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CHALLENGES AND STRATEGIES IN IMPLEMENTING ENGLISH-MEDIUM INSTRUCTION IN A PRIMARY SCIENCE CLASSROOM

Suci Febriyani[1], Yuyun Yulia[2*]
[1]sucifebriyani.2023@student.uny.ac.id , [2]yuyunyulia@uny.ac.id

UNIVERSITAS NEGERI YOGYAKARTA

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ABSTRACT

This study investigates the challenges and instructional strategies involved in implementing English as a Medium of Instruction (EMI) in a primary science classroom. Employing a qualitative case study design, data were collected through classroom, a semi-structured teacher interview, and document analysis in an Islamic-based primary school in Yogyakarta, Indonesia, involving one Grade 6 science teacher and sixteen students. The findings reveal that EMI implementation posed significant challenges related to the teaching and learning of scientific concepts through English, particularly in relation to abstract content, unfamiliar scientific terminology, and the influence of students' first language (Indonesian) on classroom interaction. To address these challenges, the teacher employed multiple adaptive strategies, including vocabulary pre-teaching, systematic repetition, experiential scaffolding through everyday examples, consistent English modelling, and structured opportunities for student oral and written output. In addition, Indonesian was used selectively and strategically to clarify key terms and support individual students' comprehension without undermining English as the primary instructional language. The study highlights the importance of flexible, interaction-sensitive pedagogy in primary EMI science classrooms and contributes to the limited body of research on EMI implementation at the primary education level.

Keywords: English-medium instruction, EMI challenges, Instructional strategies, Primary school, Science education

A. INTRODUCTION

In recent years, increasing attention has been given to the integration of language and content in classroom instruction, particularly in subjects that demand high levels of conceptual understanding such as science (Kaiypova et al., 2025; Tai, 2022). Due to the abstract nature of scientific concepts and the use of specialized terminology, language functions as a central resource through which students' access, construct, and communicate disciplinary knowledge. As Macaro (2018) explains, when students learn academic subjects through a second or foreign language, language becomes an essential medium for meaning-making rather than merely a tool for communication.

One approach that has gained prominence in this context is English as a Medium of Instruction (EMI). EMI is commonly defined as the use of English to teach academic subjects in settings where English is not the first language of the majority of learners (Dearden, 2014; Pecorari & Malmström, 2018). Unlike traditional English language teaching, EMI prioritizes content learning, while language development is expected to occur incidentally through exposure and use of English in subject classrooms. Amanova et al. (2024) further emphasize that EMI positions English as a vehicular language for academic learning, rather than as an explicit instructional focus.

At the primary school level, EMI is often supported by research on early language exposure. Studies have shown that young learners benefit from rich and meaningful linguistic input, which can contribute to long-term language development and academic achievement (Agostini et al., 2025; Silvey et al., 2021). Furthermore, Jaekel et al. (2022) found that sustained exposure to a second language at an early age enhances children's processing skills, supporting both language and content learning. However, as Omar et al. (2020) cautions, early exposure alone is insufficient; effective learning in EMI contexts depends heavily on the quality of classroom interaction and instructional support.

Despite its potential benefits, implementing EMI in non-English-speaking contexts presents substantial challenges. Recent reviews note that EMI teachers are typically subject specialists who often lack language-teaching backgrounds and preparation for integrating content and language instruction (Lasagabaster & Fernández-Costales, 2025; Wang et al., 2025). This gap between disciplinary expertise and language-pedagogical knowledge can make it difficult to balance content delivery with students' linguistic needs, potentially constraining classroom interaction and meaning-making (Wang et al., 2025). Empirical studies similarly show that limited teacher English proficiency and insufficient EMI-specific training may hinder clear explanations and effective classroom communication (Handayani et al., 2022; Richards & Pun, 2022). These challenges are particularly acute in science lessons, where abstract concepts and technical terminology demand precise yet accessible language (Macaro, 2018; Othman, 2024).

From the students' perspective, learning science through English can also be cognitively demanding. Studies indicate that students with limited English proficiency often struggle to understand subject content, as they must process unfamiliar language and complex concepts simultaneously (Othman, 2024; Peng & Zhou, 2025). Puspitasari & Ishak (2023) similarly report that students in EMI classrooms tend to focus on decoding language before engaging with content, which can reduce comprehension and participation. In science subjects, this challenge is further intensified by discipline-specific vocabulary and abstract terminology (Alam et al., 2024).

The role of students' first language (L1) in EMI classrooms has therefore become a contested issue in the literature. While EMI is often associated with an English-only ideology, recent EMI scholarship argues that strategic L1 use/translanguaging can function as a pedagogical resource to support comprehension and classroom meaning-making rather than as an obstacle to English learning (Sah & Kubota, 2022; Sahan, 2020). Research suggests that judicious code-switching may help clarify complex concepts, reduce learner anxiety, and support comprehension, particularly in content-heavy subjects such as science (Guimong et al., 2025; Richards & Pun, 2022). Nevertheless, excessive reliance on L1 may limit students' exposure to English and undermine the intended goals of EMI, highlighting the need for balanced language use in classroom practice.

In response to these challenges, researchers have emphasized the importance of instructional strategies that integrate language support into content teaching. According to Richards and Pun (2022) effective EMI instruction involves scaffolding through simplified language, repetition, visual aids, and pre-teaching key vocabulary. The research further highlights the role of teachers as language models who reformulate students' responses, paraphrase explanations, and create opportunities for meaningful classroom interaction. Such strategies have been shown to support both content understanding and language development, particularly in science classrooms (Wang, 2021).

Although EMI has been widely examined in secondary and tertiary education, research focusing on primary-level EMI classrooms remains limited, especially in science education and Islamic-based school contexts. Existing studies have largely concentrated on policy implementation or teachers' perceptions, with fewer investigations examining how challenges and strategies unfold in everyday classroom practice. To address this gap, the present study explores the implementation of EMI in a primary science classroom at an Islamic-based school in Yogyakarta, Indonesia. Accordingly, this study addresses the following research questions:

1. What challenges do teachers and students encounter in the implementation of English as a Medium of Instruction in a primary science classroom?
2. What instructional strategies are employed by the teacher to address these challenges?

B. METHOD

This study employed a qualitative case study design to explore the challenges and instructional strategies involved in implementing English as a Medium of Instruction (EMI) in a primary science classroom. Case study research is particularly suitable for investigating complex educational phenomena by capturing processes, meanings, and contextual factors that shape classroom interaction and instruction (Mackey & Gass, 2021). In this study, the case focused on one EMI science classroom to provide a detailed understanding of how EMI was enacted in practice and how teachers and students responded to its challenges.

The study was conducted at a private Islamic-based primary school in Sleman, Yogyakarta, Indonesia, where EMI is integrated across most academic subjects except Indonesian language and certain Islamic studies components. Participants, selected through purposive sampling (Cresswell & Cresswell, 2023), consisted of one Grade 6 science teacher and sixteen female students (aged 11-12) from class P6B. The teacher (pseudonym: Ms. ENH), aged 29, held a Bachelor's degree in Biology and Master's in Basic Medical Sciences with five years of science teaching experience, including one year teaching through EMI. Her self-reported English proficiency was intermediate, developed primarily through academic reading and writing rather than spoken interaction. Her EMI-specific training was limited to one publisher-led workshop on Cambridge science materials. The students were native Indonesian speakers with varied English proficiency and no regular English use at home, reflecting limited exposure to English outside the school environment.

Data were collected through classroom observations, semi-structured interviews, and documentary analysis. Three science lessons (3 x 60 minutes) were observed and audio-video recorded. Following the observations, a semi-structured interview was conducted with the teacher. The interview focused on the teacher's experiences, perceived challenges in

implementing EMI, and strategies used to support students' learning. Open-ended questions were used to allow the teacher to express her perspectives freely (Cresswell & Cresswell, 2023). The interview protocol was adapted from previous EMI studies to ensure relevance and depth (An, 2019; Pun, 2017). In addition, documentary analysis was conducted using lesson plans, teaching materials, and school documents to complement and triangulate the observational and interview data (Tisdell et al., 2025)

C. FINDINGS AND DISCUSSION

Drawing on data from classroom observations, a semi-structured teacher interview, and document analysis, this section integrates the presentation of findings with their interpretation in relation to previous EMI research. While the data revealed multiple challenges commonly reported in EMI literature, such as teachers limited English proficiency and students' diverse language backgrounds, this article focuses on two particularly significant findings that illuminate the distinctive nature of primary-level EMI implementation: (1) challenges in teaching and learning science content through English, and (2) the instructional strategies employed by the teacher to address these challenges. These findings are organized to address the research questions, with immediate interpretation and discussion integrated throughout.

1. Challenges in Teaching and Learning Scientific Content Through English

The challenges identified in this study manifested in three interrelated forms: students' unfamiliarity with scientific terminology, confusion arising from cross-linguistic similarities between Indonesian and English terms, and difficulties in explaining and comprehending scientific concepts in English.

Students' Unfamiliarity with Scientific Terminology

The first pattern involved scientific terms that students had not encountered in either English or their first language (Bahasa Indonesia). The teacher described this challenge when teaching plant anatomy.

> *"…There are some terms that I worry they cannot explain in Indonesian. For example, when I explained the topic of flowers. In the Cambridge book, there is no definition provided, full terms. For instance, parts of a flower: petal and sepal. Petal means mahkota in Indonesian, and sepal means kelopak. That does not exist in Cambridge: sepal is just sepal; petal is just petal. So, for them, these are just terms, but they do not really understand it."*

She explained that the Cambridge curriculum introduced terms directly in English without providing explanatory definitions. This sometimes cause confusion among students since the know the term but does not know the Indonesian Equivalents. Document analysis of the Cambridge Primary Science curriculum materials confirmed this explanation: the textbook introduced scientific terms directly in English without providing explanatory definitions or Indonesian equivalents. This revealed a gap where students were learning scientific concepts and terminology exclusively through English without developing corresponding vocabulary in their first language. The terms remained abstract labels rather than concepts anchored in either linguistic system. This pattern aligns with recent EMI science research showing that learners may demonstrate surface familiarity with English terminology without deep

conceptual understanding, particularly when language and content demands are not sufficiently integrated (Pun et al., 2022).

Confusion over similarities between Indonesian and English terms

Both the teacher and students experienced difficulty identifying and distinguishing terms across languages. Some words appeared similar in Indonesian and English but differed in pronunciation, usage, or meaning, creating what the teacher described as persistent confusion. She explained:

> *"Sometimes there are terms where the Indonesian and English words are the same, like organ, which is the same in both languages. However, the pronunciation patterns are different. We might say organ in Indonesian, but if we use the same pronunciation in English, it would be incorrect. There are also loanwords, for example, temperatur, which is commonly used in Indonesian. But we cannot use temperatur in English; it should be temperature. So, I make sure of these differences first."*

A Surprising pattern also emerged when students were familiar with English scientific terms but could not identify or remember the Indonesian equivalents. This was evident in the following classroom interaction:

Exchange 1.
T: So, reflection in Bahasa is *pemantulan*. What is refraction in *Bahasa*?
S: *Refleksi*.
T: No, in scientific terms, what is that? *Pembiasan.*
S: *Bias!*
T: *Pembiasan* or *bias*, yes. But the term is refraction

This exchange illustrates what Othman (2024) describes as the complexity of academic vocabulary learning in EMI contexts. The student's initial response "*Refleksi*" suggested confusion between similar-sounding English and Indonesian words. Even when the teacher provided the correct Indonesian term *pembiasan*, the interaction revealed that students had not previously connected the English term "refraction" with its Indonesian equivalent. These finding challenges simplistic assumptions that cognates automatically facilitate comprehension. Instead, it reveals how false friends and phonological similarities can create confusion in primary EMI classrooms, particularly when students lack robust conceptual understanding in either language.

Difficulty in explaining and understanding scientific concept in English

The vocabulary patterns collectively created significant challenges for both explanation and comprehension. The teacher acknowledged that certain concepts were difficult to explain precisely because of these linguistic constraints:

> *"Sometimes there are things that I find difficult to explain in English, maybe because the person I'm talking to also has that as their mother tongue."*

Analysis of lesson plans indicated that the teacher anticipated this difficulty. Margin notes across several plans showed pre-planned simplifications, alternative phrasings, and reminders to use concrete examples. However, despite this preparation, the difficulty remained evident in classroom interaction, as shown in Exchange below:

Exchange 2.

T: Okay, this material is actually easy, but it's quite challenging to explain, so please pay attention.

T: So, if we move from gas into liquid, because it's higher density, it means slower. So, for example, there is faster. Yes, if there is slower. If it needs time, so it will be- Okay. there or here? There or here? If it needs time, the speed is become slower. So, it will be still like this, mbak. *Nah,* we called as refracted-

S1: Why confusing?

T: Why confusing? [laugh; continue writing] refracted rays. I will give you another example after this. This is refracted rays. So, we call it is B. how to measure A And B is the angle of incidence or angle of refraction. That is- go to the normal line.

SS: haaaaah?/haaahh? [expressing confusion]

This interaction exemplifies what Macaro (2018) describes as the "double bind" of EMI instruction: teachers must simultaneously manage content complexity and linguistic limitations. The teacher's struggle to articulate the concept of refraction clearly in English directly impacted students' ability to access the scientific content, confirming findings from previous studies that limited teacher English proficiency can hinder effective explanation of subject matter (Handayani et al., 2022; Richards & Pun, 2022). Interestingly, the teacher noted a paradox in her experience. While she struggled with English explanations in general, she found some scientific terminology actually clearer in English than in Indonesian:

> *"It actually becomes much clearer because in English there are terms that, in my opinion, sound odd in Indonesian, but when used in English, they make more sense. That is why I avoid explaining things in Indonesian, as I worry it might make them more confusing."*

This created an additional challenge: even when students struggled to understand English explanations, switching to Indonesian was not always a viable solution because Indonesian scientific terminology could be equally or more confusing. The teacher thus faced a double bind, struggling to explain in English while finding Indonesian explanations potentially "more confusing" for certain concepts. The teacher thus faced a double bind, struggling to explain in English while finding Indonesian explanations potentially "more confusing." This finding complicates simplistic assumptions that L1 use automatically facilitates understanding in EMI contexts and underscores the complexity of language choice in primary science EMI classrooms, where neither language may provide an optimal medium for explanation.

2. First Language Influence on Science Learning

Another major challenge concerned the pervasive influence of students' first language (Indonesian) on classroom interaction. The school operates under an institutional policy requiring English as the medium of instruction and communication. The teacher explicitly stated her commitment to this policy: "Actually my hope is to follow the rules in the school, full English". However, the reality of classroom practice revealed a more complex picture. This manifested not only as limited English proficiency but also as habitual communication practices, including spontaneous code-mixing and direct transfer of Indonesian grammatical patterns into English utterances.

Analysis of classroom observation transcripts revealed that students frequently initiated interactions in Indonesian or mixed languages, even when the teacher consistently used English. For example, during Meeting 1, students uttered expressions such as "Bu, *capek*" (Teacher, I'm tired), and “This one. I *nggak tahu*” (This one, I don’t know) during lessons, or used Indonesian discourse markers like "*iya*" (yes) and "*nah*" to signal understanding (Field Notes, Meeting 1 & 2). Similarly, field notes from Meeting 2 documented that during note-taking activities, students chatted loudly and went off topic, often using Indonesian. Comparable patterns were also observed in Meeting 3, where students interacted actively while mixing Indonesian and English during classroom activities.

Beyond code-mixing, first-language influence was also evident in the direct transfer of Indonesian grammatical structures into English. The teacher explained that students often translated Indonesian sentence patterns directly into English, particularly in question formation. She recalled:

> *“Students sometimes tend to translate directly from Indonesian. The most unusual example I encountered when I first arrived was when I asked them to open their books and they responded, “Page how many?” This reflects Indonesian 5W1H question patterns, where the question word is placed at the end of the sentence.”*

This example indicates that the challenge was not lexical, as students possessed the relevant English vocabulary, but syntactic, stemming from structural differences between Indonesian and English question formation. Similar EMI studies also show that translanguaging (e.g., cross-language labeling and code-mixing) often emerges naturally and routinely in classroom interaction, sometimes occurring unconsciously as part of everyday communication (Abouzeid et al., 2025; Jiang & Zhang, 2023). The teacher reflected on this phenomenon:

> *“They can be said to have a lot of language influence leaks. Maybe because the intensity of their communication with their friends is much more than with educators, and the leakage must be there.”*

Importantly, students were frequently able to self-correct and produce appropriate English forms when prompted by the teacher. This observation suggests that code-mixing functioned as a default interactional strategy rather than a gap-filling mechanism necessitated by linguistic incompetence. As Pun et al. (2022) note, EMI learners may rely on L1 due to classroom routines and comfort rather than lack of competence, highlighting the importance of teacher management strategies in shaping language use patterns.

3. Strategies for Addressing EMI Challenges

In response to the linguistic and conceptual challenges identified above, the teacher adopted a set of deliberate and context-sensitive instructional strategies. To address these interconnected EMI challenges, the teacher implemented four complementary strategies: systematic vocabulary scaffolding, connecting abstract concepts to students’ everyday experiences, modeling and encouraging English output, and the strategic, principled use of the first language.

Vocabulary Scaffolding through Pre-Teaching and Repetition

The teacher deliberately introduced important or unfamiliar terms at the beginning of new topics. Lesson plans showed evidence of systematic vocabulary identification and

sequencing, with key terms listed at the start of each unit in a dedicated "Key Vocabulary" section. She described her approach:

> *"Before starting a new unit, I usually write the key words first, either on the PowerPoint or on the whiteboard. Especially the new ones for them. Then I cross them off one by one, like, "Oh, this one is done, this one is done," so it's clear which ones are new and which ones they already know."*

This pre-teaching strategy served multiple functions: it allowed the teacher to identify which terms were already familiar to students, it provided advance notice of terminology students would encounter, and it created a reference point throughout the lesson. This approach aligns with Othman's (2024:3) findings that effective EMI science instruction requires "integrating scaffolding strategies to simplify complex scientific terms", with pre-teaching key vocabulary recognized as essential for supporting students' access to vocabulary-dense scientific content. Moreover, the teacher emphasized repetition as a central strategy for helping students internalize new terminology. When asked how she dealt with difficult words, she explained,

> *"For very scientific terms, I repeat them over and over. Verbally, I ask a lot of questions. I try to make them say the word as often as possible. I ask about the meaning and the function, and they answer using that term. This way, they become familiar with the words first. It is to avoid simple memorization, so they naturally have to use them."*

This statement reveals a sophisticated understanding of vocabulary acquisition. Rather than relying on rote memorization, the teacher used varied questioning about word meanings and functions to ensure students repeatedly encountered and produced terms in meaningful contexts. This approach aligns with research showing that repeated, contextualized repetition and productive use are more effective for developing deep academic vocabulary knowledge than passive exposure or memorization, particularly in content-heavy subjects such as science (Othman, 2024; Richards & Pun, 2022). The teacher also incorporated systematic review at the beginning of subsequent lessons:

> *"I always review first to bridge to the next topic. I think there needs to be some recall beforehand. I try to do this before starting the new material so the students are not suddenly confused about why we are discussing a new topic, but are gradually guided toward it."*

This spiral approach to vocabulary development: introducing, repeating, reviewing, and recycling terms across lessons created multiple opportunities for students to consolidate their understanding. Analysis of student notebooks and worksheets revealed that students were able to reproduce scientific terms in written form, demonstrating receptive understanding of vocabulary introduced through pre-teaching and repetition strategies

Connecting Abstract Concept to Students' Everyday Experience

The teacher strategically used students' prior knowledge and everyday experiences to make abstract scientific concepts more accessible. This strategy was particularly evident when teaching refraction, where the teacher drew on a familiar activity:

Exchange 3

T: When you sit down beside the swimming pool and then put your legs there. Did you see that your legs become shorter?
S: Yes/yes/yeah [laughter]
T: And who can swim? Sometimes, if you see your friends inside the water. *Wahhh*, why it is so short, *ya*?
S1: And the head.

By referencing an activity that is familiar to students, swimming, the teacher provided a concrete reference point for the abstract concept of refraction. This approach reflects Lin's (2016, cited in Richards & Pun, 2022) emphasis on experiential scaffolding, where teachers link new scientific concepts to learners' lived experiences to support meaning-making. In EMI contexts where linguistic barriers can impede comprehension, such experiential anchors become even more critical for helping students grasp abstract ideas. This strategy also demonstrates how effective EMI instruction involves more than language support—it requires culturally responsive pedagogy that draws on students' contextual knowledge and experiences.

Modeling and Encouraging Student English Output

The teacher reported making deliberate efforts to use English consistently throughout lessons to provide maximum language input and model proper usage. When asked how she encouraged students to speak English, she stated,

> *"The way I do it is by speaking English. I always make sure to ask and answer in English, so at least they know that I do not use Indonesian."*

She further explained her commitment to the school's language policy: "Actually my hope is to follow the rules in the school, full English." This suggests that her consistent English use was both a personal commitment and an institutional expectation, aligning with research showing that EMI implementation is shaped by how closely teachers' enacted practices align with institutional language policies and expectations (Orduna-Nocito & Sánchez-García, 2022). To support her English use, the teacher reported engaging in preparation before teaching,

> *"I use a pronunciation app. Before teaching, I always practiced first. For example, words like organ—it's written as organ, but the pronunciation is different."*

This preparation demonstrates the adaptive practices commonly reported in EMI teaching (Yang et al., 2024), where subject-specialist teachers invest additional effort in developing their own linguistic competence to better serve as language models. Such self-directed professional development, though not formally recognized, represents a significant hidden labor in EMI contexts. Additionally, the teacher employed direct but gentle correction when students mixed languages or made errors. The following interaction illustrates her approach:

Exchange 4.

S: Bu, capek
T: English please.
S: I'm tired, bu. Can I...

The phrase "English please" functioned as a brief, non-threatening reminder that elicited immediate self-correction from the student. The student was able to produce the correct English version without additional support, confirming that the code-mixing was habitual rather than caused by linguistic gaps. This gentle prompting strategy helps establish English use as the classroom norm while maintaining a supportive learning environment. The teacher also emphasized the importance of requiring English output in both oral and written forms:

> *"When I explain fully in English and they ask questions and then write it again in their notebooks or answer worksheets, it works. Especially with workbook questions that are long, like definitions, they have to retell it or show their understanding in their own words. That process really works."*

Analysis of student workbooks and worksheets confirmed this emphasis on written output: assignments required students to write definitions, explanations, and responses in complete English sentences rather than simply filling in single-word answers. This pedagogical choice reflects recent research emphasizing that productive language use, particularly writing that requires reformulation and synthesis of scientific concepts is essential for developing both content understanding and academic English proficiency in EMI science classrooms (Pun et al., 2025).

Strategic and Principled Use of L1

To manage L1 use while maintaining an English-rich environment, the teacher adopted a nuanced approach that balanced institutional expectations with pedagogical responsiveness. She reflected:

> "I really try to avoid giving explanations (in Indonesian). If I use Indonesian, it's only for translation. So, for example, with reflection and refraction, just *pemantulan* and *pembiasan*, That's it. But for the explanation, I prefer saying 'when the light bends' rather than '*ketika sinarnya…*"

This statement reveals a deliberate strategy: rather than explaining new concepts fully in Indonesian, the teacher provided only brief Indonesian equivalents of key terms and then delivered conceptual explanations in English. This approach was evident in classroom practice:

Exchange 5.

T: Okay, today we are going to learn about reflection. Have you ever heard this term? *(writes "Reflection" on the board)* What does it mean? Reflection can be scientific or non-scientific.
SS: Pemantulan
T: *Pemantulan.* Okay, good. In Indonesian, reflection means *pemantulan*. What does *mantul* mean? Remember: reflection is when light hits an opaque object. An opaque object does not let light pass through, so the light bounces back—*memantul*.

In the interaction excerpt above, the teacher introduced reflection in English and elicited students' prior knowledge. When students answered with the Indonesian term pemantulan, she briefly validated it and then continued the conceptual explanation in English, using Indonesian only to clarify *mantul/memantul*. This demonstrates what Macaro (2018) terms

"principled L1 use"—selective, purposeful deployment of L1 to support comprehension while preserving English as the dominant instructional language. Importantly, the teacher also used L1 responsively to support individual students experiencing difficulty, rather than switching languages for the entire class:

> *"So, my strategy is that I have to translate it, but I try not to explain it in front of the whole class. When there is a student who does not understand, I approach them and switch to Indonesian only with that student, not with everyone."*

This individualized support strategy was observable in classroom interaction:

Exchange 6.

T: So, if it's glass to glass like this, right? But if it's glass to water, it becomes different—different from the usual. Do you get it? Umm… how should I explain this? I'll speak in Bahasa for a moment: *jadi mulai dari yang lebih rapat ke yang kurang rapat, jadi bisa lebih cepat*. So "faster" means—normally it goes like this, then continues to here. Okay? This is faster. For example, here it is smaller because light travels from air to glass—does it slow down or get faster?

S: (xxx)

T: Okay, correct.

The teacher first attempted to explain in English, then provided a brief Indonesian clarification when she perceived student confusion, and immediately returned to English for follow-up questioning. This responsive switch aligns with EMI research showing that translanguaging often occurs naturally and moment-by-moment as an interactional resource for meaning-making (Jiang & Zhang, 2023). Rather than unrestricted fluid language use, the teacher employed Indonesian briefly and strategically for clarification, while maintaining English as the primary instructional medium—a pattern also observed in EMI classrooms where translanguaging occurs naturally but is actively regulated by (Abouzeid et al., 2025). This balanced approach addresses a widely noted tension in EMI: while English-only expectations are often justified through the belief that maximal English exposure will improve proficiency, classroom learning also requires comprehension support and meaningful engagement, not exposure alone (Curle et al., 2020; Sah, 2025). By limiting L1 use to brief translations and individual support, the teacher created a linguistic environment that prioritized English input and output while providing comprehension scaffolds when necessary. This nuanced practice challenges both English-only ideologies and unrestricted translanguaging approaches, suggesting instead a middle path appropriate for primary EMI contexts where students are still developing both linguistic systems.

The findings collectively demonstrate that effective EMI implementation at the primary level requires more than linguistic competence. It demands flexible, responsive pedagogy that integrates language support into content teaching. The challenges identified, unfamiliar scientific terminology, cognate confusion, difficulty explaining abstract concepts, and pervasive L1 influence were not isolated issues but interconnected manifestations of the fundamental tension in EMI: learning challenging content through a developing linguistic medium.

The teacher's strategies responded to this complexity through a coherent pedagogical approach: systematic vocabulary scaffolding provided linguistic access; experiential connections made abstract concepts concrete; consistent modeling and output requirements

created opportunities for language development; and principled L1 use supported comprehension without displacing English. Together, these strategies illustrate how content learning and language development can be jointly supported in primary EMI science classrooms, contributing to the limited body of research on primary-level EMI implementation and offering practical insights for teachers navigating similar contexts.

D. CONCLUSION

This study examined the challenges and instructional strategies involved in implementing English as a Medium of Instruction (EMI) in a primary science classroom within an Islamic-based school context. The findings demonstrate that EMI implementation at the primary level presents complex pedagogical challenges, particularly in explaining abstract scientific concepts through English, managing unfamiliar scientific terminology, and addressing the strong influence of students' first language on classroom interaction. These challenges were not merely linguistic but were deeply intertwined with conceptual understanding and classroom communication practices. Despite these constraints, the study reveals that effective EMI instruction is achievable through adaptive and interaction-sensitive pedagogy. The teacher employed a range of scaffolding strategies, including pre-teaching and repetition of key vocabulary, connecting scientific concepts to students' everyday experiences, consistent English modelling, and encouraging student oral and written output. Importantly, Indonesian was used selectively and strategically to clarify key terms and support individual learners without displacing English as the dominant instructional language. This principled use of L1 functioned as a pedagogical scaffold rather than a replacement for English instruction.

Several limitations of this study should be acknowledged. The research was designed as a single-case qualitative study situated in one classroom with one teacher, which restricts the transferability of the findings to broader EMI contexts. Moreover, the limited participant pool and concentration on a single subject area may not adequately represent the diversity of EMI practices across institutions and curricula. Overall, the findings suggest that successful EMI implementation in primary science classrooms depends less on rigid English-only policies and more on teachers' ability to flexibly integrate language support into content teaching. This study contributes to the limited body of research on primary-level EMI by highlighting how classroom interaction, vocabulary work, and strategic language choices shape meaningful learning experiences. Future studies may address these limitations by examining multiple settings, including learners' perspectives, and employing mixed methods designs to better understand the effects of EMI strategies on content learning and language development.

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