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Navigating linguistic transitions: Pre-service science and math teachers' perspectives on English as a medium of instruction in professional preparation

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Abstract

This study explores the perceptions of pre-service science and mathematics teachers on the effectiveness of studying in English, despite the necessity of teaching these subjects in Arabic. The central concern is the linguistic and pedagogical challenges in bilingual education systems. Using a quantitative research design, data were collected through a validated questionnaire administered to 52 participants in Oman, examining differences by gender and specialization. The instrument assessed academic competence, specialized skills, and teaching practices across lesson planning, delivery, and evaluation stages. Findings indicated positive perceptions of English as a medium of instruction (EMI), particularly in accessing international resources and enhancing professional competencies. Science teachers rated EMI more favorably than mathematics teachers, reflecting the universal nature of scientific terminology. However, challenges were evident, such as difficulties in transferring EMI-acquired knowledge into Arabic, especially for lesson planning and assessment. While no significant gender differences were found within groups, females rated EMI slightly higher in coeducational contexts. This study adds value to the international literature by addressing an underexplored context in bilingual education–the linguistic transition from EMI to native-language instruction in the Arab world. It highlights the importance of localized strategies like translanguaging and tailored teacher training to bridge linguistic gaps. Future research should assess EMI's long-term impacts on teaching efficacy and student outcomes, ensuring alignment with bilingual education policies.

Keywords: English as a medium of Instruction, bilingual education, pre-service science teachers, teaching performance, translanguaging

INTRODUCTION

The effective teaching of science and mathematics in schools (KG-12) requires teachers to grasp core concepts and communicate them in practical, accessible ways. The language of instruction plays a pivotal role in ensuring student understanding, making it essential for teacher training institutions to produce educators who are adept at using the target language in the classroom. This importance is magnified in multilingual educational systems, where teachers must navigate linguistic transitions and adapt instructional methods to meet diverse language needs. In the Sultanate of Oman, mathematics and science are taught in Arabic, the mother tongue (MT) of teachers and students; however, pre-service science and mathematics teachers at Sultan Qaboos University (SQU) receive their undergraduate training in English. This linguistic duality significantly impacts both the teachers and their prospective students, raising questions about the effectiveness of such an approach and its implications for science and mathematics education in Oman and comparable multilingual contexts globally.

Over the past decade, Oman has implemented major educational reforms to improve science and math curricula. For instance, in 2017, the Ministry of Education partnered with Cambridge University Press to create new curricula based on international standards

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Contribution to the literature

- This work contributes to the broader discourse on bilingual and multilingual education by presenting quantitative evidence from a non-native English context.
- Additionally, it offers unique insights into gender and disciplinary differences in perceptions of EMI.
- It enriches the understanding of how language policies influence teacher education outcomes.

and translated into Arabic, aiming to address low performance in assessments such as trends in international mathematics and science study (TIMSS) (Cambridge University Press and Assessment, 2022; The Educational Council, 2018). Despite these efforts, Oman ranked 30th out of 64 countries in TIMSS 2019, with a science score of 457 compared to the international average of 500. Research links this underperformance to difficulties in

(a) applying knowledge,

(b) understanding shapes and graphs, and

(c) connecting concepts to real-world phenomena (Shahat et al., 2022).

While curriculum reforms have aligned with Oman vision 2040's global competitiveness goals (Oman Educational Portal, 2020), their success heavily depends on effective teaching, which is intertwined with linguistic competence (Neumann et al., 2012).

Globally, English as a medium of instruction (EMI) has been adopted in teacher preparation programs to enhance access to international academic resources and improve global competitiveness. EMI is particularly prevalent in higher education institutions in non-English-speaking countries, where it is seen as a means to provide students with linguistic and professional advantages (Wilkinson, 2012; Zhang & Pladevall-Ballester, 2021). However, studies highlight both the benefits and challenges of EMI. For example, Lasagabaster and Doiz (2021) report that EMI enables students to access cutting-edge research and international resources, yet Margić and Vodopija-Krstonović (2018) observe that insufficient academic language proficiency can hinder comprehension and effective classroom communication. These findings reflect a global tension between the promise of EMI and the practical challenges it presents, particularly in contexts where students and teachers must transition back to their MT for practical application.

In Oman, this linguistic divide creates unique challenges for pre-service teachers. While EMI broadens their academic horizons and enhances their professional competencies, many report difficulties in transferring EMI-acquired knowledge into Arabic, particularly during lesson planning and assessment. These challenges are consistent with findings from other bilingual and multilingual educational contexts, such as Malaysia and the United Arab Emirates, where similar linguistic transitions affect teaching efficacy (Alhamami, 2015; Amin & Badreddine, 2019). Translanguaging, code-switching, and localized terminology development have been proposed as strategies to address these challenges, yet their implementation remains uneven and context-specific.

Given this global context, this study focuses on exploring science and mathematics student-teachers' attitudes toward using English in their preparation programs. By examining their perceptions, the study seeks to contribute to the international discourse on bilingual education and teacher preparation. Specifically, it aims to address how exposure to EMI influences the ability of pre-service teachers to teach effectively in their MT, and what implications this has for broader teacher education practices. This study aspires to provide theoretical insights and practical recommendations for multilingual contexts beyond Oman by situating the findings within the global literature on teaching and teacher education.

LITERATURE REVIEW

Science and mathematics teaching relies heavily on a teacher's ability to comprehend and convey complex concepts effectively. Communication, facilitated through language, is critical for building students' understanding of scientific and mathematical ideas. Language serves as a medium for imparting knowledge and as a tool for creating networks of ideas and establishing meaningful connections between concepts (Lasagabaster & Doiz, 2021). The role of language in education is particularly significant in science and mathematics, as these subjects often involve abstract and technical terms that require precise communication. Essien (2010) emphasizes the importance of developing subject-specific terminology in indigenous languages to facilitate understanding in multilingual classrooms. Furthermore, Kazima (2008) discusses the challenges of translating mathematical and scientific terminology into the MT, highlighting the need for precise language to convey abstract concepts effectively. This underscores that effective teaching in these disciplines necessitates a strong grasp of the subject matter and the ability to communicate it with linguistic accuracy.

English as a Medium of Instruction

The adoption of EMI has been widespread in non-English-speaking countries, particularly in higher education. EMI refers to the practice of teaching academic content in English to students who speak English as a second or additional language (Guo et al., 2024). Globally, EMI has been adopted in diverse contexts, driven by factors such as globalization, internationalization, and the increasing dominance of English as a lingua franca in academia and industry.

In Oman, EMI is a critical component of teacher preparation programs at SQU. These programs aim to enhance the linguistic and academic competencies of pre-service teachers by exposing them to English-based resources and methodologies. Wilkinson (2012) and Dimova and Kling (2018) highlight that EMI fosters positive attitudes toward learning by enabling students to engage with cutting-edge academic materials. Additionally, Zhang and Pladevall-Ballester (2021) argue that EMI enhances students' disciplinary knowledge while simultaneously improving their English proficiency. This dual benefit equips pre-service teachers with the skills to access international research and resources, contributing to their professional development. However, despite these advantages, EMI poses several challenges. Margić and Vodopija-Krstonović (2018) report that limited English proficiency among teachers can hinder comprehension and effective communication in the classroom. Similarly, Tong and Shi (2011) observe that students in EMI programs often struggle with understanding lectures and completing assignments, which places additional pressure on teachers to simplify complex content and navigate linguistic limitations.

In the Omani context, these challenges are compounded by the requirement for pre-service teachers to transition from English-based training to Arabic-based teaching during their practicum and professional careers. Studies by Amin and Badreddine (2019) and Alhamami (2015) emphasize that this linguistic transition creates significant pedagogical and cognitive challenges for educators. Translanguaging and code-switching have been proposed as strategies to bridge linguistic gaps in multilingual classrooms. Mazak (2016) describes translanguaging as a dynamic approach that allows teachers to draw on their entire linguistic repertoire to enhance comprehension and engagement. This approach is particularly effective in science and mathematics classrooms, where abstract terms and technical vocabulary often pose challenges (Kazima, 2008). However, Mabule (2015) cautions that the success of these strategies depends on the teacher's ability to balance multiple languages effectively, which requires targeted training and support.

Mother Tongue as a Medium of Instruction

The use of the mother tongue as the medium of instruction (MTMI) has long been advocated as an effective approach to teaching, particularly in primary education. Research indicates that using students' native language in the classroom enhances comprehension, engagement, and academic performance (Makonye, 2015; Nkonde et al., 2018). Teaching science and mathematics in the MT allows students to build on their existing linguistic and cultural knowledge. For example, studies by Kazima (2008) and Nkonde et al. (2018) demonstrate that MT instruction facilitates students' understanding of mathematical concepts and reduces reliance on rote memorization. By using familiar language, teachers can explain abstract ideas more effectively, enabling students to grasp complex concepts with greater ease.

Despite its benefits, MTMI faces several challenges, particularly in contexts where the MT is not widely used in higher education or professional settings. Margić and Vodopija-Krstonović (2018) found that teachers often lack formal training in using the MTMI, which can negatively impact classroom interaction and content delivery. Additionally, the use of MTMI may limit students' exposure to global academic resources, particularly in disciplines like science and mathematics, where English dominates as the language of research and innovation (Wilkinson, 2012). This raises questions about the long-term implications of MTMI for students' academic and professional trajectories.

Theoretical Framework: Social Constructivist Theory

This study is framed within social constructivist theory (SCT), which highlights the importance of language, culture, and social interaction in the learning process. SCT posits that knowledge is co-constructed through dialogue and collaboration with peers, instructors, or experts (Kumar Shah, 2019). In the context of bilingual education, SCT underscores the need for effective communication to scaffold learning and build students' understanding of abstract concepts. According to van de Pol et al. (2010), teachers play a critical role in facilitating this process by creating linguistic and cultural bridges that enable students to connect their prior knowledge with new information.

By grounding this study in SCT, the research seeks to illuminate the complex interplay between language, pedagogy, and student learning in multilingual contexts. It aims to provide insights into how teacher preparation programs can equip educators with the skills needed to navigate these challenges, thereby enhancing teaching and learning outcomes in science and mathematics education.

Aims and Research Questions

This study aims to explore the perceptions and experiences of pre-service science and mathematics teachers regarding the use of EMI during their undergraduate preparation programs. Specifically, it examines how these perceptions influence their ability to teach effectively in Arabic and identify the linguistic and

Table 1. Breakdown of specialization and gender in the sample

Gender	Specialization	Total
Male (n = 27)	Mathematics	4
	Physics	4
	Chemistry	9
	Biology	10
Female (n = 25)	Mathematics	2
	Physics	4
	Chemistry	13
	Biology	6

pedagogical challenges they face in transitioning between English and Arabic. The study contributes to the international discourse on bilingual education and teacher preparation by addressing these issues, offering insights into how similar challenges can be addressed globally.

To achieve these aims, the study addressed the following research questions (RQs):

1. What are the perceptions of pre-service mathematics and science teachers regarding the academic and specialized skills gained through studying in English?
2. How do pre-service mathematics and science teachers perceive the impact of EMI on their teaching practices, particularly in Arabic-based classroom settings?
3. Are there statistically significant differences in perceptions based on gender regarding the effectiveness of EMI in teacher preparation programs?
4. Are there statistically significant gender differences for mathematics and science student teachers combined regarding their perceptions of EMI and its impact on their professional competencies?

METHODOLOGY

Design

This study employed a quantitative research design to investigate the perceptions and viewpoints of pre-service science and mathematics teachers regarding the impact of studying in English on their teaching performance in Arabic. The research aims to determine whether these perceptions vary based on gender and field of specialization. The following sections outline the methodology adopted for this study: participants, instruments, data collection procedures, data analysis techniques, and ethical considerations.

Participants

The study employed a stratified random sampling method to ensure representation across different specializations and genders. The sample included science and mathematics pre-service teachers from SQU. A total of 52 pre-service students participated in the study. **Table 1** provides a detailed breakdown of the participants according to gender and specialization.

The study obtained ethical clearance from the Institutional Review Board at SQU. This approval ensured compliance with all ethical guidelines governing research involving human subjects. These guidelines are designed to protect the rights, dignity, and well-being of participants throughout the study. The recruitment of participants was facilitated through collaboration with faculty members in the college of education at SQU. Faculty members helped identify potential participants who met the inclusion criteria for the study. An invitation letter was distributed to prospective participants, explaining the purpose of the study, the procedures involved, and the voluntary nature of participation. This communication ensured transparency and encouraged informed participation, which was a critical aspect of this study. All participants received a consent form that clearly outlined their rights, including confidentiality, anonymity, and the option to withdraw from the study at any time without facing any penalty. The consent form also detailed the study's objectives, the procedures involved, and the intended uses of the collected data. Participants were required to review and sign the consent form before completing the questionnaire, ensuring that they fully understood their role in the study and their rights as participants. This process emphasized the ethical commitment of the research team to uphold the highest standards of research integrity.

Instrument

The study questionnaire was meticulously designed based on the theoretical framework, insights from previous studies, and the study's problem, questions, and objectives. The initial version of the instrument is included in **Appendix A**. The questionnaire is divided into two main sections. The first section gathers general information such as gender (male, female) and specialization (mathematics, physics, chemistry, and biology).

The second section of the questionnaire was designed to assess the study's primary variables across two dimensions. The first dimension, academic competence and specialized skills, comprises 10 items aimed at measuring each participant's expertise and abilities in their field. The second dimension focuses on teaching practices, which is further divided into three specific areas: lesson planning (10 items), lesson presentation (14 items), and evaluation (8 items). Overall, the questionnaire includes 42 items, comprehensively evaluating the study variables.

Table 2. Perceptions of academic competency among mathematics students

Item no	Rank	Statement	M	SD	Agreement level
3	1	Helped me master and better understand the subject matter.	3.17	0.408	Agree
10	2	Increased my chances of employment in the private sector, such as in bilingual schools.	3.00	0.894	Agree
5	10	Assisted me in accessing knowledge from multilingual sources.	1.83	0.753	Disagree

To measure responses, the questionnaire utilized a four-point Likert scale. Participants rated each item according to their level of agreement: strongly agree, agree, disagree, and strongly disagree, with scores assigned as 4, 3, 2, and 1, respectively. A judgment criterion was also developed to interpret the results based on the Likert scale. Calculating the range (4 - 1 = 3) and class interval length (3 ÷ 4 = 0.75) allowed for the categorization of responses into four levels of agreement. Responses ranging from 1.00 to 1.74 indicated "strongly disagree," 1.75 to 2.49 indicated "disagree," 2.50 to 3.24 indicated "agree," and 3.25 to 4.00 indicated "strongly agree."

The questionnaire was subjected to validation processes to ensure its reliability and relevance. Expert reviews were conducted to assess content validity, and pilot testing was conducted to establish reliability. The pilot study involved administering the questionnaire to a sample similar to the study participants and analyzing the data for internal consistency using statistical measures such as Cronbach's alpha.

This structured and validated instrument should ensure the accurate collection of data that are aligned with the objectives of the study. The questionnaire's internal consistency was evaluated with a sample of 30 participants, confirming significant item correlations across all axes. For academic competence and specialized skills, correlations ranged from 0.34 to 0.88. The teaching practices axis showed correlations across all three domains: lesson planning (0.27-0.74), lesson presentation (0.12-0.48), and evaluation (0.12-0.78), all significant at 0.05.

Factor analysis identified four factors aligning with the study dimensions that explained 80.01% of the total variance: academic competence and specialized skills (30.66%), lesson planning (19.46%), lesson presentation (16.43%), and evaluation (13.46%). The KMO measure was 0.875, and Bartlett's test was significant ($p < 0.001$), confirming sample adequacy and the robustness of the questionnaire structure (Field, 2009).

Cronbach's Alpha values were used to determine the reliability of the questionnaire and found to be acceptable: for academic competence Cronbach's Alpha was 0.69, for lesson planning 0.68, for lesson presentation 0.77, and for evaluation 0.73. The overall reliability was 0.72, demonstrating the instrument's overall robustness and reliability (Field, 2009).

Data Analysis

The study used the statistical package for the social sciences version 25 to analyze the data collected. Descriptive statistics, including means (M), standard deviations (SDs), and percentages, were calculated to summarize responses and rank agreement levels for RQ1 and RQ2. Inferential statistics, specifically independent sample t-tests, were conducted to examine differences in perceptions based on gender and specialization for RQ3, RQ4, and RQ5. Cronbach's alpha coefficients and correlation analyses were used to assess the reliability and internal consistency of the questionnaire. This comprehensive approach ensured accurate and meaningful analysis of participants' perceptions.

RESULTS

Perceptions of Academic Proficiency and Specialized Skills (Response to RQ1)

The perceptions of mathematics and science student teachers regarding their academic proficiency and specialized skills gained through studying in English revealed key differences between the two groups. To provide a more in-depth analysis of these findings, the discussion section will interpret these results within the broader constructs of academic competency, linguistic adaptability, and professional preparedness rather than relying solely on individual item scores.

For mathematics student teachers, the overall mean score was 2.57 (SD = 0.27), indicating students mostly *Agree* with the statements (**Table 2**). Their highest-rated item, *'helped me master and better understand the subject matter'* (M = 3.17, SD = 0.408), reflects a strong perception of academic competency developed through EMI. This suggests that mathematics students find EMI beneficial for grasping core mathematical concepts, likely due to the standardized nature of mathematical symbols and formulas across languages. However, their lowest-rated item, *'assisted me in accessing knowledge from multilingual sources'* (M = 1.83, SD = 0.753), which was rated at the *disagree* level, highlights challenges in linguistic adaptability and the ability to leverage EMI for academic resource accessibility. This implies that while mathematics students gain disciplinary content mastery, they may struggle to effectively engage with diverse linguistic sources for further academic development. Rather than fully engaging with multilingual sources, they may primarily be translating content without deep

Table 3. Perceptions of academic competency among science students

Item no	Rank	Statement	M	SD	Agreement level
5	1	Assisted me in accessing knowledge from multilingual sources.	3.17	0.709	Agree
8	2	Provided an opportunity to expand my research and resources.	3.13	0.718	Agree
3	10	Helped me master and better understand the subject matter.	2.30	0.813	Disagree

comprehension or meaningful integration into their learning processes.

In contrast, science student teachers demonstrated a slightly more favorable overall perception, with an overall mean score of 2.75 (SD = 0.37), also at the *agree* level (**Table 3**). Unlike mathematics students, the highest-rated item for science students was *'assisted me in accessing knowledge from multilingual sources'* (M = 3.17, SD = 0.709), followed closely by *'provided an opportunity to expand my research and resources'* (M = 3.13, SD = 0.718). These results indicate that science students perceive EMI as a way to improve their access to international knowledge and broadening their academic scope, which aligns with research highlighting the global nature of scientific literature (Lasagabaster & Doiz, 2021). However, their lowest-rated item, *'helped me master and better understand the subject matter'* (M = 2.30, SD = 0.813), suggests that EMI might not have significantly enhanced their academic competency at a conceptual level. This finding implies that while science students excel in linguistic adaptability–using EMI to access global knowledge–they may require additional instructional support to strengthen disciplinary understanding through EMI.

If we compare the two groups, science students consistently rated their academic proficiency higher than mathematics students; the overall mean score for science students (2.75, SD = 0.376) was higher than that of mathematics students (2.57, SD = 0.273). However, these findings are better understood within the following three broader constructs:

1. Academic competency: Mathematics students place greater emphasis on EMI's role in concept mastery, suggesting that they benefit more from EMI when it enhances subject-specific knowledge. Conversely, science students seem to experience more challenges in deepening their understanding of scientific concepts through EMI, which may be due to the abstract and language-heavy nature of science education compared to the formulaic nature of mathematics.
2. Linguistic adaptability: Science students exhibit stronger linguistic adaptability, as evidenced by their high ratings of EMI's role in accessing multilingual resources and expanding research opportunities. This suggests that they see EMI as an avenue for engaging with global knowledge, which is essential in science disciplines that rely heavily on international research and publications. Mathematics students, however, rated this aspect lower, indicating that EMI may be less useful in facilitating their engagement with multilingual scientific discourse.
3. Professional preparedness: Science students' stronger perception of EMI as a means to expand research opportunities suggests a broader view of EMI as a tool for long-term career development. Mathematics students, on the other hand, appear to associate EMI primarily with subject mastery rather than career or research expansion, highlighting a potential gap in how EMI supports professional preparedness across disciplines.

Table 4. Comparison of academic competency perceptions across groups

Role	Specialization	M	SD	Agreement level
Students	Science	2.75	0.376	Agree
Students	Mathematics	2.57	0.273	Agree

These trends, summarized in **Table 4**, underscore the need for tailored EMI strategies to address the unique academic and linguistic needs of both groups. The findings suggest that mathematics students may require additional support in leveraging EMI for global research access, while science students may need enhanced instructional strategies to strengthen subject mastery in English. Ensuring that EMI benefits are equitably distributed across disciplines requires a balanced instructional approach that enhances both content mastery and global research engagement.

Perceptions of the Impact of Studying in English on Lesson Planning Practices (Response to RQ2)

Mathematics and science student teachers' perceptions of the impact of studying in English on their teaching practices revealed notable trends across three broader constructs: pedagogical adaptability, linguistic flexibility, and assessment integration. These constructs provide a more comprehensive framework for analyzing how EMI influences lesson planning, lesson delivery, and assessment, beyond the reliance on individual survey items and mean values.

Lesson planning and pedagogical adaptability

In the lesson planning domain, mathematics students reported a mean score of 2.88 (SD = 0.43), reflecting a moderate agreement level regarding EMI's impact. Their highest-rated statement, *'I frequently mix Arabic and English when writing equations, numbers, and mathematical expressions in lesson plans'* (M = 3.33, SD = 0.516, **Table 5**), indicates a strong reliance on linguistic flexibility, where

Table 5. Perceptions of lesson planning practices among mathematics students

Item no	Rank	Statement	M	SD	Agreement level
3	1	I often integrate Arabic and English in writing equations, numbers, and mathematical expressions while planning lessons.	3.33	0.516	Strongly agree
5	10	I can reconcile the knowledge I studied in English with the content I plan to teach in Arabic.	2.50	0.548	Agree

Table 6. Perceptions of lesson planning practices among science students

Item no	Rank	Statement	M	SD	Agreement level
3	1	I often integrate Arabic and English in writing equations, numbers, and mathematical expressions while planning lessons.	3.11	0.767	Agree
2	10	Studying science/mathematics in English weakened my ability to prepare creative plans in Arabic.	2.39	0.856	Disagree

Table 7. Perceptions of lesson delivery practices across groups

Item no	Rank	Statement	M	SD	Agreement level
7	1	I believe studying the specialization in Arabic significantly aids in delivering scientific knowledge more clearly.	3.33	3.33	Strongly agree
10	14	There is no negative relationship between studying science and mathematics in English and teaching them in Arabic in schools.	2.00	2.59	Disagree

translanguaging serves as a practical tool for integrating EMI knowledge with Arabic instruction. This finding aligns with studies emphasizing code-switching as a coping mechanism for language barriers in bilingual classrooms (Chikiwa & Schäfer, 2014). However, the lowest-rated statement, *'I can align the information I studied in English with the content I plan to teach in Arabic'* (M = 2.50, SD = 0.548, **Table 5**), highlights challenges in pedagogical adaptability. This suggests that while mathematics students can effectively switch between English and Arabic when incorporating symbols and technical expressions, they struggle to contextualize EMI-based knowledge within an Arabic teaching framework.

As with math students, science students exhibited a slightly lower mean score for the lesson planning domain (M = 2.78, SD = 0.39, **Table 6**) compared to their overall score across all domains, indicating that lesson planning posed greater challenges relative to other aspects of instruction. Also similar was science students highest-rated item, *'I often integrate Arabic and English in writing equations, numbers, and mathematical expressions while planning lessons'* (M = 3.11, SD = 0.767, **Table 6**), which reinforces the role of linguistic flexibility in structuring lesson plans. However, science students' lowest-rated item, *'I can reconcile the knowledge I studied in English with the content I plan to teach in Arabic'* (M = 2.39, SD = 0.856, **Table 6**), suggests a difficulty in aligning EMI content with Arabic instruction, though slightly less pronounced than for mathematics students.

These findings suggest that while EMI facilitates access to international knowledge, it does not seamlessly translate into lesson planning for Arabic-medium instruction. Mathematics students seem to struggle more with integrating EMI-acquired content into Arabic, whereas science students appear to leverage EMI more effectively for multilingual knowledge acquisition.

Lesson delivery and linguistic flexibility

In the lesson delivery domain, both mathematics and science student teachers strongly agreed that *'studying the specialization in Arabic significantly aids in delivering scientific knowledge more clearly'* (M = 3.33, SD = 0.76, **Table 7**). This highlights the perceived effectiveness of Arabic for instructional clarity, reinforcing the idea that students and educators feel more confident conveying scientific content in their native language. However, a key challenge in EMI-based lesson delivery is the disconnect between English-medium learning and Arabic-medium teaching. Mathematics students expressed more concern in this area, as seen in their lowest-rated item, *'there is no negative relationship between studying science and mathematics in English and teaching them in Arabic in schools'* (M = 2.00, **Table 7**) received a low rating, indicating that mathematics teachers do, in fact, perceive challenges in transitioning between the two languages. This suggests that the shift between English-medium learning and Arabic-medium teaching is particularly difficult for mathematics educators, likely due to the specialized terminologies and conceptual frameworks unique to the subject.

Science students, while also recognizing the challenges of EMI-to-Arabic transitions, rated this item slightly higher (M = 2.59, **Table 7**). This indicates that while they also experience difficulties, they perceive EMI as less disruptive to their teaching compared to mathematics students. One possible explanation for this difference is that scientific terminology is more standardized internationally, whereas mathematical instruction often incorporates localized problem-solving

Table 8. Perceptions of assessment practices across groups

Item no	Rank	Statement	Mathematics (M)	Science (M)	Agreement level
6	1	I believe studying scientific content in Arabic helps diversify the assessment methods used.	2.50	3.20	Agree

approaches that may not align well with EMI-based training (Nkonde et al., 2018).

Overall, the results suggest that while EMI expands knowledge, it does not necessarily enhance instructional clarity, leading to a reliance on Arabic for effective content delivery. This reinforces the importance of bilingual instructional strategies to support EMI-trained teachers in Arabic-dominant classrooms.

Assessment integration and instructional alignment

In the assessment domain, mathematics students reported an overall mean score of 2.33 (SD = 0.06), indicating a lower perception of EMI's impact on assessment practices. In contrast, science students rated this domain more positively, with an overall mean score of 2.65 (SD = 0.38), suggesting that science assessments may be more adaptable to EMI-acquired knowledge (**Table 8**).

The highest-rated statement in this category, *'I believe studying scientific content in Arabic helps diversify the assessment methods used'*, was rated at M = 3.20 by science students and M = 2.50 by mathematics students (**Table 8**). This suggests that science students perceive Arabic instruction as a tool that enables flexible and diverse assessment approaches, possibly because science assessments often involve conceptual explanations, research-based responses, and practical applications, which may allow for more flexible creation of assessments using different languages.

Mathematics students, however, rated the same item lower, reinforcing the idea that mathematical assessment is more rigidly tied to the language in which it is learned. The complexity of translating mathematical concepts into Arabic-based problem-solving assessments could explain why mathematics students view EMI as less beneficial for assessment design.

These findings suggest that while EMI exposure enhances access to international assessment strategies, its effectiveness depends on the linguistic and disciplinary characteristics of the subject. Mathematics students require more structured support in developing Arabic-based assessments that align with EMI training, as mathematical concepts often rely on precise symbolic representation and problem-solving methods that may not directly translate between languages. In contrast, science students may benefit from enhancing their ability to apply EMI-acquired knowledge in Arabic evaluation frameworks, as scientific assessments typically involve more descriptive explanations, experimental analysis, and reasoning that require fluency in both scientific terminology and instructional language.

Table 9. t-test results for science students' perceptions by gender

Gender	M	SD	t-value	Significance level
Male	2.76	0.25	-0.27	0.562
Female	2.79	0.27		

Gender-Based Differences in Perceptions of the Effectiveness of Studying in English (Response to RQ3)

To determine whether statistically significant gender differences existed in student teachers' perceptions of the effectiveness of studying in English, t-tests were conducted separately for science and mathematics students. While descriptive statistics indicate that female students had slightly higher mean scores than male students in both groups, the statistical analysis revealed that these differences were not significant. As with earlier RQs, to provide a more in-depth understanding of these findings, the results will be interpreted in the discussion section within three broader constructs.

Gender differences in science students' perceptions

For science students, the mean perception of female students (M = 2.79, SD = 0.27) was slightly higher than that of male students (M = 2.76, SD = 0.25), as shown in **Table 9**. However, the t-test results (T = -0.27, p = 0.562) indicate that this difference was not statistically significant. The p-value exceeds the 0.05 significance threshold, meaning that gender did not influence science student teachers' perceptions of the effectiveness of studying in English.

This suggests that science students, regardless of gender, perceive EMI in a similar way, reinforcing the idea that their experiences are shaped more by the subject matter and instructional context than by gender. The lack of significant differences could be attributed to the universal nature of scientific terminology, which minimizes gender-related disparities in content comprehension and application. This aligns with previous research suggesting that science instruction in EMI settings is less influenced by gender-specific learning preferences due to the standardized nature of scientific discourse (Dafouz & Camacho-Miñano, 2016).

Gender differences in mathematics students' perceptions

For mathematics students, female participants also reported slightly higher mean perceptions (M = 2.80, SD

Table 10. t-test results for mathematics students' perceptions by gender

Gender	M	SD	t-value	Significance level
Male	2.54	0.21	-1.39	0.893
Female	2.80	0.23		

Table 11. Gender-based differences in EMI perceptions

Gender	M	SD	t-value	p-value
Male	2.72	0.23	-0.19	0.048
Female	2.73	0.28	-	-

Note. The t-test result indicates a statistically significant difference between male and female students' perceptions of EMI ($p < 0.05$)

= 0.23) compared to their male counterparts (M = 2.54, SD = 0.21), as detailed in **Table 10**. Despite this observed difference, t-test results (T = -1.39, p = 0.893) indicate that the difference was not statistically significant.

As with science students these findings suggest that gender does not play a critical role in shaping mathematics students' perceptions of EMI effectiveness. However, the slightly higher ratings from female math and science students may reflect greater linguistic adaptability, as studies suggest that female students often demonstrate higher engagement with multilingual learning contexts and greater openness to EMI-based education (Hahl et al., 2016; van der Worp, 2017). That said, the absence of statistical significance confirms that both male and female mathematics students face similar challenges in adapting EMI content to Arabic-based instruction, indicating that linguistic and pedagogical factors outweigh gender differences in shaping EMI perceptions.

Differences in Perceptions of Studying in English for Mathematics and Science Student Teachers Combined (Response to RQ4)

To examine whether there were statistically significant differences in perceptions of studying in English for mathematics and science student teachers, a combined t-test was conducted for both groups. While a slight difference was observed between male and female students, the findings suggest that subject specialization plays a more dominant role in shaping EMI perceptions than gender alone.

The results revealed that female students reported a marginally more positive mean perception (M = 2.73, SD = 0.28) compared to male students (M = 2.72, SD = 0.23), as shown in **Table 11**. Although this difference was small, the t-test results (t = -0.19, p = 0.048) indicate that the difference was statistically significant. This contrasts with the earlier gender comparison within each discipline (mathematics and science), where no significant differences were found. The significance here emerges when combining both subject groups, suggesting that gender differences in EMI perceptions may be more apparent when viewed across disciplines rather than within them. Since the p-value falls below the 0.05 significance threshold, gender appears to play a limited but noteworthy role in shaping perceptions of EMI.

While female students rated EMI slightly higher, the practical implications of this difference are minimal, as the overall effect size remains small. This suggests that gender-based differences in EMI perceptions are subtle and that disciplinary variations in learning approaches and linguistic demands have a greater influence than gender alone.

DISCUSSION

Regarding the RQ1: Perceptions of EMI in Professional Preparation, the results showed that both science and mathematics participants viewed EMI as a valuable aspect of their professional preparation, albeit with slightly higher ratings from science participants. These findings highlight the recognized advantages of EMI in three key constructs: academic competency, linguistic adaptability, and professional preparedness. These constructs are interrelated, shaping how pre-service teachers perceive and utilize EMI in their academic and teaching practices.

Both groups recognized EMI as instrumental in broadening their access to scientific literature, international research, and professional development opportunities. This aligns with Aguilar and Rodríguez (2012), who argue that EMI enhances students' subject mastery while improving their global academic competitiveness. Similarly, Ball and Lindsay (2013) emphasize EMI's role in equipping learners to participate in international academic and professional contexts. More recent studies reaffirm these benefits, with Guo et al. (2024) highlighting EMI's role in fostering international academic engagement and improving students' access to research beyond their native linguistic constraints. Similarly, Zhang and Pladevall-Ballester (2021) noted that EMI in higher education improves discipline-specific language skills, particularly in STEM fields, where terminology and research output are predominantly in English.

A key consideration in interpreting these findings is the nature of EMI exposure across different disciplines. This study examines how EMI is perceived to support professional preparation rather than assuming it directly enhances the ability to apply subject-specific knowledge in teaching. . Given that participants from different specializations undertake different EMI courses, differences in their reported ease of applying their EMI mediated learning to their teaching in Arabic may be influenced by variations in course design rather than EMI exposure itself.

For example, science participants may find EMI more accessible because scientific terminology and methodologies are internationally standardized, making the transition between English-based and Arabic-based instruction smoother (Costa & Coleman, 2012). In contrast, mathematics participants may experience greater difficulty due to the context-dependent nature of mathematical expressions and the challenge of translating these concepts into Arabic (Kazima, 2008; Nkonde et al., 2018). These findings suggest that perceived differences in the ease of applying EMI-acquired knowledge may be shaped more by disciplinary factors and course content rather than exposure to different EMI courses alone.

Regarding RQ2–Lesson planning: The participants reported that EMI expanded their access to international resources, which they perceived as enriching their lesson planning. This aligns with Ball and Lindsay (2012), who emphasized that EMI broadens educators' access to cutting-edge materials and methodologies. More recent research by Guo et al. (2024) further supports this claim, highlighting how EMI enhances teachers' ability to engage with global educational advancements, ultimately improving curriculum planning and lesson design.

However, despite this advantage, participants noted significant challenges in adapting these resources to Arabic, particularly when striving for creative and contextually relevant lesson plans. This difficulty reflects Bukhari's (2022) findings, which highlight the cognitive burden of integrating content learned in one language into another, especially in contexts requiring localized adaptation. Moreover, research by Lasagabaster and Doiz (2021) reinforces this point, emphasizing that transitioning from EMI-based resources to mother-tongue instruction often leads to difficulties in content transfer, especially when teachers lack formal training in bilingual adaptation strategies.

With regards to RQ2–Lesson delivery: The participants indicated that delivering lessons in Arabic enhanced clarity and student comprehension, particularly when scientific terms were explained in their native language. This supports Al-Bakri's (2017) findings, which observed that teaching in Arabic fosters deeper engagement and understanding in Omani classrooms. More recently, Zhang and Pladevall-Ballester (2021) examined similar outcomes in EMI programs in China and found that while EMI enhances subject-specific understanding, students often struggle with applying knowledge effectively in their first language.

However, the occasional need to use English terms during delivery highlights the participants' reliance on code-switching, a common feature of bilingual instructional settings (Shartiely, 2016). Code-switching serves as a bridge for linguistic gaps, especially when Arabic lacks direct equivalents for technical terms. The challenge of translating technical terms, particularly in mathematics, aligns with the findings from Chikiwa and Schäfer (2014), who advocate for the development of indigenous language registers to enhance conceptual understanding in multilingual contexts.

Addressing RQ2–Assessment: It was found that science participants rated EMI as having a stronger positive impact on assessment practices compared to mathematics participants. This finding reflects Dimova and Kling's (2018) research, which noted that EMI fosters diverse assessment strategies, particularly in science-related disciplines where international benchmarks and methodologies are more prevalent. More recent research by Hu and Wu (2020) supports this claim, suggesting that EMI provides a more structured framework for science assessments, enabling students to engage with standardized international assessment practices.

However, both science and mathematics student-teacher participants reported difficulties translating EMI-acquired knowledge into Arabic assessments. This challenge was also described by Mabule (2015), who highlighted student teachers' linguistic complexities when creating high school-level assessments in a non-native language. Furthermore, Makonye (2015) examined the challenges associated with bilingual assessments in STEM education, noting that the lack of clear language policies in bilingual instruction can lead to inconsistency in how students interpret assessment items.

For RQ3–Gender differences in EMI perceptions: The results revealed no statistically significant gender differences among science or math students' perceptions of EMI, suggesting that both male and female participants gained similar benefits while also experiencing similar challenges. This finding is supported by a study carried out by Dafouz and Camacho-Miñano (2016), who found minimal gender-based differences in EMI contexts, particularly when instructional quality and exposure to EMI are consistent across genders. More recent studies, such as those by Zhang and Pladevall-Ballester (2021), have reinforced this perspective, suggesting that when EMI implementation is structured and well-supported, gender-based differences in perceptions are minimized.

Regarding RQ4–Comparative gender perceptions for the disciplines combined: When science and mathematics participants were combined, a small but statistically significant difference emerged, with females rating EMI slightly higher than males. This finding aligns with Hahl et al. (2016), who reported that female university students perceive EMI more positively due to their higher linguistic adaptability and willingness to engage in multilingual settings. More recent studies, such as those by Yunus and Sukri (2017), further support this claim, suggesting that female students tend to demonstrate greater confidence in multilingual environments, which can influence their overall positive perception of EMI.

The findings of this study highlight the complex interplay between gender, subject matter, and language in EMI contexts. While EMI enhances access to international knowledge and professional opportunities, it also poses significant linguistic and pedagogical challenges, particularly in adapting English-based content to Arabic instruction. Work from Dimova and Kling (2018), suggests that ease of linguistic adaptability in EMI settings is a more significant determinant of success than gender alone, reinforcing the notion that content-specific linguistic factors play a more critical role than demographic variables.

These results underscore the need for further research into subject-specific and gender-based variations in EMI contexts to support more effective instruction in bilingual education systems. Future research should explore whether these perceptual differences persist in different academic disciplines and the extent to which cultural and institutional factors influence gendered attitudes toward EMI. A study by Wilkinson (2012) emphasizes the importance of longitudinal studies to determine how gendered perspectives on EMI evolve over time and across different academic and professional settings. Addressing these issues would provide deeper insights into how EMI can be optimized to ensure equitable learning experiences for all students, regardless of gender or field of study.

CONCLUSION

This study has explored the perceptions of pre-service science and mathematics teachers regarding the use of EMI and its impact on their ability to teach effectively in Arabic. The findings highlight the dual benefits of EMI in providing access to international resources and enhancing professional competences, while also revealing significant linguistic and pedagogical challenges in transitioning to Arabic-based instruction. By situating these results within the broader global discourse on bilingual education, this research contributes valuable insights into the design and implementation of teacher preparation programs in multilingual contexts.

The results emphasize the importance of equipping educators with the tools and strategies needed to navigate the complexities of bilingual teaching environments. Specifically, targeted training in translanguaging, the development of localized terminology, and professional development in bilingual pedagogy are critical for supporting pre-service teachers. Additionally, fostering confidence in using the MT and creating resources that bridge the gap between English-based training and Arabic-based teaching are essential for improving teaching efficacy and student outcomes.

Ultimately, this study highlights the need for educational institutions to adopt a balanced approach that leverages the strengths of EMI while addressing its challenges. By doing so, teacher preparation programs can better align with the linguistic and cultural realities of multilingual education systems, ensuring that future educators are equipped to meet the demands of their profession.

Implications for Teaching Science and Mathematics

The findings of this study have several implications for teaching science and mathematics, particularly in multilingual educational systems. A balanced approach to teacher preparation is necessary to ensure that EMI enhances student learning while minimizing linguistic barriers. Bilingual pedagogical strategies, such as translanguaging and code-switching, should be integrated into teacher training programs to equip educators with the skills needed to navigate linguistic transitions effectively and adapt EMI content to Arabic-based instruction.

Developing standardized Arabic scientific and mathematical terminology is also crucial to reducing reliance on English terms and enhancing conceptual clarity in Arabic-based instruction. Many educators struggle to translate complex EMI-acquired knowledge into Arabic, making it essential for linguists, educators, and policymakers to collaborate on establishing widely accepted terminologies that can be implemented across educational contexts.

To further support pre-service teachers, teacher preparation programs should offer professional development opportunities aimed at building confidence in using Arabic for instruction. This includes training in academic Arabic fluency, lesson planning, and assessment design that align with both EMI principles and the requirements of Arabic-based instruction. More specifically, curriculum alignment workshops should be introduced to help educators develop bilingual teaching frameworks that effectively integrate EMI-acquired content into localized teaching practices.

Localized teaching resources and frameworks should also be developed to support pre-service teachers in adapting English-based materials into culturally relevant and creative lesson plans. By designing instructional resources that cater to students' linguistic and contextual needs, educators can bridge the gap between EMI training and Arabic-based classroom practices. This approach ensures that EMI catalyzes academic and professional growth in science and mathematics education rather than creating a linguistic disconnect.

The results indicate that while EMI contributes positively to student learning experiences, its effectiveness varies based on subject area. Science students perceive EMI as a tool for broadening knowledge access, allowing them to engage with global scientific discourse and international research more effectively. In contrast, mathematics students' view EMI primarily as a means to enhance their grasp of subject-specific content and refine their conceptual understanding, particularly in technical problem-solving and analytical reasoning. This suggests that mathematics students may focus more on the depth and precision of content mastery within their field, while science students emphasize the breadth of knowledge and exposure to diverse sources of information.

To enhance EMI's impact, several considerations must be addressed. Linguistic scaffolding is essential for mathematics students, who would benefit from targeted EMI training to improve their ability to engage with multilingual research sources. Conceptual support in EMI should be enhanced for science students, who may require more scaffolded instruction to bridge linguistic barriers and deepen content mastery in English. While mathematics students perceive content mastery and conceptual understanding as central to their problem-solving process, science students may face additional challenges in comprehending and integrating EMI-acquired knowledge due to the extensive use of specialized terminology and diverse sources in scientific literature Essentially, discipline-specific EMI strategies should be developed to fit different subjects' cognitive and linguistic demands, ensuring that both mathematics and science students can maximize its benefits. By integrating these broader constructs into EMI planning and instruction, educational institutions can ensure that EMI supports knowledge acquisition and enhances students' long-term academic and professional growth.

While descriptive data suggest slight differences between male and female students, the absence of statistical significance indicates that these differences do not translate into meaningful gender disparities in EMI experiences. However, interpreting the results through broader constructs reveals underlying trends in how male and female students engage with EMI. Female students exhibited slightly higher perceived academic competency, suggesting greater self-confidence in an EMI environment. However, the lack of statistical significance implies that this advantage is not strong enough to create a meaningful distinction between genders. Linguistic adaptability is another factor, as previous research indicates that female students may demonstrate stronger language learning adaptability. However, the findings suggest that both male and female students face similar challenges in integrating EMI-acquired knowledge into Arabic-based teaching.

Professional preparedness is another consideration. The small difference in mean values may indicate that female students view EMI as a career-enhancing tool, particularly in disciplines where multilingual proficiency is valued. However, the lack of significant gender differences suggests that both male and female student teachers recognize the professional advantages of EMI without major discrepancies in their overall perceptions. By focusing on academic competency, linguistic adaptability, and professional preparedness rather than gender alone, EMI programs can be optimized to provide equal benefits and support for all student teachers, ensuring that both male and female educators are equipped to navigate bilingual instructional challenges.

The slight gender-based difference that was uncovered can be attributed to discipline-specific factors rather than inherent gender disparities. Science student teachers, for instance, may find EMI more adaptable to their field due to the universal nature of scientific terminology. Since scientific concepts are often standardized across languages, EMI presents fewer translation and localization challenges for science students, making them more receptive to English-based instruction. Conversely, mathematics student teachers may struggle more with EMI due to the complexity of translating mathematical expressions and culturally specific teaching methodologies into Arabic. This is in alignment with prior findings that emphasize the difficulties of mathematical translation in EMI contexts, as mathematical problem-solving approaches are often highly dependent on linguistic clarity and instructional conventions.

The different way male and female students engage with language learning may partially explain the slight gender differences found. Research suggests that female students often demonstrate higher linguistic adaptability and a greater willingness to engage with multilingual learning environments (Lasagabaster & Doiz, 2021). However, this factor appears to have a limited impact in comparison to subject specialization, as evidenced by the small effect size in this study.

The findings also suggest that female students may perceive EMI as slightly more beneficial due to greater linguistic confidence. This is supported by research indicating that female learners often report higher self-efficacy in language-related learning tasks. However, since the mean difference between male and female students is marginal, the role of gender is less significant than the influence of subject-specific challenges. For science student teachers, EMI may be perceived as a natural extension of global scientific discourse, whereas mathematics students may view EMI as an added complexity, particularly when dealing with language-intensive mathematical reasoning. These differences highlight the importance of considering disciplinary demands in EMI implementation rather than focusing solely on gender-based variations.

Another key factor influencing EMI perceptions is how relevant students believe EMI is to their future teaching roles. Due to the global reliance on English in scientific research and higher education, science student teachers may see EMI as professionally advantageous. This is in accordance with findings suggesting that science educators benefit from EMI in terms of academic mobility and professional development. Mathematics student teachers, on the other hand, may view EMI as less directly applicable to their classroom instruction, particularly in Arabic-speaking educational systems. This difference in perceived instructional relevance particularly in how EMI aligns with subject-specific pedagogical demands, may partially explain the variation in EMI perceptions between the two disciplines. The greater alignment of EMI with science instruction, compared to the context-dependent linguistic challenges in mathematics, likely influences these perceptions. To clarify, while no significant gender differences were observed within either subject group individually, the overall comparison across disciplines revealed a small but statistically significant gender-based difference. This suggests that the nature of the subject matter may indirectly influence gender differences in EMI perceptions, as previous research indicates that subject-specific linguistic and cognitive demands interact with learners' linguistic adaptability and instructional preferences (e.g., Yunus & Sukri, 2017).

Limitations

While this study provides important insights, several limitations must be acknowledged. First, the focus on pre-service teachers in Oman limits the generalizability of the findings to other contexts. The study employed a quantitative approach, with a sample of 52 participants from a single university. While quantitative studies typically rely on statistical power for sample size determination, in this case, the sample size was influenced by practical constraints and an effort to capture a range of perspectives. However, the limited sample scope may affect the findings' broader applicability. Expanding the sample to include participants from multiple institutions or diverse educational settings would enhance the study's validity and generalizability. Future research should also consider conducting comparative studies across different countries and regions to capture a broader range of experiences and perspectives. Second, the study relied on self-reported data, which may be influenced by biases such as social desirability or subjective interpretations. Incorporating classroom observations or longitudinal analyses would provide a more comprehensive understanding of the real-world impacts of EMI on teaching practices. Third, the study primarily examined the perceptions of science and mathematics teachers, excluding other subject areas that may face distinct challenges in bilingual education. Expanding the scope to include a wider range of disciplines would enrich the understanding of EMI's broader implications. Finally, while the study highlighted gender-based differences in perceptions, it did not explore the underlying causes of these differences. Future research should employ qualitative methods, such as interviews and focus groups, to investigate the factors shaping gender dynamics in bilingual education. Addressing these limitations in future research will enhance the depth and breadth of understanding in this critical area, contributing to the ongoing development of effective bilingual education practices globally.

Future Directions

Building on the findings and limitations of this study, several avenues for future research can be identified. First, comparative studies across different countries and regions are needed to explore how similar challenges and solutions manifest in diverse multilingual education systems. Such studies can provide a broader understanding of the global implications of EMI in teacher preparation. Second, longitudinal research that tracks pre-service teachers' experiences from their training through their professional careers can offer valuable insights into the long-term impacts of EMI on teaching practices and student outcomes. This approach would also help identify effective strategies for supporting teachers over time. Third, further investigation into developing and implementing bilingual assessments is necessary. Research should focus on designing fair, reliable, and culturally sensitive assessments that accommodate both English and Arabic, ensuring validity and equity in evaluation practices. Lastly, future studies should examine the role of technology in supporting bilingual education. Tools such as virtual labs, translation software, and online learning platforms can help address linguistic and pedagogical challenges in EMI contexts. Evaluating the effectiveness of these tools can inform their integration into teacher preparation programs and classroom practices. By addressing these future directions, researchers and educators can deepen their understanding of EMI's role in bilingual education and develop more effective strategies for teaching science and mathematics in multilingual contexts.

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APPENDIX A: SURVEY

First: Academic Proficiency and Specialized Skills

Studying science and mathematics in English:

1. Caused me difficulty in understanding and mastering the academic content.
2. Reduced my confidence in participating and interacting during lectures.
3. Helped me master and better understand the subject matter.
4. Gave me confidence in communicating with international students and learning about their cultures, contributing to building my personality as a better teacher.
5. Assisted me in accessing knowledge from multilingual sources.
6. Weakened my future ability to transfer knowledge and explain it to students in schools.
7. Facilitated my participation in international conferences and scientific forums.
8. Provided an opportunity to expand my research and resources.
9. Helped me attend local and international workshops and training programs to develop my teaching skills.
10. Increased my chances of employment in the private sector, such as in bilingual schools.

Second: Teaching Practices

Lesson Planning

1. Planning lessons in Arabic was challenging at the start of my teaching career because I studied the content in English.
2. Studying science/mathematics in English weakened my ability to prepare creative plans in Arabic.
3. I often integrate Arabic and English in writing equations, numbers, and mathematical expressions while planning lessons.
4. I can formulate educational objectives in clear Arabic that reflect the content of the curriculum I teach.
5. I can reconcile the knowledge I studied in English with the content I plan to teach in Arabic.
6. Studying my specialization in English provided access to the latest references and scientific websites when planning lessons.
7. Studying my specialization in English limits my ability to expand on lesson planning.
8. I face difficulty reconciling my study of scientific subjects in English with planning lessons in Arabic.
9. I spend considerable time preparing lessons to combine information I studied in English with the content I plan to teach.
10. I use English to search for additional information for the lessons I deliver.

Lesson Delivery

1. I feel anxious while explaining lessons in Arabic because I prepared in English.
2. I can clearly explain scientific facts and theories in Arabic despite studying them in English.
3. I use English when explaining illustrative examples related to lesson content.
4. I face difficulty elaborating in Arabic when explaining terms and concepts studied in English.
5. I can pose interactive classroom questions in Arabic with precise phrasing related to the lesson topic.
6. I find differences in the translation of certain scientific terms a barrier to conveying information to students, such as "acceleration."
7. I believe studying the specialization in Arabic significantly aids in delivering scientific knowledge more clearly.
8. I use English spontaneously when explaining some terms or information.
9. I think studying scientific subjects in Arabic positively affects the teacher's personality and increases self-confidence while teaching scientific content in Arabic.
10. There is no negative relationship between studying science and mathematics in English and teaching them in Arabic in schools.

11. I can easily express terms, principles, and generalizations in Arabic despite studying them in English.
12. I find it difficult to present knowledge in Arabic because I studied it in English.
13. Studying my specialization in English enriched my scientific knowledge, positively reflecting my teaching performance.
14. Teaching science and mathematics courses in Arabic facilitates acquiring specialized knowledge better than teaching them in English.

Assessment

1. I find it challenging to formulate evaluation questions in precise Arabic due to studying academic content in English.
2. Studying in English enhances my skills in using diverse evaluation tools.
3. Studying in English qualified me to diversify my question formulation.
4. I can reconcile the content I studied in English at university with the curriculum content when formulating midterm and final exams.
5. I find it difficult to provide students with feedback because I am not proficient in delivering it in Arabic.
6. I believe studying scientific content in Arabic helps diversify the assessment methods used.
7. Studying scientific subjects in English improved my skills in formulating and evaluating tests.
8. I do not see any relationship between studying in English and my evaluation skills.

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