

Science and Technology Teachers' Attitudes on Linguistic Alternation: Embracing Multilingualism in Moroccan Secondary Schools

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Abstract:- The research purpose serves to examine the issue of introducing foreign languages as a tool of instruction through “linguistic alternation” in the teaching of non-linguistic subjects. By exploring the attitudes of Moroccan scientific and technology teachers concerning the changing of the teaching language from Arabic to French. As well as identifying the challenges that prevent them from using “linguistic alternation” in their teaching practices and proposing relevant solutions to promote the quality of teaching. The study built upon a quantitative approach, by using a questionnaire instrument. The survey involved 86 science and technology teachers in secondary schools of the Provincial Directorate of National Education Inezgane Ait Melloul. The data were analyzed with SPSS statistical software. The results showcase that the majority of teachers seem to rather agree with the implementation of linguistic alternation by adopting French language as a teaching language. Hence, students' lack of French language skills was the main obstacle to understanding and assimilating courses in scientific and technical subjects, which hinders the application of linguistic alternation in the classrooms. However, teachers suggest the need to introduce compulsory French support courses at elementary and secondary level.

Keywords:- Linguistic Alternation; Science; Technical Subjects; French Language; Teachers.Insert

I. INTRODUCTION

In a constantly expanding world, the promotion of foreign language teaching is a primordial educational mission. In this regard, learning a foreign language has become a crucial qualification and an essential aspect of learning. This interest in acquiring language skills has led to the emergence of various pedagogical approaches. Among the approaches that help to master language skills is “the CLIL approach”.

Teaching a subject through a foreign language began with linguistic immersion. The origins of this approach can be traced back to the 1960s. Indeed, Marsh (2002) states that the introduction of bilingual immersion education in Canada took place in 1965, due primarily as a result of a parental movement to provide and offer to English-

speaking children with innovative ways of learning and assimilating French. Thus, immersion education programs in Canada have proved tremendously high and effective success. The participations of parents and the assistance of educational authorities were unquestionably essential components of this achievement (EURYDICE, 2006, p. 7).

Based on the same principle, various approaches have been appeared and emerged. These are known according to Duverger and al (2011) as: bilingual sections, CLIL (Content and Language Integrated Learning) sections... These CLIL-related forms of teaching have been evolving in France and throughout Europe since the early 1990s, with the European Commission's active support (Eduscol, 2020). These approaches are concerned with teaching specific content by using foreign languages, the idea that Béliard and Gravé-Rousseau (2019) strongly confirm. According to the same authors, CLIL means a bilingual learning situation in which a language different from the mother tongue is a mean for teaching/learning a subject. Thus, Charunsri (2020) indicates that CLIL refers to an approach that involves teaching students both content and language concurrently. This is employed as a means of instruction of non-linguistic disciplines, such as mathematics, geography, history, etc. Moreover, Marsh (2002) states that the terms CLIL and CLIL describe any dual-focused educational situation where another language, generally other than the first language of the learners concerned, serves as a tool for teaching and learning non-language content.

From this perspective, one effective strategy of achieving the goal of learning foreign languages. While ensuring that they remain a genuine medium of communication for learners, is through teaching various school subjects by using foreign language (Pena Díaz & Porto Requejo, 2008). In addition, CLIL implicates language as well as disciplinary skills, while also offering enriching and stimulating environments in which learners are able to develop personal, learning and thinking abilities that are pertinent to the larger curriculum (Coyle et al., 2009). Thus, Lyster and De Zarobe (2017) highlight that a highly attractive characteristic of both CLIL and immersion programs is the enhanced exposure to the targeted language and involvement in it.

In Morocco, a similar approach to CLIL has been adopted, based on linguistic alternation as an innovative educational language policy in Moroccan secondary schools. This approach designed to meet the requirements of Morocco's two educational reforms, namely the “2015-2030 strategic vision” and “Framework Law 51.17”. The choice that guided the introduction of linguistic alternation is the proficiency in non-native languages including French, English by students, alongside a reinforcement of disciplinary concepts.

At the core of this pedagogical approach are teachers, who are considered crucial actors in the implementation of linguistic alternation and play a primary role in its success. Their opinions, experiences and methods are vital to understanding and enhancing the efficiency and pertinence of this educational choice, and to determining the barriers that teachers may encounter.

The goal of the current study is to showcase science and technology teachers' attitudes regarding the change of the teaching languages of these disciplines, as well as identifying the challenges and issues they are facing while teaching these subjects and offer suitable solutions to promote the quality of scientific education in secondary school. To reach the aim of the ongoing study, we raise these questions:

- What are the attitudes of teachers of scientific and technical disciplines regarding the adoption of linguistic alternation as an educational choice, and how do teachers' gender, their continuing training and students' level influence their attitudes of this alternation?
- What are the most common challenges science and technology teachers face when using linguistic alternation, and how do they overcome them?
- So as to provide an answer to these questions, we propose the following two hypotheses:
- ✓ Teachers are rather agreeing with the implementation of linguistic alternation in science teaching. However, their attitudes vary according to teachers' gender and their continuous training as well as students' level.
- ✓ Science and technology teachers are faced with barriers such as the lack of didactic materials, overcrowded classrooms and lack of communication with students.

II. LITTERATURE REVIEW

Nowadays, learning a subject by means of a supplementary or second language is widespread across the world (Villabona & Cenoz, 2022). However, despite its advantages, CLIL faces a variety of challenges, Karabassova (2020) states that there has been limited research and work done on the large-scale, top-down deployment of CLIL approach, in which schools and teachers have absolutely no autonomy concerning the amount of teaching as well as the manner in which learning is structured. According to Coyle et al (2009), teachers are faced with the challenge of bringing the level of language up to the level of content, without getting into the trap

where language and content are limited to low, unimposing levels.

In Europe for example, curriculum integration is a major challenge for new teachers joining CLIL programs. This is primarily attributable to their inexperience in the planning of syllabus and to the fact that this kind of program involves an 'integrated design', whereby both linguistic and non-linguistic objectives, requirements, content and evaluation standards are established (San Isidro, 2018). In Andalusia, southern Spain, teachers pointed out that one of the major deficiencies of the program was their lack of methodological skills. Even though educational authorities have approved CLIL methodology for the bilingual program, certain teachers overtly confessed to being not completely sure on how to implement it, having uncertainties regarding their proficiency in its application, and/or not knowing if they were applying adequate CLIL teaching practices (Barrios & Milla Lara, 2020).

Hence, in a trilingual context like Kazakhstan, teachers were not conscious of their own contribution to their pupils' language progress, nor of language's function in content learning. They thought that they had no real function in providing “explicit language” teaching, but instead an implicit one, in “facilitating acquisition” (Karabassova, 2018). However, in Malaysia, sciences and mathematics teachers in secondary schools are particularly focused on subject mastery and pupils' results. For them, language is only a secondary consideration (Tan, 2011). One of the reasons why teachers of contents do not take particular interest to the language is their unawareness of the incorporation of both content and language as a CLIL programs goal (Villabona & Cenoz, 2022). San Isidro (2018) also points out that Teachers of CLIL subjects are not accustomed to programming their curricula and courses while taking into account the languages without mentioning foreign or complementary languages.

Moreover, another frequently mentioned issue that requires attention is the qualification of instructors: their poor proficiency in the intended language has emerged as a serious preoccupation, as well as the absence of support provided by the education authorities and the paucity of teacher training programs (Pérez Cañado, 2016). Hence, also in several developing countries, the absence of training in second language teaching constitutes a huge deficiency in teacher education (Eisemon, 1992).

Certainly, learners' insufficient language skills are also a major challenge, in order to facilitate the transmission of disciplinary knowledge, teachers find themselves in a situation where they have to resort to “code-switching” between the native language or mother tongue of the country and the foreign language employed for educational purposes in CLIL programs. In Finland for example, The CLIL learners reported having a poorer grasp of non-natives languages than those in “non-CLIL classes” (Seikkula-Leino, 2007, p. 335). However, in south Africa, as several post-colonial countries in Africa who has

adopted English as the primary medium of teaching. Teachers felt extremely pressured to teach in a language that not all pupils understand correctly and students struggle to learn in a language that they do not master (Probyn, 2001).

Nevertheless, Studies on bilingual education within post-colonial contexts, particularly in French-speaking African countries, are still in their infancy (Ben Hammou & Kesbi, 2021). Among the studies that have been elaborated in Morocco in this context, we spotlight the study realized by Kaddouri (2018) for students and teachers of the International Baccalaureate French Option (BIOF), the results revealed that the main barrier to understanding science courses (scientific content) is the French of specialty. In order to enable students to overcome this linguistic barrier, teachers alternate between mother tongues and French to make it easier for students to understand.

III. METHODOLOGY

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

A. Sample and Research Design

The current study is exploratory, investigating the introduction of linguistic diversification in Morocco educational system, notably in the instruction of science and technology subjects at secondary level. It aims to establish the attitudes of teachers towards the application of "CLIL approach" as "linguistic alternation" in Moroccan high schools, especially in scientific and technical subjects teaching, as well as the challenges teachers are facing in instructing these subjects.

The questionnaire was distributed to 200 teachers in various public secondary schools in the Provincial Directorate of National Education Inezgane Ait Melloul, but only 86 took part in the study, which explains why the sample is made up of 86 teachers of scientific and technical subjects applying linguistic alternation in their teaching practices. The teachers were selected using a random sampling technique designed to ensure the representativeness of the teachers.

B. Instrument and Data Collection

To achieve the objective and provide responses to research questions, the study mainly uses a quantitative approach. To collect the data; the choice fell on a survey by questionnaire which was distributed to respondents. The questionnaire is a versatile and adequate tool for the

collection of quantitative and qualitative data (El Kirat El Allame & Laaraj, 2016).

Before carrying out the questionnaire, the literature on the CLIL approach and the diversification of languages of instruction in non-language subjects was reviewed. To enhance internal validity, international and national studies were considered. Subsequently, the survey questions were designed in function of the study's objectives. Before distributing the survey to our study participants (the main study sample), we carried out a preliminary test on a limited number of teachers to check the comprehensibility and consistency of the survey questions. According to the teachers' responses, the questions were clear and understandable. Hence, the questionnaire included three main sections:

- **Avoid Section about Socio-demographic information:** In this section, we have gathered data about teachers relating to their: gender, age, level of education, profession, experience and area. The pertinence of socio-demographic variables comes from their capacity to offer primordial information concerning teachers' demographic and social characteristics.
- **Section on linguistic alternation and the challenges:** This section included closed questions designed to analyze teachers' attitudes towards linguistic alternation and their practice of this pedagogical approach. Teachers were asked to express their agreement or disagreement with the proposals made concerning their attitude to the introduction of linguistic alternation in science teaching, as well as the use of this teaching method in their science lessons.
- **Open questions section:** In this section, teachers were asked to identify the main constraints they have faced when practicing linguistic alternation in teaching science and technology lessons. By choosing from a pre-established and pre-defined list of obstacles and difficulties, and by providing, if necessary, relevant comments and additional answers to these questions. Indeed, this section also enabled teachers to formulate concrete answers on their own experience of linguistic alternation, their suggestions and recommendations for strengthening the use of linguistic alternation in science classes.

C. Analyzing of Data

The Data collection took place over a four-week period. After being approved by several secondary school administrations, the survey was distributed to participants. Teachers were contacted via their secondary school directors, who facilitated the distribution of the questionnaire. For ethical consideration, a full clarification of the research has been provided to participants that: (a) Their information will be used for research purposes only and (b) Their identities will not be divulged.

Data analysis was conducted with SPSS software. For the closed questions, descriptive statistics were employed to summarize the teachers' responses, tables and diagrams were presented on teachers' attitudes towards linguistic

alternation and the challenges encountered. In addition, to check the association between the various variables of hypothesis 1, the “chi-square test” was implemented to verify the significance of teachers’ attitudes and various variables as teachers’ gender, continuous training and students’ level, so as to confirm or refute the research hypothesis.

IV. RESULTS

According to the Table 1, the sample is composed of 61 males and 25 females. Regarding age of respondents, 39 are between 30 and 40 years old, 33 are over 40 and 14 teachers are under 30. In terms of level of education, 60 teachers have a bachelor's degree, 16 have a master's degree and 5 have a PhD. This representation is shown in the Table 1 below.

Concerning profession of respondents, 35 are teachers of mathematics, 21 are teachers of physics and chemistry, 25 are teachers of life and earth sciences and finally 5 are technology teachers. As regards seniority or experience, 73 have more than 4 years of professional experience, while 6 have between 2 and 4 years of experience as well as 7 have less than two years' experience. Finally, the vast majority of teachers are located in urban areas with a percentage of 91.9% and 8.1% of them are based in rural areas. Authors and Affiliations.

Table 1: Socio-Demographic Characteristics of the Respondents

No	Demographic Characteristics		Teachers	
			Total	%
1.	Gender	Male	61	70.9
		Female	25	29.1
2.	Age	<30	14	16.3
		30-40	39	45.3
		>40	33	38.4
3.	Educational Qualifications	Bachelor	60	74.1
		Master	16	19.8
		PhD	5	6.2
4.	Profession	Mathematics teacher	35	40.7
		Life and earth science teacher	25	29.1
		Technology teacher	5	5.8
		Physics and chemistry teacher	21	24.4
5.	Experience	<2 Years	7	8.1
		2-4 Years	6	7.0
		>4 years	73	84.9
6.	School establishment	Rural area	7	8.1
		Urban area	79	91.9

Fig. 1 presents teachers’ attitudes regarding the implementation of linguistic alternation in science teaching.

According to Fig. 1, we notice that 25 respondents are rather agree with the change of the languages of teaching of scientific and technical disciplines, however 23 teachers do not really agree with the linguistic alternation, 21 of them totally disagree with it. On the other hand, 17 teachers totally agree with the introduction of this pedagogical approach in non-linguistic subjects, those teachers think that the introduction of linguistic alternation is a good choice to improve the quality of educational system. However, in order to test the association between teachers' attitudes towards linguistic alternation and various variables in the study, we used the “chi-square test”, which checks the association of two variables. We began by testing the significance of teachers' attitudes and their gender.

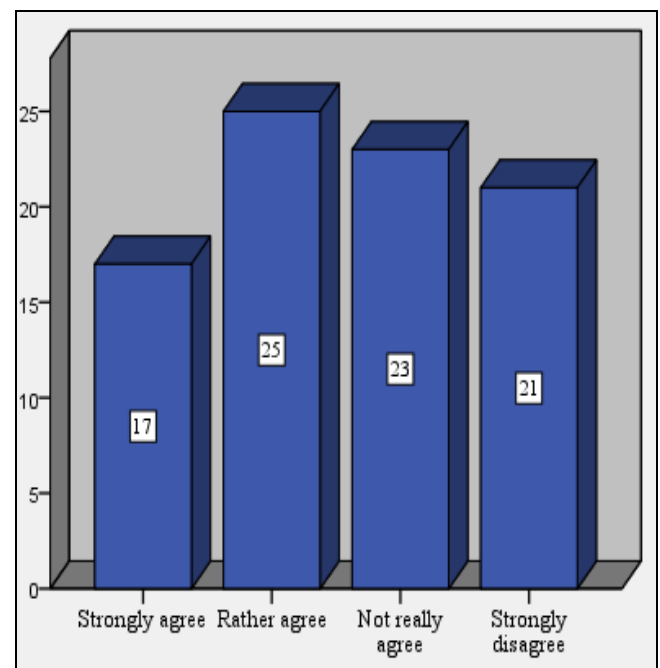


Fig 1: Teachers’ Attitudes Regarding the Change of Language Teaching of Science and Technology at Secondary Level

Table 2 illustrates the results of the “chi-square test” in order to identify whether teachers' attitudes towards linguistic alternation depend on their gender.

Table 2: Chi-Square Test Between Teachers’ Attitudes and Teachers’ Gender

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8,743 ^a	3	,033
Likelihood Ratio	9,833	3	,020
Linear-by-Linear Association	1,803	1	,179
N of Valid Cases	86		

According to the finding, p value = $0.033 < 0.05$, which indicates that the null hypothesis is denied, this null hypothesis states that the two variables are independent if $p > 0.05$. Thus, in our case $p < 0.05$, which shows the existence of a significant association between teachers' genders and their attitudes, so teachers' attitudes vary according to their gender.

Therefore, according to the finding in Table 3, p value is also under 0.05, $p = 0.025 < 0.05$ which indicates the existence of a significant association between teachers' continuous training and their attitudes, so teachers' attitudes vary according to their continuous training.

Table 3: Chi-Square Tests Between Teachers' Attitudes and their Continuous Training

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9,389 ^a	3	,025
Likelihood Ratio	13,695	3	,003
Linear-by-Linear Association	2,893	1	,089
N of Valid Cases	85		
a. 1 cells (12,5%) have expected count less than 5. The minimum expected count is 4,71.			

Table 4: Chi-Square Tests Between Teachers' Attitudes and Students' Level

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8,057 ^a	3	,045
Likelihood Ratio	7,277	3	,064
Linear-by-Linear Association	4,217	1	,040
N of Valid Cases	85		
a. 2 cells (25,0%) have expected count less than 5. The minimum expected count is 3,76.			

Based on results in table 4, p value = $0.045 < 0.05$ which means the existence of a significant association between teachers' attitudes and students' level, so the attitudes of teachers regarding the introduction of linguistic alternation depend on students' level.

As a result, based on Figure 1, which illustrates teachers' attitudes towards linguistic alternation, and Tables 2, 3 and 4, which demonstrate the test of association between this variable and other variables, namely teachers' gender, their continuous training and students' level, we

conclude that hypothesis 1 of our research is confirmed, which means that teachers are rather agree with the implementation of linguistic alternation and their attitudes vary according to teachers' gender and their continuous training as well as students' level.

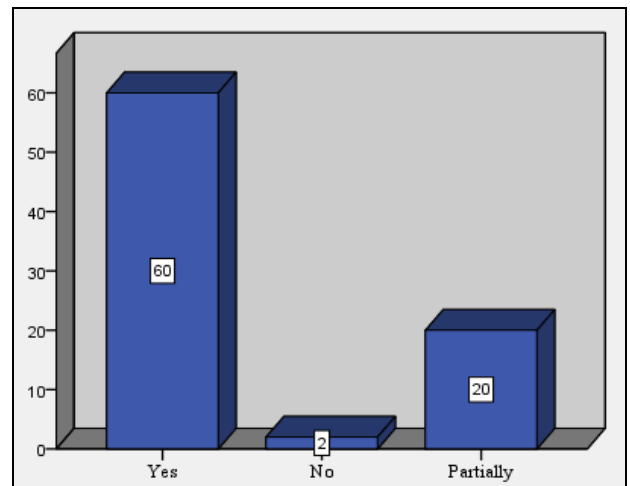


Fig 2: The Application of Linguistic Alternation in Classes

Hence, Fig. 2 shows the application of linguistic alternation as a pedagogical approach by science and technology teachers, we find that 60 teachers use linguistic alternation in their teaching practices and 20 of them use it in a partial way. This distribution can be seen in Figure 2 above. However, we found that four data were missing in this question, since four respondents did not specify if they were currently using this approach in their teaching practices or not.

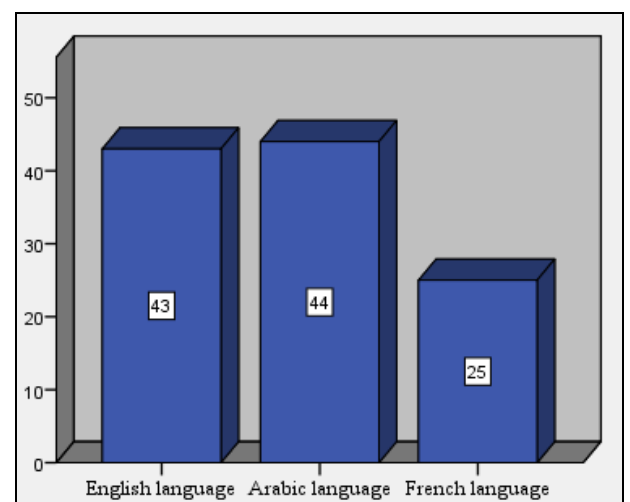


Fig 3: Preferred Language of Instruction

In Fig. 3, The question was multiple-choice, enabling teachers to choose their preferred language(s) of instruction. So according to the Figure 3, 44 teachers prefer to instruct in Arabic language, which is Morocco's official language, while 43 teachers prefer English since it symbolizes the language of internationalization and scientific research, we can notice that the number of teachers who prefer English and those who prefer Arabic are almost equal. Nevertheless, the remaining 25 teachers

prefer French which is considered the language used in superior education, in administrations and so on.

However, according to Table 5 the majority of teachers who disagree with the implementation of linguistic alternation in the instruction of science in high schools are

those who prefer Arabic as a language of instruction. Nevertheless, we notice that teachers who opt for non-natives languages as a tool of teaching are those who agree with the introduction of linguistic alternation in secondary level.

Table 5: Teachers' Attitudes and their Preferred Language(S)

		Teachers' attitudes towards linguistic alternation			
		Strongly agree	Rather agree	Not really agree	Strongly disagree
Preferred language	Arabic language	0	6	19	19
	French language	11	12	2	0
	English language	10	15	10	8

Indeed, these teachers encounter several challenges and obstacles, and each teacher can indicate various challenges it faces, including the following:

Table 6: The Challenges and Obstacles Teachers Encounter When Teaching Scientific and Technical Subjects in French

Challenge		Total	%
Students do not assimilate scientific courses given in French	Yes	77	89,5
	No	9	10,5
Lack of didactic tools	Yes	36	41,9
	No	50	58,1
Lack of experimental equipment	Yes	34	39,5
	No	52	60,5
Overcrowding in the classroom	Yes	40	46,5
	No	46	53,5
Overloaded textbooks	Yes	53	61,6
	No	33	38,4
Other challenges	Yes	11	12,8
	No	75	87,2

As it shown in Table 6, 77 teachers state that students do not assimilate scientific lessons given in French, 53 of them suffer from school manuals overloading, 40 affirm that the overcrowding of the classes is a challenge that makes the teaching/learning process difficult. Certainly, 34 of them are confronted with the lack of experimental equipment and finally 36 suffer from a deficit of didactic tools. This distribution of challenges can be better seen in Table 6 above. Other challenges reported by some teachers include: lack of technological equipment and students' low French language skills in all classes.

So, according to Table 6, our second hypothesis is confirmed which states that teachers are faced with barriers such as the lack of didactic materials, overcrowded classrooms and lack of communication with students.

Hence, to overcome these challenges and promote the integration of linguistic alternation in the instruction of certain subjects, particularly science and technology, teachers suggest the following:

- "A solid and comprehensive language training for teachers of non-language subjects."
- "Mandatory introduction of supplementary French courses in elementary and secondary schools."
- "A reduction in the number of teaching units."
- "Number of pupils must be less than 30."
- "Accessibility of information technology and didactic tools."

V. DISCUSSION

This study explores the application of linguistic alternation in Morocco's public secondary schools involving science and technology teaching in non-native languages, particularly French. Based on a quantitative survey of 86 teachers of these subjects, the study shows their attitudes regarding the introduction of this linguistic diversity and the adoption of French as a teaching language for scientific and technical subjects. The findings of this study revealed a several conclusions: Firstly, it reveals that the majority of Moroccan teachers seem rather agree with the adoption of CLIL approach in teaching non-language subjects by teaching science and technology subjects in French instead of Arabic. Hence According to the finding, there was a significant statistical association that exists between teachers' attitudes and various variables as gender of teachers, ongoing training and students' level which means that teachers' attitudes depend of this variables. Indeed, the majority of teachers surveyed apply linguistic alternation fully, with a minority of respondents practicing it partially, and they use this pedagogical approach in their teaching practices to instruct these science subjects in French. Nevertheless, the teachers surveyed claim that they encounter difficulties that hinder the use of linguistic alternation to teach these subjects, the first one concerns communicating with their pupils who are often unable to understand what the teacher is explaining to them.

Certainly, even with the implementation of linguistic alternation in 2019 to teach science and technology subjects in French, students' low level of French does not permit them to study these disciplines in a foreign language. Pupils suffer from the lack of language skills; those students are unable to assimilate the scientific courses taught in French which hindered their learning of these lessons. In fact, since after 3 decades of teaching non-linguistic subjects in Arabic, students are used to studying scientific subjects in these language. This reflects the primary challenge that faces teachers, the majority of them underlined the fact that their students cannot understand correctly what they said in. Aimade (2018) state that whatever the level of learners - primary, secondary or university - the sharp decrease in Moroccan Students' French level is a fact that cannot be ignored or denied. This has led to the use of code switching by most of the respondents, who admit that they use this practice to facilitate the transmission of disciplinary knowledge, as well as for better subject learning and to interact with students and attract their attention. According to Ben Hammou and Kesbi (2021), teachers reported that pupils' lack of knowledge with the vehicular language affects the quality of learning in these disciplines and requires the usage of the first language (Arabic language) as a tool to help pupils' understanding.

Thus, this situation is not limited only to Morocco, as numerous studies have demonstrated the use of code-switching in several countries when teaching CLIL programs to facilitate the concepts. Concurrently, Lebanon situation is similar, it seems that French (or English) is the teaching language in non-linguistic disciplines, although in a bilingual communication context, the use of code-switching represents the classroom discourse in these subjects (Smaili et al., 2016). In china for example, a study realized by Jiang et al. (2019) about teachers' practices and perceptions concerning the instauration of English as a tool of teaching, they point out that one of their participating teachers claimed that code-switching provides the most effective method of avoiding disruption and incomprehension, and more pertinently, of guaranteeing efficient and appropriate teaching. This teacher believes that to resort to Chinese in order to explain conceptual knowledge is not only safer, but also faster. Thus, they add that it's true that the transition to the first language (L1) and written instructions could have been helpful in removing incomprehension. Probyn (2001) state that some teachers indicated that they concentrate on communicating content subject and employing their native language to surmount the obstacle to comprehension raised by English. However, the lack of language skills doesn't just concern students; some teachers are also faced with a lack of mastery of the target language. According to Jiang et al. (2019), teachers admitted that their proficiency in English was not sufficient to achieve the implementation of content and language teaching as defined in the lesson guidelines. Nevertheless, the additional workload related to course planning was not a concern, the poor outcomes of academic content teaching were very worrying for them. In the local context, Bouziane and Rguibi (2018) adds that the Moroccan education system's lack of performance in language teaching has been

highlighted by several organizations in both national and international one. According to analysis of the results of PNEA (2019), which concerns pupils in their final year of both primary and middle school, we find that two essential subjects, French language and mathematics, have poor proficiency levels in learning on both linguistic and cognitive levels. These results revealed that, there is a widespread deficit in students' language, mathematical and scientific knowledge and skills. Nevertheless, according to Zhaoui (2020), the deficiency of Moroccan educational system is not exclusively due to linguistic barriers, there are multiple other factors involved: school drop-out, inadequate teacher supervision, lack of equal opportunities between pupils in both public as well as private areas, overcrowded classrooms and so on.

Secondly, teachers suffer from overcrowded classrooms and lack of didactic materials and tools to facilitate the understanding of courses and the transmission of knowledge. In Serbia the challenges faced by teachers are numerous: concerning legal requirements, CLIL teaching planning, linguistic skills of teachers, materials usage and increase, as well as teacher progress and assistance (Lazarević, 2022). Pérez Cañado (2016) reports that insufficient curriculum and lack of availability of ICT, as well as the lack of access to equipment in English, have all been documented. In Malaysia, Tan (2011) specifies that teachers are not trained in language pedagogy. However, Cenoz (2013) states that successful learning of a language or content is inevitably connected with the right pedagogical practices implemented by properly trained teachers using the most suitable equipment. In addition to not being able to complete courses before the end of the year, teachers complain of overloaded curricula. Nasser et al. (2017) confirm these idea, in accordance with their study on "Difficulties in learning physical sciences among secondary qualifying schools students in morocco", teachers claim that it is difficult to use pedagogical approaches to encourage pupils to follow the subject and engage their attention, due to the quantity and structure of the curricula, these difficulties are linked to curriculum restrictions. Programs have tended to be overloaded because there has been no commensurate increase in teaching time as content has expanded and diversified.

Therefore, concerning the preferable language of teaching, most of the respondents prefer Arabic as the tool of instruction of scientific and technical subjects, even after the adoption of the educational language policy based on linguistic alternation in the instruction of these disciplines in a non-native language. Indeed, most teachers who have expressed their disagreement with the application of linguistic alternation in the teaching of science in secondary schools were those who preferred Arabic as the medium of instruction. In fact, many of them believe that science subjects should be taught in the mother tongue, so as to allow students to grasp their lessons. According to Mgharfaoui (2016), when we refer to insufficient proficiency in the French language, this difficulty in fact mainly concerns pupils in public schools. This leads teachers to favor Arabic as the language of teaching for

scientific and technical subjects and to offer their lessons in this language.

On the other hand, there are other teachers who prefer English as the instruction language of science, advocating the replacement of French language by the English one, which is widely represented and worldwide spoken and symbolize the language of science and research. This observation has been emphasized by Ben Hammou and Kesbi (2021), according to their study conducted with 17 scientific and technical teachers. These teachers believe that English should replace French as well as they castigate the promotion of French to the detriment of other popular foreign languages. Hence, a minority of respondents prefer adopting French language in their teaching practices, believing that it is the best language for teaching non-linguistic subjects. This could be due to the preferential and favored status of French in Moroccan society. ER-RADI and BOUALI (2020) indicates that French language holds a twofold position: taught language and language of instruction within the educational system. This position strengthens its value within the Moroccan socio-linguistic employment market. However, this is no longer the case, given the increasing focus on the introduction of other foreign languages including English and Spanish.

As is obvious, our study has its limitations, as every study has one. Firstly, the contingent of teachers surveyed for the study is small and cannot be considered representative of all science and technology teachers in Morocco. Furthermore, a group of teachers refused to take part in the study and complete the questionnaire, which explains the small sample size.

VI. CONCLUSION

The goal of the current study was to get an overview of the application of the new language policy based on linguistic alternation that is being introduced in science and technology teaching in Moroccan schools at the secondary level.

Two fundamental recommendations can be obtained from the background of the results achieved. Firstly, science and technology teachers should receive continuous formation in French (L2), the first foreign language in Morocco, because we cannot teach a subject in a language besides the mother tongue without mastering it.

Secondly, in order to overcome the linguistic challenges of the primary to secondary transition, linguistic alternation should be applied starting from the first year of elementary school, and students should be assessed in foreign languages to determine their exact language skills and provide them with foreign language support courses, if necessary. These courses aim to bridge linguistic gaps. In light of this, these courses may be a valuable resource for students hoping to improve their French language abilities and accomplish their academic goals.

REFERENCES

- [1]. G. Aimade, N. (2018). L'enseignement/apprentissage du français au Maroc entre réalité et utopie [The teaching/learning of French in Morocco between reality and utopia]. *SEMEION MED*, (1), 63-91. https://revues.imist.ma/index.php/SEMEION_MED/article/view/23208/12345
- [2]. Barrios, E., & Milla Lara, M. D. (2020). CLIL methodology, materials and resources, and assessment in a monolingual context: An analysis of stakeholders' perceptions in Andalusia. *The Language Learning Journal*, 48(1), 60–80. <https://doi.org/10.1080/09571736.2018.1544269>
- [3]. Béliard, J., & Gravé-Rousseau, G. (2019). Les programmes EMILE : principes, objectifs et mise en œuvre [CLIL programs : principes, objectives and implementation]. Commission européenne [European Commission], 1-9. <http://afef.org/system/files/2019-01/6.Les-programmes-EMILE-principes-objectifs-et-mise-en-oeuvre.pdf>
- [4]. Ben Hammou, S., & Kesbi, A. (2021). The Teaching of Science Subjects Through Foreign Languages in Moroccan Secondary Schools: Science Teachers' Perceptions and Experiences. *RELC Journal*, 1-16. <https://doi.org/10.1177/00336882211035832>
- [5]. Cenoz, J. (2013). Discussion: Towards an educational perspective in CLIL language policy and pedagogical practice. *International Journal of Bilingual Education and Bilingualism*, 16(3), 389–394. <https://doi.org/10.1080/13670050.2013.777392>
- [6]. Charunsri, K. (2020). The Challenges of Implementing Content Language Integrated Learning in Tertiary Education in Thailand: A Review and Implication of Materials. *Advances in Language and Literary Studies*, 10(4), 125-129. <https://doi.org/10.7575/aialc.all.v.10n.4p.125>
- [7]. Conseil Supérieur de l'Education, de la Formation et de la Recherche Scientifique [Higher Council for Education, Training and Scientific Research]. (2019). Programme National d'Evaluation des Acquis [National Program of the Learning Achievements Evaluation]. <https://www.csefrs.ma/wp-content/uploads/2021/11/Rapport-PNEA-2019-V-Fr.pdf>
- [8]. Coyle, D., Holmes, B., & King, L. (2009). Towards an integrated curriculum–CLIL National Statement and Guidelines. The Languages Company. <http://www.rachelhawkes.com/PandT/CLIL/CLILnationalstatementandguidelines.pdf>

- [9]. Duverger, J., Beacco, J. C., Causa, M., Cavvalli, M., Demarty-Warżée, J., Gajo, L., & Vigner, G. (2011). Enseignement bilingue, le Professeur de "Discipline Non Linguistique". Statut, fonctions, pratiques pédagogiques [Bilingual teaching, the "Non-Linguistic Discipline" teacher. Status, functions, teaching practices]. C. Beacco.–Paris: ADEB. https://liseo.france-education-international.fr/index.php?lvl=notice_display&id=31460
- [10]. Eduscol. (2020). Guide pour l'enseignement des langues vivantes : Oser les langues vivantes étrangères à l'école [Guide to teaching modern languages : Daring foreign languages at school]. Ministère de l'éducation nationale et de la jeunesse [French Ministry of Education and Youth], Paris, 1-56. <https://eduscol.education.fr/document/347/download?attachment>
- [11]. Eisemon, T. O. (1992). Language issues in scientific training and research in developing countries. World Bank. <https://documents1.worldbank.org/curated/zh/240771468739327406/pdf/multi-page.pdf>
- [12]. El Kirat El Allame, Y., & Laaraj, Y. (2016). Reframing language roles in Moroccan higher education: Context and implications of the advent of English. *Arab World English Journal*, December, 7(4), 43-56. <https://awej.org/images/conferences/Aselesproceedingsmorocco2016/4.pdf>
- [13]. ER-RADI, H., & BOUALI, R. (2020). L'alternance codique et l'enseignement du/par le français au Maroc [Code switching and the teaching of/with French in Morocco]. *Revue TDFLE [TDFLE journal]*, 1(1), 1-13. https://doi.org/10.34745/NUMEREV_1379
- [14]. EURYDICE. (2006). L'enseignement d'une matière intégré à une langue étrangère (EMILE) à l'école en Europe [Content and Language Integrated Learning (CLIL) at school in Europe]. Eurydice European Unit. Brussels. https://www.indire.it/lucabas/lkmw_file/eurydice/CLIL_EN.pdf
- [15]. Jiang, L., Zhang, L. J., & May, S. (2019). Implementing English-medium instruction (EMI) in China: Teachers' practices and perceptions, and students' learning motivation and needs. *International Journal of Bilingual Education and Bilingualism*, 22(2), 107–119. <https://doi.org/10.1080/13670050.2016.1231166>
- [16]. Kaddouri, L. (2018). L'enseignement scientifique dans les tronc communs du biof au maroc: cas des lycées d'aït ourir au haouz [Scientific teaching in the first year of high schools of the International Baccalaureate French option in Morocco: Situation of High Schools in Aït Ourir at Haouz]. *Langues & Usages [Language & Usage]*, 2(2), 4-14. <https://www.asjp.cerist.dz/en/downArticle/618/2/2/123762>
- [17]. Karabassova, L. (2018). Teachers' conceptualization of content and language integrated learning (CLIL): Evidence from a trilingual context. *International Journal of Bilingual Education and Bilingualism*, 25(3), 787–799. <https://doi.org/10.1080/13670050.2018.1550048>
- [18]. 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>
- [19]. Lazarević, N. (2022). CLIL teachers' reflections and attitudes: Surviving at the deep end. *International Journal of Bilingual Education and Bilingualism*, 25(2), 571–584. <https://doi.org/10.1080/13670050.2019.1703897>
- [20]. Marsh, D. (2002). CLIL/EMILE-The European dimension: Actions, trends and foresight potential, University of Jyväskylä, 1-204. https://www.ecml.at/Portals/1/resources/Articles%20and%20publications%20on%20the%20ECML/CLIL_EMILE.pdf
- [21]. Mgharfaoui, K. (2016). Enseignement du français au Maroc: Le paradoxe d'une langue « privilégiée » [Teaching French in Morocco : The paradox of a "privileged" language]. Bacha, Jacqueline, Ben Abid-Zarrouk, Sandoss, Kadi, Latifa et Mabrou, Abdelouahed. *Penser les TIC dans les universités du Maghreb [Thinking about ICT in Maghreb universities]*, Paris, L'Harmattan, 106-123. https://www.researchgate.net/publication/331629751_Enseignement_du_francais_au_Maroc_le_paradoxe_d'une_langue_privilegiee
- [22]. Nasser, N., Mustapha, Khouzai, E., & Mohamed, T. (2017). Difficultés d'apprentissage des sciences physiques chez les élèves du secondaire qualifiant au Maroc [Difficulties in learning physical sciences among secondary qualifying schools students in morocco]. *American Journal of Innovative Research and Applied Sciences*, 5(2), 119-125. https://www.researchgate.net/profile/taoufik-mohamed/publication/320466621_difficultes_d'apprentissage_des_sciences_physiques_chez_les_eleves_du_secondaire_qualifiant_au_maroc/links/59e7188a4585151e5465900e/difficultes-d'apprentissage-des-sciences-physiques-chez-les-eleves-du-secondaire-qualifiant-au-maroc.pdf
- [23]. Pena Díaz, C., & Porto Requejo, M. D. (2008). Teacher beliefs in a CLIL education project. *Porta Linguarum*, 10, 151-161. <https://digibug.ugr.es/bitstream/handle/10481/31786/PenaDiaz.pdf?sequence=1&isAllowed=y>
- [24]. Pérez Cañado, M. L. (2016). Are teachers ready for CLIL? Evidence from a European study. *European Journal of Teacher Education*, 39(2), 202–221. <https://doi.org/10.1080/02619768.2016.1138104>

- [25]. Probyn, M. (2001). Teachers Voices: Teachers Reflections on Learning and Teaching through the Medium of English as an Additional Language in South Africa. *International Journal of Bilingual Education and Bilingualism*, 4(4), 249–266. <https://doi.org/10.1080/13670050108667731>
- [26]. San Isidro, X. (2018). Innovations and Challenges in CLIL Implementation in Europe. *Theory into Practice*, 57(3), 185–195. <https://doi.org/10.1080/00405841.2018.1484038>
- [27]. Seikkula-Leino, J. (2007). CLIL Learning: Achievement Levels and Affective Factors. *Language and Education*, 21, 328–341. <https://doi.org/10.2167/le635.0>
- [28]. Smaili, W., Dannoun, D., & Messai-Farkh, S. (2016). L’alternance codique dans les interactions en classes des Ddnla collège au Liban [Code switching in non-linguistic subjects classrooms' interactions at secondary school in Lebanon. The effect of educational culture on teachers' language skills]. *Recherches en didactique des langues et des cultures [Research in didactics of languages and cultures]. Les cahiers de l’Acedle*, 13(1), Article 1. <https://doi.org/10.4000/rdlc.526>
- [29]. Tan, M. (2011). Mathematics and science teachers’ beliefs and practices regarding the teaching of language in content learning. *Language Teaching Research*, 15(3), 325–342. <https://doi.org/10.1177/1362168811401153>
- [30]. Villabona, N., & Cenoz, J. (2022). The integration of content and language in CLIL: A challenge for content-driven and language-driven teachers. *Language, Culture and Curriculum*, 35(1), 36–50. <https://doi.org/10.1080/07908318.2021.1910703>
- [31]. Zhaoui, L. (2020). Les enjeux du parcours international au collège, le cas de Sidi Slimane [The challenges of the international program in middle school, the case of Sidi Slimane]. *Langues, cultures et sociétés [Languages, cultures and societies]*, 6(2), 148-163. <https://doi.org/10.48384/IMIST.PRSM/lcs-v6i2.23137>