

Physics teachers' attitudes towards content and language integrated learning: Morocco's multilingual context

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The present study seeks to contribute to the ongoing debate about the integration of foreign languages as media of instruction in secondary schools, through exploring Moroccan physics teachers' attitudes towards the use of English and French as media of instruction in secondary schools. Grounded theory methodology, in which data is analysed to generate new hypotheses, is suitable for such studies which seek to describe the reality of bilingual education as perceived by practising teachers. The fifteen physics teachers interviewed in this study show a level of satisfaction in teaching their subjects through a foreign language, French. They think the bilingual program, implemented in Moroccan schools, is a good opportunity for both students and STEM teachers to improve their language proficiency. However, they seem to critique the Ministry of Education for not involving them in the conception of this new language reform. With respect to English-medium instruction, the participating teachers do not think Moroccan schools are ready for the use of English as a medium of instruction. They suggest upgrading the status of English as a foreign language in all levels of schooling and improving both teachers' and students' English proficiency before moving in such a new direction.

Introduction

The use of a foreign or second language as a medium of instruction is an old practice in Moroccan education. Before the arrival of the French in 1912, Arabic, which is a second language, had been used as a language of instruction in the Quranic schools and the University of Karaouine in Fes (Redouane, 1998). After 1912, the French administration introduced the French educational system in Morocco, imposing and generalising French, which is a foreign language, as a language of instruction for the teaching of both scientific and literary subjects. Meanwhile, Arabic was relegated to the status of a foreign language (Sadiqi, 1991). After independence, Moroccan nationalists called for the Arabisation of the Moroccan education. Hence, Arabic was gradually adopted as a language of instruction instead of French, in primary schools and then later in secondary schools. However, French has been maintained as a medium of instruction in science universities and technical secondary schools, yielding a form of bilingual education.

Although concerns and questions have been raised about the real intentions of francophonie in Africa, French continues to enjoy prestige in several former French colonies in Africa due to its widespread use in education, the economy and the media (Alidou, 2004; Kesbi, 2012). In the Moroccan context, the predominance of French in Moroccan life is the result of several previous educational policies, which have bolstered its status by having brought about more policies in its favour, to the detriment of other languages which are part of the Moroccan language market. The fact that French is progressively receding at the international level, due to the hegemony of English, has little

effect on its status in the Moroccan context since enacted policies, deliberately or not, continue to support the dominance of the French language to the detriment of the other languages in the Moroccan job market.

More recently, a new initiative known as 'Language alternation' has been launched by the Ministry of Education in secondary schools. The initiative is based on teaching scientific subjects through foreign languages, namely French, English and Spanish, while Arabic is maintained for the instruction of other non-scientific subjects. The initiative is a part of an educational reform known as the *Framework Law for Education* adopted by the Moroccan parliament in 2019. The objective of this new language-in-education initiative, as documented by the second article of the Framework Law for Education, is to diversify the instruction of foreign languages and boost multilingual education through using foreign languages to teach some scientific subjects or modules (Ben Hammou & Kesbi, 2021). However, although the framework does not favour or specify any foreign language, the Ministry of Education has adopted French-medium instruction as a large-scale practice in most secondary schools, while English-medium instruction and Spanish-medium instruction are launched as pilot programs in a few high schools.

The prioritisation of French as a language of instruction and marginalisation of other national and foreign languages has been a subject of heated debate, not only in the parliament but also within the Moroccan government. The debate has been fuelled by two contrasting political groups. The "liberals" insist on the adoption of the new initiative. They argue that the switch to French-medium instruction will promote the quality of education and improve students' language proficiency, which is a requirement in today's Moroccan job market. By contrast, the "conservatives" defend the maintenance of Arabic as a medium of instruction in secondary education and recommend replacing French with English as a first foreign language given that it is the world de facto language of science, technology and international relations. They reject the generalisation of French-medium instruction and accuse the proponents of the new reform of attempting to 'Frenchify' the Moroccan educational system and marginalise Standard Arabic.

However, the debate ended up adopting and generalising French-medium classes in secondary education. Thanks to this new language policy, the French language dominance and prestige will continue growing not only in education but also in other aspects of life, which might lead to more favourable policies for this language in the future. On the one hand, the main conclusion that can be drawn from this debate is that the francophone lobby, which defends the presence of the French language and culture in Morocco, plays an instrumental role in the Moroccan language policymaking. On the other hand, there is an increasing awareness of the importance of English as a global language of science, technology and communication, which results in a growing competition between French and English within the Moroccan linguistic scene. This competition might bring about changes in future language policies. In this regard, Bukner (2009, cited in Elkirat & Laaraj, 2016) found that 41.4% of her respondents chose English as their favourite language and preferred it to French and Spanish. She concluded that Moroccans hold positive attitudes towards English, in comparison with French and Spanish which bear colonial connotations. Also, the results of a poll published in 2015 by the widespread Moroccan

electronic newspaper *Hespress* showed that the majority of the respondents support the shift towards English as a first foreign language instead of French (*Hespress*, 2015). Similar outcomes obtained by Elkirat and Laaraj (2016) showed that Moroccan university students and educational professionals think it is time to enhance English instruction in technical and scientific streams. However, more studies are needed to determine to what extent the presence of English in Morocco is forceful enough to compete with French, which is still predominant in most areas of life.

Unlike most bilingual programs worldwide, which are small-scale initiatives initiated locally by some schools, the bilingual program implemented in Moroccan schools is a large-scale, top-down educational policy. In addition, while English is the major language of instruction worldwide, the use of other languages is limited to contexts where English is not the second language or the first foreign language. For instance, in Kazakhstan, English is a third language after Kazakh and Russian (Palatova et al., 2020; Smakova & Paulsrud, 2020). Similarly, in the Moroccan context, English is a second foreign language. Hence, it is not the major language of science. French, which is a colonial language, is taught in all levels of schooling as a first foreign language and, recently, generalised as the major medium of instruction for the teaching of science subjects in secondary and higher education. A grounded theory methodology has been used for data collection and analysis in order to investigate physics teachers' attitudes towards this new initiative in Moroccan education.

Literature review

Content and language integrated learning (CLIL)

Content and language integrated learning (CLIL) has been used as an umbrella term since the 1990s to encompass several bottom-up, bilingual education programs implemented across Europe to promote multilingualism. The main concept of CLIL is the integration of language and content learning in the same classroom through teaching non-linguistic content subjects through a foreign or second language (Coyle et al., 2010; Dalton-Puffer, 2007). The approach is conceptually similar to the 'Linguistic alternation' initiated in Moroccan secondary schools to teach scientific subjects through one of the prestigious international languages, namely French, English and Spanish. In other words, despite the differences between the European and the Moroccan contexts, the practice of CLIL is the same in the sense that there is a fusion of foreign language learning and content learning.

Although CLIL shares principles and characteristics with other common language teaching approaches such as the communicative language teaching and content-based approaches, it is distinctively different from these. First, its scope goes beyond language learning to include content learning in the sense that it aims not only to enhance students' language skills, but it also seeks to promote students' subject-matter knowledge. Secondly, language is not the focus in CLIL instruction since the curriculum is not designed to teach language but rather a non-language disciplinary subject. By contrast, in the traditional language teaching practices, the curriculum is designed to teach language forms and skills. Even when content is included in the language classroom, no matter how authentic and

realistic the content is, the emphasis remains on language forms and functions. Whereas in CLIL classrooms, the language learning is achieved implicitly since all the materials are authentic in purpose and content driven.

CLIL teachers, as is the case in Morocco, are not language teachers and are mainly concerned with facilitating students' content learning. However, as Dalton-Puffer (2007) proposed, the emphasis on content using a foreign language results in natural-like acquisition of language because students in a CLIL environment experience situations which are somehow similar to a real life context. In addition, contact time with the foreign language in CLIL instruction is higher than in traditional learning where there is very limited time for language use. CLIL students continue their traditional foreign language classes together with their disciplinary subjects through the foreign language, which allows them higher amounts of exposure to learn the language easily and naturally, in contrast to non-CLIL students. (Coyle et al., 2010; Dalton-Puffer, 2011).

Regarding the nature of the CLIL language, in most cases, the target language is either a foreign language or a second language (Eurydice, 2006). In a few other cases, a minority or heritage language can be used as a medium of instruction in areas where this language is spoken, such as the case of Welsh in England (Eurydice, 2006). English as a foreign language or as a second language is reported to dominate most CLIL initiatives all over the world (Dalton-Puffer, 2011; Eurydice, 2006). However, the Moroccan case is much different as French-medium instruction is generalised in secondary schools while English-medium instruction is confined to some few areas. In fact, the previous language policies and the prestigious status of French in different domains of life in the country have somehow contributed to this choice.

There is some diversity in the subjects taught through CLIL. In Europe, the subjects taught through CLIL vary from one country to another, although in most cases CLIL is used for instruction in humanities, such as history, geography and social sciences (Eurydice, 2006). By contrast, countries worldwide, including Morocco, have chosen natural sciences, physics and mathematics as CLIL subjects and maintain humanities in national languages. The main reason behind such a choice is that some international languages such as English are the global languages of science and technology. Therefore, there is an assumption that students learn better when they study content knowledge through a global language since that content knowledge was originally produced in that language

Previous studies

Reviews of previous studies on bilingual education reveal positive outcomes for both foreign language and content learning, in comparison to traditional learning (Ruiz de Zarobe, 2015; Perez-Cañado, 2018; San Isidro, 2019). However, the most common trend among most of previous studies is their focus on language gains in bilingual education programs, in contrast to content learning which has received less attention. Even with CLIL programs in Europe, recent reviews of research have shown that evaluation is still concerned mainly with foreign language benefits (Coyle et al., 2010; Ruiz de Zarobe,

2015). Therefore, Coyle et al. (2010) suggested that research should provide both performance and affective evidence to substantiate CLIL efficacy. While the performance elements enable investigation of the learning outcomes for students in both language and content learning, the affective elements are also an important component in evaluation as they help to understand the reasons behind positive or negative attitudes towards a particular bilingual program. This combination will help gain a deeper understanding of the programs and suggest new ways to overcome deficiencies.

Regarding the performance evidence, studies can be grouped into two main categories. The first, which is the most abundant, has investigated the impact of CLIL on students' foreign language proficiency. Most studies in this group have revealed positive effects of CLIL on the target language proficiency (Admiraal et al., 2006; Merikivi & Pietilä, 2014; Verspoor, de Bot & Xu, 2015; Perez-Vidal & Roquet, 2015; Merino & Lasagabaster, 2018, among others). However, in Germany, Dallinger et al. (2016) and Rumlich (2017) did not find any significant effect of CLIL provision on language learning. The second group includes studies which have been concerned with content learning outcomes in CLIL programs. These studies can be put into three types of findings. The first type found that CLIL students outperformed their non-CLIL cohorts in content subjects (Jappinen, 2005; Serra, 2007; Perez-Canado, 2018; Hughes & Madrid, 2020). The findings in the second type revealed no significant effect of CLIL on subject matter knowledge (Vollmer et al., 2006 cited in Ruiz de Zarobe, 2015; Stohler, 2006; Admiraal et al., 2006; Grisaleña et al. 2009). In contrast to the previous mentioned studies, studies in the third type found detrimental effects of CLIL provision on content learning (Marsh et al., 2000; Seikkula-Lein, 2007; Anghel et al., 2011; Fernández-Sanjurjo et al., 2017).

The second important component in the evaluation of bilingual programs is affective factors, namely attitudes and motivation. In this regard, many studies have revealed that stakeholders including the teaching staff, students and parents hold positive attitudes towards the implementation of bilingual programs (Lasagabaster, 2009, 2011; Navarro Pablo & García Jiménez, 2018; San Isidro & Lasagabaster, 2019, 2020; San Isidro, 2019, among others). Also, positive outcomes have been revealed regarding teachers' and students' motivation to engage in bilingual programs (Seikkula-Leino, 2007; Pfininger, 2016; Navarro Pablo & García Jiménez, 2018; San Isidro & Lasagabaster, 2019, 2020). By contrast, some other studies have revealed either neutral or negative outcomes regarding the affective factors in bilingual programs (Fernández-Fontecha & Canga-Alonso, 2014; Herax & Lasagabaster, 2014; Lasagabaster & Doiz, 2017; Papaja (2012).

In the Moroccan context, there is inadequate research on CLIL instruction in secondary schools, although CLIL practices have always been a normal state in Moroccan education. Kaddouri (2018) surveyed students' and teachers' perceptions to examine the challenges that students face in learning content through French in common core classes in the region of Houaz. The findings revealed that students find difficulty understanding scientific content through French and that teachers tend to switch to Arabic to facilitate students' comprehension. As for EMI, apart from one unique study on doctoral students' attitudes towards the potential use of EMI in higher education (Belhiah & Abdelatif, 2016), the researcher could not locate any other studies addressing the potential use of

EMI in Moroccan education. The findings obtained in this study show that doctoral students prefer English-medium instruction in higher education.

To sum up this section, although most studies have found positive outcomes regarding the implementation of bilingual programs, especially in terms of language benefits and affective factors, the results remain somewhat inconclusive since research concerns have been raised about onset differences between the experimental and the control cohorts. In several studies where CLIL students have achieved positive results, there have been initial differences in favour of the experimental groups. (Bruton, 2011, 2015). Furthermore, most bilingual education research is carried out on small-scale initiatives. Little is known about the large-scale bilingual education experiences in a multilingual postcolonial context, as is the case with Morocco.

Method

Research design and questions

The present study seeks to understand the implementation of the Language Alternation policy which is based on teaching scientific subjects through foreign languages. Grounded theory, which is a branch of the qualitative approach, has been adopted as a methodology for exploring teachers' attitudes. In grounded theory methodology, based on Strauss and Corbin's model (1998), participants play the major role in defining and explaining their challenges and problems rather the researcher. Codes and themes are defined through an inductive approach, which suits such real-life settings. The semi-structured interviews conducted in this study were guided by the following questions:

- a. What are physics teachers' attitudes towards the teaching of science subjects through a foreign language, French and English?
- b. Can science teachers cope with French as medium of instruction instead of Arabic?
- c. Does the use of French as a medium of instruction have any positive effects on students' language learning and academic progress?

Participants

Fifteen physics teachers from four different regions in Morocco participated in this study. All the teachers have at least one International Baccalaureate class, where students are taught through French, in addition to mainstream classes. Their years of experience range from 3 to 20. Their age ranges from 28 to 52. Ten of the participating teachers are teaching in urban areas, while the others are teaching in rural areas. Concerning their gender, 9 teachers are male while 6 are female.

The participating teachers have all their university degrees from Moroccan universities, 10 have a master's degree, while five have a bachelor degree. All the participating teachers had been taught through Arabic in their secondary schools and through French in their higher education. Table 1 provides general demographics about the participating teachers.

Table 1: Teachers' demographics

Interview ID	Pseudonym	Age	Years of teaching experience
1	Yousra	32	4
2	Mehdi	39	15
3	Abdelaziz	31	6
4	Omar	29	3
5	Karim	48	18
6	Halima	34	11
7	Lamyaa	35	7
8	El Maati	46	15
9	Adil	50	20
10	Mohsine	30	5
11	Nora	37	14
12	Amina	28	5
13	Nabiha	30	7
14	Slimane	52	20
15	Mohammed	28	6

SPSS was used to analyse participants' educational background and language proficiency. Findings are presented in Table 2.

Table 2: Teachers' educational background and language proficiency

		Frequency	Percent
Educational background	Bachelor degree	5	33.3
	Masters degree	10	66.7
French proficiency	Very good	5	33.3
	Good	8	53.3
	Medium	2	13.3
English proficiency	Very good	0	0
	Good	1	6.7
	Medium	3	20
	Low	11	73.3

Procedures

The study investigates the use of foreign languages for the teaching of science subjects in Moroccan secondary schools through exploring the attitudes of physics teachers towards the integration of content and foreign language in the same classroom. Based on grounded theory methodology, the participating teachers were interviewed in two phases, 8 teachers in the first phase and 7 others in the second phase. The first 8 interviews were face-to-face, while the other 7 interviews were through phone calls. The face-to-face interviews were longer. The longest interview lasted 63 minutes. The shortest interview,

which was through a phone call, lasted 23 minutes. The semi-structured interview questions are given in Appendix 1.

The interviews were conducted in Moroccan colloquial Arabic. The researchers worked together to transcribe the data, translate into English, and identify the major themes.

Results

Following grounded theory methodology, the researchers identified five themes:

1. teachers' perceptions of French and English;
2. the effect of the Language Alternation on students' first language and identity;
3. the language of instruction;
4. teachers' French and English proficiency;
5. the impact of French-medium instruction on students' physics achievement.

Teachers' perceptions of French and English

When asked about the teaching of foreign languages in Moroccan education, most participating teachers made a comparison between the status of English and French in the international language market. They perceived English as a global language for communication, unlike French which, they thought, is limited in use to the previous French colonies. They thought that the language policy makers in Morocco seem to ignore the increasing importance of English in major domains of life, and insist on prioritising French as a first foreign language, despite its recession worldwide. This indicates that although French is still institutionally supported, English is increasingly spreading in the Moroccan community, especially among the youth.

Excerpt 1 When deciding to teach a foreign language to young generation, we should take into account the importance of this language in the most domains of life in the world. Based on this factor, I think education authorities in our country should invest more to promote the learning of English, which is the leading language in the world unlike French which is very weak and very limited in scientific areas. (Mehdi, a high school teacher)

Some teachers drew a comparison between the use of French in formal and informal settings. They think French still enjoys prestige in formal settings such as education, the media and the administration, due to official support, unlike informal settings such as the Internet where there is an increasing interest in English thanks to the advances and expansions technology. Some teachers give the example of videogames and content designing on *YouTube*, where English is the major working language. Because Moroccan youth are increasingly becoming interested in such areas, they are unconsciously influenced by the dominance of English in such fields, which triggers positive attitudes towards the English language.

Excerpt 2 People have become aware that English is the language of science and technology. Young people are obsessed with computer games. Most of these games are in English. These games help them learn English unconsciously and better than school. Also, they find English easy and simple to convey their ideas. English has become a trend among young people. It's a prestige. Also, if you follow the famous Moroccan youtubers you'll see that they sometimes use English words and expressions. In science, technology and economics, English is a reference. Most scholars in these areas write in English. (Yousra, a junior high school teacher)

When asked about their opinion about the introduction of EFL subject in elementary schools along with French, most participants refuse the idea of having two foreign languages in elementary schools. They think it is too challenging for elementary students to cope with two foreign languages along with Arabic, which is a second language. They insist on gradually replacing French with English starting from first grade. They argue that students will find it easier to learn English, unlike French which they consider to be the bane of students' academic career. Although French is taught in all levels of schooling as a first foreign language, students still find it challenging to master the language.

Excerpt 3 No, we should not introduce two foreign languages in the elementary level as this would be too challenging to students. It would be difficult to cope with two different foreign languages at this young age. I think we should start with English in primary schools and then maybe introduce French in secondary schools. (Halima, a junior high school teacher)

The effect of the bilingual program on official languages and national identity

In response to the question about the effect of foreign languages on students' learning of national languages, the participating teachers raised issues related to students' mother tongue, identity, culture and students' Arabic proficiency. The findings show different views. For example, Omar, a junior high school teacher, thought the priority given to foreign languages in our education affects the maintenance and transmission of our identity and culture to the young generations.

Excerpt 4 The expansion of the prestigious languages in Morocco has negative effects on our identity and culture. It's because we haven't developed intellectual immunity towards the cultural influence which is transmitted through foreign languages. Our education is also responsible because it doesn't emphasise the maintenance of our identity and the transmission of our culture to the young generations. (Omar, a junior school teacher)

Similarly, Mohsine, a high school teacher, thought the focus on French has led to the marginalisation of official languages in both formal and informal settings. He explained that the dominance of French in higher education and the Moroccan job market has led parents to worry more about their children's French proficiency, ignoring national languages, which, according to him, represent our identity.

Excerpt 5 National languages are marginalised in both official and informal settings. We see, for instance, several parents who prefer to use French with their kids instead of Arabic. The students' proficiency in Arabic has decreased due to the exaggerated priority dedicated to French. (Mosine, a high school teacher)

Adil, a high school teacher, mentioned factors related to students' parents' level of education and social class. He argued that educated parents in upper classes tend to use foreign languages, especially French, in their interactions with their children. This negatively affects the children's acquisition and use of their mother tongue and hence influences their identity and culture. By contrast, students who live in poor rural areas are not influenced, because their exposure to French is limited to school and their French proficiency is low.

Excerpt 6 For the poor classes, there aren't any significant effects because the use of French is limited to school. By contrast, French affects negatively the higher and the middle classes, because parents in these classes tend to speak French with their children. Children's use of their mother tongue is highly influenced by French vocabulary. Parents have become aware that languages can help their children have an edge in the job market, more than their technical or scientific competence. (Adil, a high school teacher)

Unlike the previously mentioned views, Mohammed, a junior high school teacher, did not think identity to be a big issue in our education. He thought we should care more about students' futures by equipping them with the necessary skills to integrate in the job market.

Excerpt 7 I know that some people associate language with identity and teaching our kids foreign languages will affect their identity, but I don't see evidence for that. Even learning only through Arabic does not secure their identity. so we should stop getting obsessed with the issue of identity and think about our kids' future. (Mohammed, a junior high school teacher)

The language of instruction

Most of the physics teachers interviewed preferred teaching their subjects through French instead of Arabic. They thought scientific subjects in secondary schools should be taught in the language which is used in higher education, i.e., French, to facilitate students' integration in higher education. They argued that current instruction which is based on using Arabic as a language of instruction in early levels of schooling and French in higher education is 'unhealthy', because students in higher education face a lot of challenges due to the language barrier and discontinuity in the language of instruction. They added that many students find themselves obliged to change their streams after they graduate from high school, due to their low proficiency in the language of instruction.

Excerpt 8 I think in order to benefit from the evolving knowledge in the scientific field we should change the language of instruction. (El Maati, a junior high school teacher).

Excerpt 9 In mainstream learning where Arabic is used as a medium of instruction, we find it difficult to teach concepts which are originally produced in the foreign language and translated into Arabic. Therefore, I think that teaching and learning scientific subjects through a foreign language is more useful and beneficial for our education. (Nora, a high school teacher).

Teachers' French and English proficiency

While most participating teachers perceived their French proficiency as sufficient (Table 2) to engage in the new policy, they did not think their English proficiency was good enough to teach their subjects through English (Table 2). Although they showed willingness to participate in any future planning for English as a medium of instruction, they did not think it to be a good choice at present the time. In addition to their low proficiency, they also thought students would find it difficult to learn physics or any other science subject through English, because their English proficiency is not sufficiently well-developed. They explained that unlike French, which students start learning at primary level, English is not taught until 9th grade. Hence, they emphasised the gradual introduction of EFL in primary schools instead of French, in order to prepare a generation of students who can continue their future schooling in English. Some teachers also suggested making English proficiency a requirement in recruiting the new generations of science teachers, through incorporating EMI in teacher education. They thought such a policy would need much training and preparation for both teachers and students.

Excerpt 10 ... Yes, I have no problem with teaching my subject through French. I had an experience last year and it was successful. But for English, I don't think I'm ready at the moment. But if we are trained, we may be able to engage in English-medium instruction in the future. (Mohsine, a high school teacher)

Excerpt 11 ... I don't think we are ready to switch to English-medium instruction at the time being. We don't have professionals who can teach in English and the training is very weak ... and even students are not prepared to learn scientific subjects through English. I think such a change needs both time and training for both teachers and students. In Moroccan public schools, students start learning English as a subject in 9th grade, how can they cope with scientific subjects in English given that their level in English is still basic? (Nabiha, a junior high school teacher)

The effect of French-medium instruction on students' achievement in physics

Although the participating physics teachers held positive attitudes towards the teaching of their subject through French, claiming that it has positive effects on students' language proficiency, they confessed that such a new direction did have some negative effects on students' achievements in physics, especially at the beginning of the program. Students sometimes encountered difficulty understanding some concepts, which necessitated the use of Moroccan colloquial Arabic for explanation. Also, in exams some students with low French proficiency found it challenging to answer questions in French.

Excerpt 12 There are students who participate actively in class, but when they sit for an exam or a test and they have to write in French, they make a lot of mistakes, which affects their achievement. They know the answer but because of their low proficiency in French, they find it difficult to write appropriately and accurately. Using a foreign language is an obstacle. If students can't graduate because of language barrier, then it's a big problem.... (Slimane, a high school teacher)

Discussion

The present study investigates the introduction of a top-down CLIL program, known as *Language Alternation*, in Moroccan secondary schools based on teaching scientific subjects through French. Using a grounded theory methodology, the study explores the attitudes of Moroccan physics teachers towards the new policy.

First, the findings emphasise the importance of teaching global languages such as French and English to young generations in the Moroccan context. Although the participating teachers agree with the teaching of physics and other science subjects through French, they call for upgrading the status of English in Moroccan education. Given that English is a world *lingua franca*, they think the teaching of English in all levels of schooling will bring more benefits for Moroccan education and students' future employment. Indeed, comparing French and English use in the domains of science and technology indicates that teachers are conscious of the increasing spread of English as a global language and the recession of French. Even the few teachers who insist on maintaining French as first foreign language in education admit that French is not a language of science worldwide, and that Moroccan students should learn English along with French. In fact, teachers' awareness of the importance of English as the world *lingua franca* has been reported in other similar multilingual contexts, such as Kazakhstan (Palatova et al, 2020; Smakova & Paulsrud, 2020). But in the context of this study, teachers think French is deeply rooted not only in Moroccan education but also in other domains of life. Hence, it is difficult to give up French and switch to English at the time being. In fact, this impression corroborates the claim made in the literature review that previous language-in-education policies both before and after independence are responsible for the dependence on French in most areas of life.

Second, this study critiques the persistent marginalisation of teachers and schools in language-in-education planning. Like previous language reforms, the *Language Alternation* policy is imposed by higher officials, with little involvement of the teaching staff. Successful bilingual programs worldwide are initiated at the bottom by schools, teachers and parents. For example, this is the case with French immersion in Quebec, which was started by parents in collaboration with teachers and schools in the mid-1960s. The program started with 26 students in a school in Montreal. Today, it is spread all over Canada, thanks to its positive outcomes. Local stakeholders are more conscious of the challenges that may hinder the success of such a language reform. In the Moroccan context, unfortunately, language planners still insist on working at the top, overlooking the

role of the local stakeholders, whose involvement can bring about promising results. Teachers are treated as mere executors of the state's educational policies.

More interestingly, the findings show that there is a gap between field executors and policymakers in education regarding the implementation of the new initiative. While the Ministry of Education chose to launch and generalise French as a medium of instruction in secondary schools, most teachers insist on switching gradually to English-medium instruction in lower levels of schooling. Although they admit that it is difficult to switch to English-medium instruction at the present time, due to teachers and students' low English proficiency, they suggested introducing English as a foreign language and a language of instruction to new generations of primary school students, to overcome the language barrier and prepare students to learn through English from the very beginning. Many of the participating teachers have shown willingness to become involved in English-medium instruction, provided that obtain appropriate training.

Also, teachers do not agree with the introduction of the new policy in senior secondary schools as a first step. Instead, they suggest implementing the new policy gradually in earlier levels of schooling before its general adoption in secondary schools. This indicates that teachers are more aware of the challenges that students face due to a switch in the language of instruction at higher levels. To overcome the challenges, many teachers call for the promotion of students' proficiency in the language of instruction, by gradually introducing it as language of instruction in primary schools.

In CLIL theoretical literature, language and content learning are considered the major indicators of a successful CLIL initiative. In the case of this study, teachers all agreed that teaching content through a foreign language tends to have positive effects on students' language proficiency. Teachers who are involved in French-medium instruction have noticed that students improve their French over time thanks to daily exposure in the three scientific subjects. This suggests that the newly introduced Language Alternation program in Moroccan secondary schools is somehow successful in terms of language learning, as it provides the favourable environment to acquire the foreign language naturally and unconsciously. This confirms findings obtained by previous studies (Admiraal et al., 2006; Merikivi & Pietilä, 2014; Verspoor et al., 2015; Perez-Vidal & Roquet, 2015; Merino & Lasagabaster, 2018, for instance).

By contrast, in congruence with Kadourri (2018) and Ben Hammou and Kesbi (2021) in Moroccan context, the findings of the present study show that such a kind of learning negatively affects students' comprehension and achievement in content learning due to their low proficiency in French. Teachers argue that students understand scientific content better through their mother tongue. Therefore, the use of Moroccan colloquial Arabic for explanation is a normal state in most French-medium classes, according to the participating teachers. These findings also tally with previous research in studies outside Morocco by Marsh et al. (2000), Seikkula-Lein (2007), Anghel et al. (2011) and Fernández-Sanjurjo et al. (2017).

Conclusion

This study sought to understand the implementation of the new language of instruction in Moroccan secondary schools. It contributes to the ongoing debate about foreign language teaching and the language of instruction in Moroccan education through investigating science teachers' perceptions and experiences about the use of foreign languages to teach scientific subjects. The findings of the study reveal the physics teachers participating in this study are satisfied teaching their subjects through French. They think the Language Alternation initiative is a good opportunity for both students and STEM teachers to improve their French proficiency. However, they seem to critique the Ministry of Education for not involving them in the conception of this new language reform. With respect to English-medium instruction, the participating teachers do not think Moroccan schools are ready for the use of English as a medium of instruction. They suggest upgrading the status of English as a foreign language in all levels of schooling and improving both teachers' and students' English proficiency before moving to such as new tendency.

Based on the study's findings, the researchers recommend the introduction of EFL in all levels of schooling starting from primary school, to enable the new generation of students to master the English language. In addition, content teachers are also required to improve their English proficiency before switching to EMI in the future. In this regard, it is desirable to set English proficiency as requirement for recruiting new generations of content teachers, which will encourage young graduates to work on their language skills. Finally, the researchers seek to raise the language in policymakers' awareness, to involve teachers and schools in the conception and implementation of future educational policies.

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Appendix 1: Teachers' Interview protocol

Date :
 Region - province :
 The interview starts at :
 The interview finishes at :

Dear colleague, the subject of this interview is the use of foreign languages as media of instruction for the teaching of scientific and technical subjects in Moroccan secondary schools. My objective from this interview is to explore your views about the new policy. Please be informed that:

- The information will be used only for research purposes.
- Your identity will not be identified.
- I will be using a recorder to record this interview.

A. Personal information form

1. May I have the following information before we begin the interview:
 - Your age:
 - Gender:
 - Education:
 - ✓ bachelor degree
 - ✓ Masters degree
 - ✓ PhD
 - Name of the institution you graduated from:
 - Your branch:
 - How many years have you been teaching?

2. What foreign language do you master? Tick the correct answer
 - French
 - English
 - Spanish
 - Other

3. How would you describe your proficiency in these languages?
 - French: 1. Very good 2. Good 3. Medium 4. Low
 - English: 1. Very Good 2. Good 3. Medium 4. Low
 - Spanish: 1. Very Good 2. Good 3. Medium 4. Low

B. Interview questions

Foreign language teaching

1. Do you think it is necessary to learn a foreign language in the Moroccan context?
 - Why is that?
 - For whom?
2. What do you think of French and English teaching in Moroccan education?
3. What do you think about the status of national languages in our education?

The medium of instruction

1. What is your general attitude towards the use of foreign languages as medium of Instruction?
2. Which foreign language would you prefer as a medium of instruction? Why is that?
3. Do you think English-medium Instruction should be generalized to all secondary schools?
4. Based on your interaction with your students, do you think they favor the use of French as a medium of instruction instead of Arabic? why is that?
5. Based on your observation, how does French-medium instruction affect students?
 - Does it contribute to learning French?
 - Do they have difficulty understanding the subject?
6. What are the major challenges in French-medium Instruction?
7. What should be done to overcome these challenges?
8. Would you encourage your children to go in for French-medium instruction, English-medium instruction, or Arabic-medium instruction?
 - Why is that?
9. Do you think you are well prepared to teach your subject in French?
10. What about EMI? Do you think you can teach your subject through English?
11. Do you use Arabic during class? if so, how often and in what situations?
12. Does teaching in French affect your performance? Why is that and how?
13. Do you have anything to add?

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