the Algerian STEM context, students perceive EMI as helping universities modernize curricula, improve international rankings, and enhance academic cooperation.

4.5 Perceived Contribution to National Development

Some participants extended EMI efficiency beyond individual benefits:

- ✓ "Develop level of Algerian universities" (65)
- ✓ "Supports economic development in Algeria" (57)
- ✓ "This will help Algeria develop" (77)
- ✓ "Updating academic curricula to keep pace with global standards" (72)

This reflects a macro-level perception of EMI as a development strategy. According to Philip G. Altbach (2013), English-medium higher education is often linked to national modernization policies and global economic integration.

Thus, EMI in Algerian STEM programs is perceived not only as pedagogically efficient but also as economically strategic.

This suggests that while EMI is widely perceived as efficient, concerns or uncertainties remain, possibly regarding implementation quality, students' English preparedness, or equity issues. As Macaro et al. (2018) note, EMI effectiveness depends heavily on teacher proficiency, institutional support, and student readiness.

The data strongly indicate that EMI is perceived as efficient in Algerian STEM programs in five major dimensions: enhancing employability, improving English proficiency, facilitating access to international scientific knowledge, promoting internationalization and supporting national academic and economic development.

The statistical (70% positive) and thematic findings converge to show that Algerian STEM students largely view EMI as a strategic and beneficial reform. However, the presence of uncertainty highlights the need for careful implementation and pedagogical support to ensure that perceived efficiency translates into measurable outcomes.

4.6 Pedagogical and Linguistic challenges of Implementing EMI in STEM Disciplines

From question twelve (Q12), a total of **100 responses** were analyzed. Because respondents could mention more than one challenge, frequencies exceed 100%.

Reported Challenge	Frequency (n)	Percentage (%)
Students' weak English level	45	45%
Difficulty understanding technical terms	42	42%
Difficulty expressing ideas	41	41%
Limited English vocabulary	36	36%
Lack of trained teachers	36	36%
Lack of English resources/materials	27	27%
Increased workload	10	10%
Other (motivation, sudden transition, prior French-medium background)	4	4%

Key statistical trends:

- ✓ The most frequently reported issue is students' weak English level (45%).
- ✓ Linguistic difficulties (vocabulary, technical terms, expressing ideas) collectively dominate the responses.
- ✓ Institutional challenges such as **lack of trained teachers (36%)** and **lack of resources (27%)** are also prominent.
- ✓ Fewer respondents mentioned **increased workload (10%)** or motivational/transition-related concerns (4%).

Thematic Analysis

A thematic coding of responses reveals four major themes:

4.6.1 Linguistic Challenges (Most Dominant Theme)

This theme includes:

- ✓ Limited English vocabulary
- ✓ Difficulty understanding technical terms
- ✓ Difficulty expressing ideas
- ✓ Students' weak English level

These responses indicate concern about both **receptive skills** (understanding terminology) and **productive skills** (expressing ideas orally or in writing). Many participants explicitly linked comprehension problems to weak general proficiency.

This aligns with findings by Macaro et al. (2018), who report that limited language proficiency is one of the most significant barriers to effective EMI implementation. Similarly, Airey (2011) highlights how students in EMI contexts often struggle with disciplinary discourse and conceptual understanding due to language constraints.

4.6.2 Pedagogical and Institutional Challenges

This theme includes:

- ✓ Lack of trained teachers
- ✓ Lack of English resources/materials
- ✓ Professors accustomed to French-medium instruction
- ✓ Mixed language delivery (French explanation, English materials)

Participants expressed concern about instructors' preparedness and the availability of appropriate materials. Some responses reflect structural issues, such as a sudden policy shift from French to English without gradual preparation.

These concerns echo Dearden (2014), who found that insufficient teacher training and limited institutional support are common EMI implementation problems worldwide. Wilkinson (2013) also emphasizes that successful EMI requires pedagogical adaptation, not merely language change.

4.6.3 Workload and Cognitive Burden

- ✓ Increased workload
- ✓ Difficulty switching language of instruction
- ✓ "Unanticipated radical transition"

Respondents suggested that EMI may increase cognitive load, as students must process both content and language simultaneously. This reflects the "dual challenge" frequently identified in EMI literature, where learners manage subject mastery and language acquisition at the same time (Macaro et al., 2018).

4.6.4 Affective and Motivational Factors (Minor Theme)

- ✓ Lack of will/passion
- ✓ Anxiety about sudden transition

Though less frequent, these responses highlight emotional and motivational dimensions, which can influence classroom participation and learning outcomes.

The findings confirm that **linguistic proficiency is perceived as the primary obstacle** to EMI effectiveness in STEM contexts. This supports Crystal's (2003) argument that while English dominates global academia, local proficiency gaps can hinder equitable participation.

The strong presence of institutional concerns (teacher preparation and materials) reflects global EMI trends identified by Dearden (2014), where policy changes often precede adequate infrastructure and training.

Finally, the dual burden of language and content learning mirrors conclusions by Macaro et al. (2018), who argue that without sufficient scaffolding and language support, EMI may negatively affect conceptual understanding, particularly in technical disciplines.

Overall, the data suggest that EMI challenges in this context are primarily:

1. Linguistic (dominant)
2. Pedagogical/institutional (substantial)
3. Cognitive workload-related (moderate)
4. Affective (limited but present)

These findings indicate that successful EMI implementation requires not only language improvement initiatives but also structured teacher training, gradual transition policies, and pedagogical adaptation.

4.7 Attitudes toward EMI in STEM and Suggested Betterments

The data show that **58% strongly support EMI**, indicating a predominantly positive attitude toward adopting English as the medium of instruction in STEM disciplines. This aligns with global trends where EMI is associated with enhanced employability, academic mobility, and

access to international scientific knowledge (Wächter & Maiworm, 2014; Macaro et al., 2018).

Response Category	Percentage
Strongly Support	58%
Neutral	36%
Strongly Oppose	7%

Opinion About Introducing EMI

However, the **36% neutral responses** suggest a considerable degree of ambivalence. According to Dearden (2014), neutrality in EMI contexts often reflects uncertainty about implementation quality rather than rejection of the concept itself. The low opposition rate (7%) further confirms that resistance is minimal, and concerns are likely pragmatic rather than ideological.

4.7.1 Preferred Mode of EMI Implementation

A strong majority (**74%**) favor gradual implementation, demonstrating awareness of linguistic and pedagogical challenges associated with abrupt language transition. Research by Airey (2011) shows that sudden shifts to EMI may increase cognitive load and reduce conceptual clarity in STEM subjects.

Only 24% support immediate implementation, reinforcing that although EMI is supported in principle (58%), stakeholders prefer a phased, scaffolded transition. This reflects recommendations in EMI research advocating staged policy adoption to ensure quality and equity (Macaro et al., 2018).

4.7.2 Perceived Institutional Readiness

Only **13% perceive universities as very ready**, while 33% believe they are not ready, and a majority (58%) are unsure. This dominant uncertainty suggests perceived gaps in institutional infrastructure, teacher training, or language support systems.

Literature indicates that EMI success depends heavily on teacher preparation, language policy clarity, and academic support mechanisms (Macaro et al., 2018). The high "not sure" rate may reflect limited transparency regarding institutional planning.

4.7.3 Willingness to Participate in EMI

Although 58% strongly support EMI in general, only **49% commit to personal participation**, while 45% remain uncertain. This gap suggests that while EMI is ideologically supported, personal linguistic confidence moderates participation decisions.

Such discrepancies are widely documented in EMI research, where support often exceeds self-confidence in English proficiency (Macaro et al., 2018).

4.7.4 Self-Perceived English Preparedness

While 51% feel fully ready, a significant **42% feel only partially prepared**, suggesting potential academic language gaps. According to Airey (2011), STEM students may possess technical vocabulary but struggle with complex explanations and academic writing in English.

Response Category	Percentage
Fully Ready	51%
Partially Ready	42%
Not Ready	7%

Preparedness to embrace EMI in STEM

The relatively low "not ready" percentage (7%) reinforces that complete linguistic inadequacy is not widespread; rather, partial readiness dominates.

4.7.5 Need for Support Mechanisms

A substantial **51% explicitly request support**, and 40% possibly require it. This means over 90% indicate at least some need for structured assistance.

This strongly confirms EMI literature emphasizing that successful implementation requires embedded language support, such as English for Academic Purposes (EAP) programs and teacher training initiatives (Henriksen et al., 2019). These findings mirror international EMI trends showing aspirational support combined with practical caution (Wächter & Maiworm, 2014; Macaro et al., 2018).

5. Recommendations and Pedagogical Implications for Practice

5.1 Adopting a Gradual, Phased EMI Implementation Strategy

- ✓ Introducing EMI progressively (e.g., first-year terminology modules, then partial EMI lectures, followed by full-course EMI).
- ✓ Beginning with STEM courses where English terminology is already dominant.
- ✓ Implementing bilingual support during early transition phases.

A phased model reduces cognitive overload and protects content comprehension, as recommended in EMI research (Airey, 2011; Macaro et al., 2018).

5.2 Establishing Structured Language Support Programs (EAP for STEM)

- ✓ Creating mandatory English for Academic Purposes (EAP) courses tailored to STEM.
- ✓ Offering discipline-specific vocabulary workshops.
- ✓ Integrating academic writing and presentation training within STEM curricula.
- ✓ Providing online self-access language support platforms.

Pedagogically, language development should not be separated from content but embedded within STEM instruction to avoid content–language imbalance (Macaro et al., 2018).

5.3 Implementing Comprehensive EMI Teacher Training

- ✓ Offering EMI certification programs for lecturers.
- ✓ Providing training in:
  - ➢ Scaffolding techniques
  - ➢ Simplified academic discourse strategies
  - ➢ Interactive classroom practices
  - ➢ Multimodal teaching methods

Teacher preparedness is central to EMI success. Without pedagogical training, EMI risks becoming "language transfer" rather than effective content instruction (Dearden, 2014).

5.4 Developing Clear Institutional EMI Policy Frameworks

- ✓ Drafting a transparent national and institutional EMI roadmap.
- ✓ Defining:
  - ➢ Language proficiency benchmarks for students and teachers.
  - ➢ Assessment adjustments during transition.
  - ➢ Long-term quality assurance measures.

Clarity in policy reduces resistance and fosters stakeholder confidence (Wächter & Maiworm, 2014).

5.5 Incorporating Translanguaging and Strategic Bilingual Practices

- ✓ Allowing limited use of Arabic/French for clarification during early EMI phases.
- ✓ Providing bilingual glossaries for complex STEM concepts.
- ✓ Encouraging code-switching strategically to maintain conceptual depth.

This flexible approach ensures conceptual accuracy while developing English proficiency (Airey, 2011).

5.6 Introducing Preparatory (Bridging) Programs before Full EMI Adoption

- ✓ Summer intensive English programs for STEM students.
- ✓ First-semester "EMI orientation" modules.
- ✓ Diagnostic placement tests to identify language gaps.

Bridging programs enhance confidence and reduce attrition risk during early EMI implementation.

5.7 Continuous Monitoring and Evaluation Mechanisms

- ✓ Conducting annual EMI perception surveys.
- ✓ Tracking academic performance pre- and post-EMI.
- ✓ Establishing feedback channels for students and teachers.
- ✓ Adjusting policies based on empirical data.

EMI effectiveness should be evidence-driven and adaptive rather than static (Macaro et al., 2018).

6. Conclusion

The findings of this study highlight significant pedagogical implications for the successful implementation of English-Medium Instruction (EMI) in Algerian STEM education. Most importantly, EMI should not be treated merely as a change in the language of instruction, but as a comprehensive pedagogical shift that carefully balances content mastery with language development. In STEM disciplines, where conceptual precision is essential, maintaining academic rigor while supporting students' linguistic growth is crucial to preserving learning quality.

To achieve this balance, teachers will need to adapt their instructional practices by adopting clearer discourse, more structured explanations, and increased use of visual and multimodal support strategies. Such approaches can reduce cognitive overload and facilitate comprehension, particularly during the early stages of EMI implementation. Additionally, assessment design must be thoughtfully reconsidered to ensure that linguistic challenges do not unfairly hinder students' ability to demonstrate their content knowledge. Evaluative

practices should distinguish between subject mastery and language proficiency, especially during the transition period.

Equity must also remain at the forefront of EMI policy and practice. Without appropriate scaffolding and institutional support, linguistically weaker students risk being disproportionately disadvantaged. Therefore, inclusive measures such as targeted language support, gradual implementation, and continuous monitoring are essential to ensure fairness and academic accessibility.

Overall, the evidence suggests that EMI in Algerian STEM education is both viable and broadly welcomed. However, its success depends on systematic planning, inclusive support structures, and pedagogically responsible implementation that prioritizes both academic excellence and linguistic development.

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