Studies in Second Language Learning and Teaching
Department of English Studies, Faculty of Pedagogy and Fine Arts, Adam Mickiewicz University, Kalisz
SSLLT 13 (2). 2023. 271-292
https://doi.org/10.14746/sslt.38275
http://pressto.amu.edu.pl/index.php/sslIt

English medium instruction (EMI) in Moroccan secondary schools: Science teachers' perception

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Abstract

The present study explored a small-scale English medium instruction (EMI) initiative in Moroccan secondary schools, which is part of a top-down multilingual policy based on teaching science subjects through foreign languages, namely French, English, and Spanish. 18 secondary EMI teachers of math, physics and life and earth sciences were interviewed in order to understand the new policy. Following grounded theory (GT) methodology, the findings show positive attitudes towards the implementation of EMI in Moroccan education, but the teachers seemed unsatisfied with the way it has been implemented. They thought science teachers were not prepared for such a new tendency. The study also revealed that teachers' low English proficiency was considered the major challenge to the successful implementation of EMI in Moroccan secondary schools and the essential reason behind using the first language in the EMI classroom. To prepare future generations for extending EMI in the Moroccan education, the teachers called for a switch to English as the first foreign language, instead of French, in all levels of schooling, and suggested gradual introduction of EMI in primary and middle schools. The study ends with some implications for overcoming the challenges of the new policy.

Keywords: EMI; French medium instruction; language of instruction; grounded theory methodology

1. Introduction

1.1. The growth of EMI worldwide

English medium instruction (EMI) is a form of bilingual education that is increasingly growing in all levels of schooling, especially in contexts where English is not the majority language (Dearden, 2015; Macaro et al., 2018). Macaro et al. (2018, p. 37) defines EMI as "the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language of the majority of the population is not English." Unlike other similar forms of bilingual education which were initiated in particular contexts, such as content and language integrated learning (CLIL) in Europe, content-based instruction (CBI) in North America and French immersion in Canada (Wesche, 2010), EMI is practiced across the globe and is not associated with any specific context (Dearden & Macaro, 2016).

Although the growth of EMI is more widespread in higher education (Dearden, 2015; Macaro et al., 2018, 2020), pre-tertiary EMI is also a growing phenomenon in many parts of the world, especially in post-colonial contexts such as Singapore (Bolton & Botha, 2017), South Africa (Probyn, 2006, 2015), India (Mohanty, 2013) and Hong Kong (Xu & Harfitt, 2019), where English is dominant as a second or foreign language (L2, Dearden, 2018). For instance, in Singapore, English is a major language of instruction in all levels of schooling including pre-tertiary and tertiary education (Bolton & Botha, 2017). Yet, it is important to note that pre-tertiary EMI may be confused with other forms of bilingual education, which are more common at this level, such as CLIL. For instance, Karabassova (2018, 2020), investigating EMI in Kazakh secondary schools, pointed out that the EMI policy in the Kazakh context was based on the principles of CLIL, mainly the integration of content and language. However, she found that teachers were not aware of this methodology and did not think they were responsible for students' English proficiency.

In terms of the EMI objectives, although pre-tertiary and tertiary EMI are based on the same principle of teaching content subjects through English as a second or foreign language, the objectives are not the same. In higher education, the implementation of EMI is usually driven by reasons associated with internationalization, increasing graduate employability, and attracting fee-paying international

students (Dearden, 2018, Macaro et al., 2018; Tamtam et al., 2012). In pre-tertiary education, the implementation of bilingual education, including EMI, is primarily driven by a desire to level up students' English proficiency. In this regard, Macaro et al. (2018, p. 39) point out that EMI in pre-tertiary phases is "motivated by a desire to trial a new approach to language teaching."

1.2. EMI in science education

The use of EMI to teach science subjects is increasingly becoming popular in several parts of the world (Pun et al., 2022). This growth has been documented in several studies worldwide (Lin & He, 2017; Lin & Lo, 2017; Lo & Macaro, 2012; Probyn, 2006, 2015; Pun & Tai, 2021; Tsui, 2004, among others). Topics explored include: translanguaging, interaction in the EMI science classrooms, the impact of EMI on students' English proficiency and conceptual development, teachers' and students' attitudes towards EMI. As a case in point, Pun and Tai (2021) investigated the benefits of translanguaging in science classrooms, that is, the use of languages other than the official medium of instruction for classroom interactions. Based on their findings, they considered translanguaging an asset in science lab classrooms as it offered a space for both teachers and students to construct knowledge and negotiate meaning. Previously, in Hong Kong, Tsui (2004) reported that both teachers and students needed to use the first language (L1), Cantonese, in EMI classrooms, especially when dealing with complex and difficult concepts. Similarly, Probyn (2006), investigating a context in South Africa, where students and teachers share the same home language, Xhosa, found that codeswitching was one of the major strategies used by teachers to mediate students' understanding. The participating science teachers admitted to using Xhosa when teaching new concepts, when students did not understand English explanations and for classroom management. By contrast, Macaro et al. (2020), investigating practices of five EMI teachers in Chinese universities, found that these teachers rarely resorted to the L1 in their instruction.

One major reason for resorting to translanguaging and codeswitching in science classrooms is the students' and teachers' limited English proficiency (Othman & Saat, 2009; Probyn, 2015; Pun & Tai, 2021). For instance, in Othman and Saat's (2009) study, the participating teachers considered the use of Malay along with English in science classrooms as necessary due to the teachers' and students' language difficulties. Byun at al. (2011) found that both teachers and students were facing challenges due to the language barrier. Similarly, Karabassova (2018, 2020) found that science teachers' limited English proficiency was considered one of the major challenges for the EMI implementation in Kazakhstani secondary schools. Another reported reason for the use of other languages in the EMI

science classrooms is science teachers' widely held perception that they are not responsible for their students' language development, given that they are not language experts. In Probyn's (2006, 2015) studies, for instance, the participating science teachers considered students' conceptual development as their major focus in their classrooms and denied any responsibility for integrating content and language. Besides, science teachers often complain about lack of training in the new EMI methodology (Dearden, 2015). Probyn (2006) found that teachers had not received any training to teach their subjects through English as an L2. She argued that science teachers needed training to understand the role of language in learning, develop students' English L2 abilities and use the L1 as a scaffolding device for conceptual and language development. This was also documented in Othman and Saat's (2009) study in the Malay context and by Ben Hammou and Kesbi (2021a), in the Moroccan context. In Ben Hammou and Kesbi's (2021a) study, science teachers blamed the ministry of education for not preparing them to teach through an additional language. Similar results were also reported elsewhere (Coonan, 2007). Despite these challenges, attitudes towards EMI implementation are generally positive. Galloway and Rose (2021) maintained that the major purported advantage of EMI is that it provides a space for both linguistic and conceptual development, "killing two birds with one stone." Similar positive attitudes were confirmed in several other studies (e.g., Galloway & Ruegg, 2020; Munoz de Prat, 2020).

Although the increasing research on EMI has explored several EMI practices in science education worldwide, the EMI phenomenon is still new, and several contexts are still under-represented in the existing literature, especially in Africa and South America (Macaro et al., 2018). For instance, in North Africa, these authors reported only two studies in secondary education (Egypt and Libya). In higher education, no study has been reported in Africa. Besides, most of the previous studies pertained to countries or jurisdictions, where English is the dominant second or foreign language. The researchers were not able to locate any EMI study in secondary education which explores science teachers' perceptions of the EMI phenomenon in contexts, where other foreign languages are more dominant than English. Seeking to fill this gap in the existing literature, the current study explores perceptions of Moroccan science teachers who volunteered to teach through English despite having been trained through French.

In the Moroccan context, the EMI program is part of a large-scale and top-down multilingual program, known as *language alternation* (LA). The LA policy is recommended in the Strategic Vision (2015-2030) and Framework Law (2019) educational reforms, which were conceptualized and planned by central agents (appointed by the King) and implemented by the Ministry of Education (Ben Hammou & Kesbi, 2021a). The policy is based on the idea of teaching science subjects in foreign languages, mainly French, English and Spanish, instead of the

Arabic language. However, given its prestigious status in Moroccan life, French has become the dominant language in this new policy. In nearly all secondary schools, French has become a compulsory language of instruction for the teaching of science subjects. EMI is a small-scale initiative, implemented as a pilot in selective EMI classes in a few secondary schools, in some big cities, namely, Rabat (Abu Dar El Ghifari high school), Casablanca (Moulay Abdellah high school), Tangiers (Allah Elfassi high school), Tetouan (Hassan II high school and Elmahdy Bennouna high school). The major explanation for the limited use of EMI is the lack of teachers who can teach through English, given that French is also the major language of instruction in higher education (Ben Hammou & Kesbi, 2021a). The program enacted is highly selective and it attracts students whose English is good enough to cope with as a medium of instruction.

Although instruction in a second language (Arabic) and or a foreign language (French) is an old practice in Moroccan education, the researchers were able to locate only a few relevant studies, two in secondary education and two in higher education. At secondary level, Ben Hammou and Kesbi (2021a, 2012b) investigated the teaching of science subjects, life and earth sciences, math and physics through foreign languages, mainly French, by delving into science teachers' perceptions and experiences. The findings revealed positive attitudes towards the switch in the language of instruction from Arabic to French despite the negative attitudes towards French, which bears colonial connotations. Many teachers justified their choice by the fact that French is the language of instruction in higher education. In higher education, R'boul (2022) investigated the spread of EMI from a multilingual, and postcolonial perspective. 24 university professors, who participated in this study, held positive attitudes towards the spread of EMI and emphasized its beneficial effects for both faculty and students. Yet, R'boul seemed critical of these findings, which he attributed to the fact that English has no colonial connotations in the Moroccan contexts. He warned that the spread of EMI in the south, including Morocco, would perpetuate linguistic, cultural and epistemic dependency. Similar positive attitudes have recently been reported in Ben Hammou and Kesbi's (2023) study of graduate students' attitudes toward the possibility to switch to EMI, instead of French-medium instruction in Moroccan science universities. Unlike R'boul (2022), the majority of participating graduate students emphasized the potential advantages of EMI for Moroccan education and for the economy. That said, to the best of the authors' knowledge, the current study is the first to investigate the EMI phenomenon in Moroccan secondary schools through the perspective of EMI science teachers. The study seeks to provide answers to the following research questions:

What are science teachers' attitudes towards the small-scale and top-down implementation of EMI in Moroccan education?

a) Does EMI enhance students' and teachers' English proficiency?
b) Does EMI have any detrimental effects on students' subject-matter knowledge?
c) What are the major challenges that science teachers encounter in their EMI classes?
d) What are their strategies to cope with these challenges?

2. Methodology

Grounded theory methodology (GT), which is a branch of the qualitative approach (Auerbach & Silverstein, 2003), was used in this study for data collection and analysis. In GT methodology, researchers follow an exploratory and inductive approach to data analysis. They investigate the phenomenon of interest without imposing any prior expectations, allowing themes of analysis to appear through the data. They form their hypotheses based on the data collected and the participants' reports (Auerbach & Silverstein, 2003). Data collection and analysis are conducted in parallel to find out emergent themes, which are used as a guide for the future gathering of data (Strauss & Corbin, 1998). Participants are considered experts in the studied phenomenon, given their experience as practicing teachers of science subjects through English. Hence, they have a crucial role in defining the benefits and challenges of the small-scale EMI program in Moroccan secondary schools.

2.1. Participants

The participants of this study were teachers of science, physics, and math who had volunteered to participate in the EMI pilot program implemented in a few secondary schools in the cities of Rabat, Casablanca, Tangier and Tetouan. Unlike the French medium instruction program, which is widely implemented in virtually all secondary schools across the country, the EMI program is confined to a few highly selective classes. Hence, the number of the practicing EMI teachers is very limited (26). No criteria were needed for the selection of the EMI teachers. Out of 18 teachers, available for this study, five were females, while 13 were males.

All the participating teachers had received their tertiary education in Moroccan universities. Eight teachers hold a bachelor's degree, while ten hold a master's degree. Two of those holding a master's degree are currently involved in a doctoral program. Twelve teachers speak Moroccan Colloquial Arabic as their native language, while six others are native speakers of Amazigh (the indigenous language of Morocco). In addition to their native languages, teachers know Standard Arabic and French. Two of the participating teachers described

their English as sufficient. Table 1 provides demographic information about the participating teachers. Pseudonyms are used for the sake of confidentiality.

Table 1 Demographic information about the participating teachers

Interview ID	Pseudonym	Age	Subject	Teaching experience	Self-attributed English proficiency level
1	Karim	34	Science	8	Not good enough
2	Jamal	35	Physics	70	Quite Medium
3	Faruk	40	Science	13	medium
4	Amisra	32	Science	7	Insufficient
5	Hakima	29	Math	5	Medium
6	Kamal	33	Science	9	Sufficient
7	Rayan	33	Math	7	Quite Medium
8	Adam	47	Physics	16	Medium
9	Samir	44	Physics	17	Medium
10	Haytam	31	Math	6	Quite medium
11	Samira	35	Physics	10	Medium
12	Adil	38	Physics	12	Insufficient
13	Mounir	40	Science	14	Quite Medium
14	Abdelsalam	36	Math	10	Medium
15	Hicham	32	Science	8	Quite good
16	Hakim	43	Physics	15	Medium
17	Manal	31	Physics	6	Not well developed
18	Hayat	34	Math	8	Sufficient

2.2. Procedures

This study used semi-structured interviews to explore science teachers' perceptions of the small-scale EMI program in Moroccan secondary education. The decision to opt for the semi-structured interviews was dictated by two reasons: (1) the number of the science teachers who are teaching through English is very limited (26), given that the small-scale EMI program is available in a few secondary schools across the country; (2) the interviews allow the researcher to collect in-depth and open-ended data about the EMI experiment in Moroccan education by carefully exploring the thoughts and feelings of the participants.

Due to the pandemic conditions, the interviews were conducted in two phases. The first phase was in January 2021, during which the researchers interviewed eight science and physics teachers, using Moroccan Colloquial Arabic. The transcripts of these interviews were translated to identify major codes. In the second phase, which was in April 2021, ten math, physics and science teachers were interviewed. As is the case with the first phase, the researchers translated the transcripts of the interviews and identified the recurrent codes. Ten interviews were face-to-face, while eight others were conducted through phone calls. The shortest interview lasted 35 minutes, while the longest one lasted 46 minutes.

In each phase, the researchers worked individually to identify the recurrent codes and then met to compare the codes. We used the percentage agreement formula, 2*M/(N1+N2), to measure the inter-coder reliability (Allen, 2017), where M represents the number of identical codes and N1 and N2 are the total number of codes identified by Coder 1 and Coder 2. The measurement yielded a satisfactory similarity rate (.801). The different codes were discussed and resolved before the researchers combined them into major themes in relation to the interview questions (see Appendix for the interview protocol). We could not opt for Cohen's kappa indicator for two reasons: (1) it is difficult to measure this indicator when there are different numbers of codes in each category (Cheung & Tai, 2021, p. 2); (2) we think the percentage agreement formula used in this study is sufficient since the study involves a simple coding activity (Feng, 2015). The interpretations were sent to a colleague, who confirmed the results. After determining the themes, the researchers worked together to choose the excerpts that better illustrate each theme.

3. Results

Rereading and analysis of the scripts of the interviews, following Strauss and Corbin's (1998) model of grounded theory methodology, enabled identification of several codes, which were combined into major themes.

3.1. Integration of content and language in EMI practice

The interviews showed that science teachers held very positive attitudes towards the use of EMI for the teaching of science subjects in secondary education. They were enthusiastic about teaching their subjects in English. They thought EMI was beneficial for both teachers and students. Yet, they seemed to disagree with the concept of integrating language and content learning. They did not think language and content could be explicitly taught equally in the same classroom. As science teachers, they thought they should be mainly concerned with students' content acquisition:

> *The problem with this new policy is that it favors foreign language learning (English) at the expense of content. For me . . ., what I care about is students' achievement in my subject. (Jamal, a teacher of physics)*

When asked about whether they took into consideration the language component when planning their lessons, most participants (16) admitted that they never planned any language-oriented activities. They did not think they needed

such activities in their classes since there were English teachers whose job was to improve students' language skills. Some teachers complained that even if they were willing to include language in their teaching, they did not have time because the science curriculum was overloaded to the extent that they found it difficult to finish it in time. Besides, they did not think they were qualified enough to teach English language forms because they were trained in French:

> *I only focus on content goals. I never include any language activities because it is not my job. (Faruk, a teacher of science)*

Hayat, a teacher of physics, expressed a different view. She thought integration of English learning and content was possible provided that teachers received continuous training in the medium of instruction by experts in English-Medium Instruction. She added that although science teachers were not English language teachers, they often found themselves obliged to explain science vocabulary, which students found difficult to understand:

> *I think EMI is very beneficial for both students and teachers. Students learn two things at the same time, English and content . . . It is also a good opportunity for teachers to improve their English proficiency. (Hayat, a teacher of math)*

3.2. Teachers' English proficiency

The findings showed that science teachers' limited English proficiency was considered the major challenge to the teaching of science subjects through English in Moroccan secondary schools. The majority of the participants considered their language abilities inadequate (16 participants) to cope successfully with English as a vehicular language in their fields. However, they all showed willingness to improve their English and contribute to the success of EMI in Moroccan education. For instance, Karim, a teacher of science, said that he volunteered to engage in the new policy despite his limited English proficiency. He preferred engaging in the EMI program although he could have chosen to teach French-medium classes. His preference can be attributed to the hegemonizing status of English in the world. In fact, the increasing interest in English all over the world and its hegemony in most areas of life seem to affect the participants' choice:

> *Although my English is not good enough, I prefer teaching through EMI . . . If my students and I improve our English, we will keep up with the advance in science and technology. (Karim, a teacher of science).*

In contrast to the majority of participants, Hayat, a teacher of math, and Kamal, a teacher of science, described their English as sufficient to manage their teaching through this language. They explained that their enrollment in a doctoral program at university had enabled them to improve their English. Indeed, although French is the major language of instruction at university, Hayat argued that English was the working language in doctoral studies. Hence, graduate students are required to work on their English proficiency so that they can develop their research and publish their scientific articles. Kamal elaborated that, without English, students would not be able to accomplish their PhD projects as they were required to publish at least two articles in Scopus-indexed journals:

> *Thanks to my PhD project, I managed to improve my level of English. I needed English to read and understand previous scientific articles. (Kamal, a teacher of science)*

Despite differences in English proficiency among the participants, they all seemed confident that their use of English as a language of teaching would enhance their proficiency in this language. Hakima, a teacher of math, explained that although science teachers were more accustomed to teaching through Arabic or French, they could overcome the language barrier over time, especially given that French and English share a lot of scientific vocabulary. In addition, the teachers benefitted from continuous professional training offered by the ministry of education in collaboration with the British Council in Morocco. This training, according to the teachers, focused mainly on language skills and forms and sought to promote teachers' English proficiency. However, not all teachers were satisfied with the training. Some participants expected to learn about some useful strategies to cope with their subject through English and facilitate students' understanding, but most of the trainers were language experts and had little knowledge about EMI methodology:

> *At the beginning of the program, I was not confident about my English proficiency, but after a while I started to gain confidence. (Hakima, a teacher of math)*

3.3. Students' initial language abilities

Unlike the teachers' English proficiency, which was considered a major challenge to the EMI program in Moroccan education, the teachers' self-reports were more positive about their students' initial English proficiency. According to the majority of the participating teachers, the students had good oral and writing English skills. The teachers thought that EMI was less challenging for students for two reasons. First, the EMI program is limited to a few secondary schools in some big cities, which makes it very selective. Students are selected based on their English proficiency. They are required to pass an entrance exam, which is

focused on language skills and forms before they can enroll in the program. Second, according to the participating teachers, most of the students who joined the EMI classes come from private schools, where they have been exposed to English since their early schooling years:

> *The students I teach speak English fluently. They use it better than I do. This is because most of them come from private schools. (Rayan, a teacher of math)*

Although the teachers agreed with the selection process, they considered it unfair as it indirectly favors students coming from private schools. Unlike private schools, students in public schools have limited exposure to the English language. They start the learning of English at 9th grade with an average of two hours a week, while the EMI program starts in 10th grade. Hence, public students do not have an equal opportunity to enroll in EMI as do their private school fellow students who spend nine years learning English before their enrollment in the program.

3.4. The effect of EMI on students' language development

The findings revealed positive outcomes regarding the effect of the EMI practice on students' language development. Nearly all participants (17 teachers) agreed the teaching of math, science and physics through English provided a favorable environment for the development of students' English proficiency. Although students had good initial English proficiency, the teachers noticed that their students' vocabulary repertoire, which was limited at the beginning of the program, had extended thanks to the acquisition of subject-matter knowledge. Mounir, a teacher of science, explained that at the beginning of 10th grade, when the program was launched, some students were less confident to participate or make presentations due to their limited science vocabulary, but as students accumulated adequate vocabulary and science knowledge, they became more active in the classroom and they themselves suggested making presentations:

> *Of course, it has a positive impact on students' English. They learn a lot of vocabulary and ideas in English. (Mounir, a teacher of science)*

Similarly, Samir, a teacher of physics pointed out that students in 11th and 12th grades became more fluent in English. They rarely used their L1 in the classroom. Even in groupwork, the teacher noticed that students preferred discussing in English:

> *The language gain in EMI is very significant, especially in 11th and 12th grades. Students face some learning difficulties at the beginning but as they develop their language, they get more fluent. (Samir, a teacher of physics)*

By contrast, Haytam, a teacher of math, argued that the effect of EMI on language development was not apparent in the Moroccan context, given that the EMI program was highly selective. He explained that the students selected were high-achieving and passionate about English learning. They have developed good English fluency before their enrollment in the EMI, which indicates their ability to sharpen their linguistic potential without the need for EMI. Yet, he acknowledged that students' science vocabulary had immensely developed thanks to their immersion in the EMI:

> *I'm not sure if EMI has any significant effect on students' English proficiency because they already had good proficiency when they first started the program. (Haytam, a teacher of math)*

Regarding the teachers' language benefits in the EMI program, the findings showed that teachers' immersion in EMI had also positively affected their English proficiency which was initially limited for most of them. Yet, their daily exposure to the English language in EMI enabled them to advance their language skills and fluency. For instance, Hicham, a teacher of science, despite being not well satisfied with his English, maintained that after one year of using English for teaching his subject, he had broadened his English vocabulary repertoire and become more confident to teach through English. Similarly, Samira, a teacher of physics, confirmed that her fears gradually disappeared as she gained more language fluency and confidence. She explained that her students' good English proficiency had encouraged her to work on her language skills and develop her fluency:

> *Yes . . . thanks to my students and the daily use of English to teach my subject, I have overcome my fears and gained more confidence to speak English. (Samira, a teacher of physics)*

3.5. The effect of EMI on content learning

The views of the participating teachers regarding the impact of EMI on content learning were also positive. Although most of them agreed that the L1 was better in content learning (14 participants), they did not think the use of English had any significant negative impact on students' ability to understand and learn content. Some teachers explained that students' initial English proficiency was sufficient to overcome the learning difficulties. Besides, most teachers resorted to the students' L1 when they found difficulty explaining complex concepts. Even those few teachers who thought that their students' achievement might be affected by the compulsory use of English in exams agreed that this effect was less significant in subsequent years as students and teachers acquired more advanced language skills:

There might be a slight effect (negative) at the beginning, but students have the ability to overcome this effect. (Abdelsalam, a teacher of math)

However, the majority of the participating teachers (15 participants) acknowledged that EMI exerted a negative effect on the quality of their teaching due to their limited language proficiency. To overcome this effect, the teachers found themselves obliged to use students' L1 to facilitate their teaching. Hamid confirmed that he sometimes found it insufficient to explain and elaborate on complex concepts through English due to a lack of required fluency. Yet, nearly, all participants agreed that after years of experience in EMI, the quality of their teaching through English had improved as they managed to overcome the language barrier which they had experienced at the beginning of the program:

I found it hard to explain my lessons clearly enough in English, at the beginning. Today, although my English is still not well developed, I do not use Moroccan Arabic very often. (Manal, a teacher of physics)

3.6. The use of the L1 in the EMI class

Although EMI students were selected based on their English proficiency, nearly all the teacher participants (17) admitted to using students' L1 as a means of explanation to facilitate their teaching and secure students' understanding. Yet, it seems that the major reason for resorting to students' L1 is not the students' English proficiency, but rather the teachers' inability to explain difficult concepts using English. Although the textbooks and lessons are written in English, the use of the L1, according to the teachers, is a necessity to ensure that students learn content and prepare for the exams:

I try to use English, but most often I find it necessary to switch back to the Moroccan Colloquial Arabic because it is not easy to explain difficult concepts in English. (Adil, a teacher of physics)

When asked if their students preferred the use of English or Moroccan colloquial Arabic, they responded that students sometimes asked for explanations in Moroccan Arabic, especially in their first year. One of the teachers explained that students sometimes had difficulty understanding their teachers' explanations in English due mispronunciation and lack of fluency. Like teachers, students were concerned about content learning because they needed to get ready for the exams. Therefore, they preferred understanding through their L1 and writing the lessons in English:

> *Although most students are good at English, I think they also prefer explanation through Moroccan Arabic, especially when it comes to difficult concepts. (Adam, a teacher of physics)*

Unlike the majority of participants, who found the use of the L1 along with English useful to facilitate content learning, Kamal, a teacher of science, disagreed with the use of Moroccan Arabic in the EMI class. He argued that the use of the L1 would have negative effects on students' performance. Given that students are required to answer exam questions solely in English, he thought teachers should make their students accustomed to the use of English by avoiding the use of the L1:

> *I think the use of Moroccan Arabic in the EMI class is detrimental to the students' language development. It should be avoided because if students get used to it, they would make less effort to improve their English. (Kamal, a teacher of science)*

4. Discussion

The present study investigated a small-scale and top-down EMI program in Moroccan secondary schools, which is part of the LA policy. The study explored the perceptions and experiences of in-service science teachers, who were engaged in the EMI program, using GT methodology.

The findings of the study provide interesting outcomes about EMI practices in the Moroccan education. First, the study confirms the purported view that EMI is primarily oriented towards content learning (Airey, 2016; Lo & Macaro, 2012; Probyn, 2006, 2015; Pun & Tai, 2021; Tsui, 2004). Although the participating teachers held positive attitudes towards teaching their subjects through English, they rejected the idea of explicit language learning in EMI science classes, suggesting a kind of dichotomy between language teaching and content teaching. They denied responsibility for language teaching because they considered themselves content experts (Pun et al., 2022). This dichotomy is not specific to EMI but is also reported in other forms of integration of content and language which are more common in secondary education, especially CLIL (Karabassova, 2018; Mehisto, 2008). As a case in point, Mehisto (2008) found that language support in content classrooms was limited to unneeded translations. Teachers were reluctant to integrate language-oriented materials, indicating that they were unaware of the CLIL methodology. In the case of this study, the participants did not think there was a need for explicit language learning in EMI classes as students had good initial English proficiency and could unconsciously and independently develop their language skills while focusing on content learning. This finding seems to resonate with the input hypothesis (Krashen, 1982) in second language acquisition, which claims that we acquire the target language when we focus on

meaning/messages, not the structure of the message. For science teachers, the main concern is to provide a "science input" that students can understand. According to Krashen (1982), it is the students' understanding of the input, "roughly tuned," that ultimately results in the acquisition of the target language. Unlike Krashen (1982), Long (1996) considers comprehensible input, input+1, insufficient for language acquisition, and emphasizes "negotiation of meaning" during interactions as necessary for acquisition to take place. In the science classroom, when students do not understand a concept, they usually seek clarification and negotiate meaning through interaction with the teacher or other students. However, negotiation of meaning requires a native speaker or a competent interlocutor, who can make linguistic and semantic adjustments to the input to achieve individualized comprehension (Long, 1996). In the Moroccan context, science teachers are trained through French, the first foreign language in the country. Hence, although the participating teachers had some exposure to English as a foreign language in secondary education, the majority were not confident about their English proficiency, which might affect their ability to modify and simplify the input in the target language. In this regard, the teachers mentioned three main language difficulties, namely, pronunciation, limited vocabulary repertoire and the inability to maintain communication with students. These language difficulties suggest that teachers may not often be able to provide necessary "scaffolding" in English, which might affect students' progress in "the zone of proximal development" (Vygotsky, 1978). To put it simply, it seems that while students have the necessary "threshold level" (Cummins, 1976) in English, the majority of the teachers are struggling with English. As a result, teachers admitted to often resorting to students' L1 to facilitate instruction, especially at the beginning of their experience. Indeed, the use of the L1 has been reported as a common practice in EMI (Probyn, 2015; Pun &Tai, 2021; Tsui, 2004).

One of the major declared objectives for the implementation of the language alternation policy in Moroccan education is the mastery of foreign languages (Ben Hammou & Kesbi, 2021a, 2021b). In the case of the EMI program, the interviews showed that the teaching of science subjects through English had significant effects on both teachers' and students' English proficiency. The teachers pointed out that although students had good initial English proficiency, their immersion in the EMI program had extended their vocabulary repertoire and boosted their fluency to the extent that they could prepare and make presentations in English about any topic in the curriculum. However, it is not easy to conclude whether this positive outcome is caused by the use of English as a medium of instruction or by other factors such as motivation and language skills, given that the program is prestigious and highly selective. Some of the interviewed teachers explained that the kind of students involved in the EMI

were likely able to improve their language skills without the need for EMI. Those students have good English skills, and they are high performing in science subjects. This tallies with some studies in the CLIL context, where English is the major language of instruction. For instance, Verspoor et al. (2015) tested the effect of CLIL instruction on vocabulary learning comparing three groups, CLIL, non-CLIL and gymnasium classes. CLIL and gymnasium classes were described as prestigious classes since they attracted high-performing students with good initial language proficiency, whereas the non-CLIL cohort had lower language proficiency. The study revealed differences in terms of language development between the CLIL and the non-CLIL groups, but the gymnasium cohort was found to have similar outcomes as the CLIL group. The authors concluded that CLIL instruction had no significant effect on students' language development. Yet, in the Moroccan context, the teachers interviewed in Ben Hammou and Kesbi's (2021b) study claimed that teaching physics through a foreign language, French, led to language gains even for low-achieving students.

In addition to students, the study showed that the EMI practice also had positive effects on teachers' English proficiency. The teachers admitted having initial medium English proficiency at the beginning of their experience, but they found their EMI experience very beneficial in terms of their L2 development. They managed to broaden their vocabulary repertoire, which positively affected their confidence and language fluency. The teachers reported that the use of Moroccan Arabic had gradually decreased in their classes as they progressed in their experience. In the Kazakhstani context, Karabassova (2020) reported that teachers' English proficiency was considered the major challenge in the enacted EMI program, but she did not explain whether the teachers' involvement in the program had any effects on their language development.

Regarding the effect on content learning, the interviews showed that the negative effect of EMI on students' subject-matter knowledge was insignificant. Although most of the participating teachers considered the use of the L1 as better when it comes to the teaching of content learning, they were not much concerned about the effect of English use on students' academic achievement. They acknowledged that the quality of teaching and learning was affected at the beginning of the program, but they explained that the detrimental effect seemed to vanish over time as teachers and students got more proficient and fluent. This echoes the findings reported by Joe and Lee (2013).

To alleviate the negative effects of teachers' low English proficiency on students' performance, it is recommended to take advantage of students' language abilities by encouraging them to take more active roles in the science classroom. The teachers can assign lessons to groups of students to prepare and present in front of other students, followed by a question-answer session. This

will give more space for student-student interactions to negotiate meaning using the target language. Yet, this requires flexibility on the part of teachers to give up their traditional role, as the sole provider of science knowledge in the classroom and adopt more engaging and facilitating strategies to help students take the lead in and responsibility for their learning. Besides, findings support a systematic and purposeful use of students' L1 as a "scaffolding" device to help learners construct knowledge and share it in the classroom (Mohanty, 2013; Probyn, 2015).

To prepare faculty better qualified to teach through English, it is recommended to recruit science teachers with a minimum threshold level in English. An English proficiency test should be part of the exams that new teachers take to join the science teaching profession. In the pre-service stage, teachers should be prepared to engage successfully in the EMI program by being equipped with the necessary strategies to cope with the challenges of EMI classrooms. In-service professional meetings of the EMI science community teachers should be regularly held to give teachers the opportunity to share their classroom experiences and discuss possible solutions to the challenges they or their students face.

5. Conclusion

This study explored science teachers' attitudes towards the teaching of their subjects through English in some Moroccan secondary schools. Using GT methodology, the data analysis yielded some insights into the EMI phenomenon in the Moroccan context, which can be further investigated in future research. First, science teachers seemed to hold positive attitudes towards the use of English as a medium of instruction instead of the official language and the first foreign language, French. This finding seems to have one major explanation, which is the hegemony of English as a lingua franca in the world in nearly all areas of life. Second, the EMI program offers a favorable environment for language development not only for students but also for teachers. Although teachers acknowledged that they had limited English proficiency at the beginning of their experience, they managed to overcome the language challenge over time thanks to their daily use of English as a medium of instruction. As for students, in addition to their enrollment in the EMI program, other factors might also have contributed to the development of their language abilities, especially their vocabulary repertoire and language fluency. These are good initial English proficiency, high performance in subject-matter knowledge, and motivation. More interestingly, although English is a second foreign language in the Moroccan context, the use of EMI for the teaching of science subjects seems not to have significant detrimental effects on the learning of content.

References

Airey, J. (2016). EAP, EMI or CLIL? In K. Hyland & P. Shaw (Eds.), *The Routledge handbook of English for academic purposes* (pp. 95-107). Routledge.

Allen, M. (Ed.). (2017). *The SAGE encyclopedia of communication research methods.* Sage.

Auerbach, C. F., & Silverstein, L. B. (2003). *Qualitative data: An introduction to coding and analysis*. New York University Press.

Ben Hammou, S., & Kesbi, A. (2021a). The teaching of science subjects through foreign languages in Moroccan secondary schools: Science teachers' perceptions and experiences. *RELC Journal*. https://doi.org/10.1177/00336882211035832

Ben Hammou, S., & Kesbi, A. (2021b). Physics teachers' attitudes towards content and language integrated learning: Morocco's multilingual context. *Issues in Educational Research*, *31*(4), 1029-1048. http://www.iier.org.au/iier31/ben-hammou.pdf

Ben Hammou, S., & Kesbi, A. (2023). English-medium instruction (EMI) in Moroccan higher education: Graduate students' attitudes. *Journal for Multicultural Education*, *17*(1), 43-55.

Bolton, K., & Botha, W. (2017). English as a medium of instruction in Singapore higher education. In B. Fenton-Smith, P. Humphreys, & I. Walkinshaw (Eds.), *English medium instruction in higher education in Asia-Pacific: From policy to pedagogy* (pp. 133-152). Springer.

Byun, K., Chu, H., Kim, M., Park, I., Kim, S., & Jung, J. (2011). English-medium teaching in Korean higher education: Policy debates and reality. *Higher Education*, *62*, 431-449. https://doi.org/10.1007/s10734-010-9397-4

Cheung, K. K. C., & Tai, K. W. (2021). The use of intercoder reliability in qualitative interview data analysis in science education. *Research in Science & Technological Education*, 1-21. https://doi.org/10.1080/02635143.2021.1993179

Coonan, M. C. (2007). Insider views of the CLIL class through teacher self-observation–introspection. *International Journal of Bilingual Education and Bilingualism*, *10*(5), 625-646.

Cummins, J. (1976). The influence of bilingualism on cognitive growth: A synthesis of research findings and explanatory hypotheses. *Working Papers in Bilingualism*, *9*, 1-43.

Dearden, J. (2015). *English as a medium of instruction: A growing global phenomenon.* British Council.

Dearden, J. (2018). The changing roles of EMI academics and English language specialists. In Y. Kırkgöz & K. Dikilitaş (Eds.), *Key issues in English for specific purposes in higher education: English language education* (pp. 323-338). Springer.

Dearden, J., & Macaro, E. (2016). Higher education teachers' attitudes towards English medium instruction: A three-country comparison. *Studies in Second Language Learning and Teaching*, *6*(3), 455-486. https://doi.org/10.14746/sllt.2016.6.3.5

Feng, G. C. (2015). Mistakes and how to avoid mistakes in using intercoder reliability indices. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences, 11*(1), 13-22. https://doi.org/10.1027/1614-2241/a000086

Galloway, N., & Rose, H. (2021). English medium instruction and the English language practitioner. *ELT Journal, 75*(1), 33-41.

Galloway, N., & Ruegg, R. (2020). The provision of student support on English medium instruction programmes in Japan and China. *Journal of English for Academic Purposes 45*(1), 100846. https://doi.org/10.1016/j.jeap.2020.100846

Joe, Y. J., & Lee, H. K. (2013). Does English-medium instruction benefit students in EFL contexts? A case study of medical students in Korea. *The Asia-Pacific Education Researcher*, *22*, 201-207.

Karabassova, L. (2018). Teachers' conceptualization of content and language integrated learning (CLIL): Evidence from a trilingual context. *International Journal of Bilingual Education and Bilingualism*, *5*(3), 787-799. https://doi.org/10.1080/13670050.2018.1550048

Karabassova, L. (2020). Is top-down CLIL justified? A grounded theory exploration of secondary school science teachers' experiences. *International Journal of Bilingual Education and Bilingualism*, *25*(4), 1530-1545. https://doi.org/10.1080/13670050.2020.1775781

Krashen, S. D. (1982). *Principles and practice in second language acquisition*. Pergamon Press.

Lo, Y. Y., & Macaro, E. (2012). The medium of instruction and classroom interaction: Evidence from Hong Kong secondary schools. *International Journal of Bilingual Education and Bilingualism*, *15*(1), 29-52.

Lin, A. M., & He, P. (2017). Translanguaging as dynamic activity flows in CLIL classrooms. *Journal of Language, Identity & Education*, *16*(4), 228-244.

Lin, A. M., & Lo, Y. Y. (2017). Trans/languaging and the triadic dialogue in content and language integrated learning (CLIL) classrooms. *Language and Education*, *31*(1), 26-45.

Long, M. (1996). The role of the linguistic environment in second language acquisition. In W. C. Ritchie & T. K. Bhatia (Eds.), *Handbook of second language acquisition* (pp. 413-468). Academic Press.

Macaro, E., Curle, S., Pun, J., An, J., & Dearden, J. (2018). A systematic review of English medium instruction in higher education. *Language Teaching*, *51*(1), 36-76.

Macaro, E., Akincioglu, M., & Han, S. (2020). English medium instruction in higher education: Teacher perspectives on professional development and certification. *International Journal of Applied Linguistics*, *30*(1), 144-157.

Macaro, E., Curle, S., Pun, J., An, J., & Dearden, J. (2018). A systematic review of English medium instruction in higher education. *Language Teaching*, *51*(1), 36-76.

Mehisto, P. (2008). CLIL counterweights: Recognizing and decreasing disjuncture in CLIL. *International CLIL Research Journal*, *1*(1), 93-119.

Mohanty, A.K. (2013). Multilingual education in India. In C. A. Chapelle (Ed.), *The Encyclopedia of applied linguistics* (pp. 1-7). Blackwell.

Muñoz de Prat, J. (2020). Teaching through English: The case of international commerce. In Carrio-Pastor (Ed.), *Internationalizing learning in higher education* (pp. 179-200). Palgrave Macmillan.

Othman, J., & Saat, R. M. (2009). Challenges of using English as a medium of instruction: Pre-service science teachers' perspectives. *The Asia-Pacific Education Researcher, 18*(2), 307-316.

Probyn, M. (2006). Language and learning science in South Africa. *Language and Education*, *20*(5), 391-414.

Probyn, M. (2015). Pedagogical translanguaging: Bridging discourses in South African science classrooms. *Language and Education*, *29*(3), 218-234.

Pun, J. K., & Tai, K. W. (2021). Doing science through translanguaging: A study of translanguaging practices in secondary English as a medium of instruction science laboratory sessions. *International Journal of Science Education*, *43*(7), 1112-1139.

Pun, J., Thomas, N., & Bowen, N. E. J. A. (2022). Questioning the sustainability of English-medium instruction policy in science classrooms: Teachers' and students' experiences at a Hong Kong secondary school. *Sustainability*, *14*(4), 2168.

R'boul, H. (2022). English medium instruction in Moroccan universities: Implications for multilingualism, linguistic dependency and epistemic justice. *Journal of Multilingual and Multicultural Development*, 1-15. https://doi.org/10.1080/01434632.2022.2069250

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (4th ed.). Sage.

Tamtam, A. G., Gallagher, F., Olabi, A. G., & Naher, S. (2012). A comparative study of the implementation of EMI in Europe, Asia and Africa. *Procedia – Social and Behavioral Sciences*, *47*, 1471-1425.

Tsui, A. B. M. (2004). Medium of instruction in Hong Kong: One country, two systems, whose language? In J. Tollefson & A. B. M. Tsui (Eds.), *Medium of instruction policies: Which agenda? Whose agenda?* (pp. 97-116). Lawrence Erlbaum.

Verspoor, M., De Bot, K., & Xu, X. (2015). The effects of English bilingual education in the Netherlands. *Journal of Immersion and Content-Based Language Education*, *3*(1), 4-27.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wesche, M. B. (2010). Content-based second language instruction. In R. Kaplan (Ed.), *The Oxford handbook of applied linguistics* (2nd ed., pp. 275-293). Oxford University Press.

Xu, D., & Harfitt, G. J. (2019). Teacher language awareness and scaffolded interaction in CLIL science classrooms. *Journal of Immersion and Content-Based Language Education*, *7*(2), 212-232.

APPENDIX

Teachers' interview protocol

A. Foreign language questions:

1. How would you characterize your English proficiency?
2. How would you characterize your students' English proficiency level?
3. Do you agree with English as the first foreign language in Morocco, instead of French? Why?
4. Do you think English as FL should be taught at all levels of schooling? Why?

B. Foreign language as the language of instruction:

1. What do you think about the experimental implementation of English-medium instruction in some secondary schools? Do you think Moroccan education is ready for EMI implementation? Why is that?
2. Do you think EMI should be generalized to other secondary schools as French-medium instruction?
3. Do you think you are well prepared to teach in English? What do you think you need to improve your performance?
4. What strategies do you use to overcome the language difficulties while teaching through English?
5. Do you have anything to add?