Morocco: Multilingualism, Cultural Identity, and Mathematics Education, Post-French Protectorate, a Historical Perspective

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ABSTRACT

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Through a historical perspective, this study highlighted significant events and milestones about multilingualism, cultural identity, and mathematics education in Morocco pre-, during, and post-French Protectorate. Prior research in this area has typically focused on the effect on education of multilingualism and cultural identity in general, involving mathematics education only in passing.

This study’s purpose was to explore Morocco’s attempt to restore its cultural identity post-French Protectorate and how that attempt influenced the Moroccan mathematical educational system. In addition, this study focused on the Arabic and indigenous Berber (Tamazight) languages of instruction in mathematics in Morocco to investigate if teaching and learning mathematics in the Arabic and Tamazight languages in secondary schools is preparing students adequately for the tertiary level. Finally, this study attempted to see if multilingualism and cultural identity are at the heart of mathematical educational reform and to offer insight into the state of mathematics education reforms suggested by the Moroccan government to remedy this challenge.

In order to develop a comprehensive picture of how multilingualism and cultural identity have historically influenced the mathematics education system in Morocco and answer the research questions of the study, a historical research methodology was employed based on views of numerous scholars about bilingual education, cultural identity, diglossia, and how they affect cognition and learning/teaching of mathematics. Supplementary knowledge about students’
achievements, retention, and dropout rates at the primary, secondary, and tertiary levels by gender and grade were acquired and supported by quantitative available data in the official archives supplied by the Ministry of Education, UNESCO, and other organizations.

After independence, the establishment of an educational system that would take into consideration the deeply rooted Arab-Islamic culture and language and, at the same time, make use of the imposed Western system was a priority. Arabisation received more attention, and the selection of Arabic as a national language was a form of countering the colonizer’s language policy. Morocco has a particularly complex language situation, where French predominates in most postsecondary institutions, despite attempts to restore Arabic. The indigenous Berber language also plays a role in local culture and education. This work reveals a great number of attempted reforms by the Moroccan government and also demonstrates serious flaws in recent past attempts to reconcile the language issues, but offer ways forward in relation to mathematics instruction.
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LIST OF ACRONYMS

BICS: Basic Interpersonal Communication Skills
CALP: Cognitive Academic Learning Proficiency
EMIS: Education Management Information Systems
ELL: English Language Learners
ESL: English as a Second Language (L2)
ICT: Information and Communication Technology
MA: Moroccan Arabic
MENA: Middle East and North Africa
LPP: Language Policy and Planning
LTR: Left to Right
PIRLS: Progress in International Literacy Study
TIMSS: The Trends in International Mathematics and Science Study
RTL: Right to Left
SA: Standard Arabic
SABER: Systems Approach for Better Education Results
SLIC: Second Language Instructional Competence
UIS: UNESCO Institute of Statistics
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M. D. A.
DEDICATION

I dedicate this work to all my family, especially my father Moulay Ahmed, my mother Kebira, and my dear wife Betty Ann, whose love, patience, and support have kept me going all these years.
Chapter I

INTRODUCTION

Need for the Study

Morocco, the official name of the Kingdom of Morocco, has constituted throughout history as a crossroads for many of the Mediterranean civilizations. This country’s geographical location has qualified it to be a transit link between the East and the West, therefore accumulating a rich heritage, generally, in teaching, education, and professional formation, and particularly in mathematics in which it has long traditions. Morocco is also considered one of the main strongholds that embraced the civilization and culture of the Islamic Nation and promised to protect it.

Historically speaking, Moroccans have always sought contact with other cultures, i.e., the Berber and Arabic languages and cultures have never shunned or feared interactions with European languages and cultures, notably Latin in the past and French today (Ayache, 1956; Fitouri, 1983, p.83). Many civilizations have influenced Morocco and contributed to its linguistic and cultural diversity to produce what is today a complex, multilingual profile. Two native languages, Berber (Tamazight) and Arabic, plus French, are predominant. Tamazight covers a number of widely different dialects that are not entirely mutually comprehensible. Arabic was introduced to Morocco in the 7th century. Two varieties of Arabic are used, as in other Arab countries: Classical Arabic or its modern version, Standard Arabic, and Moroccan Arabic. Spanish also once played an important role in northern Morocco throughout the Spanish occupation, though it is now only marginally used. Other languages, such as English and German, are more commonly taught as foreign languages in the public and private schools. English language skills are seen as highly desirable in terms of future career opportunities.
Before both the French and Spanish Protectorates began in 1912, education in the Kingdom of Morocco was carried out mainly in Quranic schools, which consisted of three stages: the Quranic schools which served as elementary schools; the Madrasa and Zawiyah which served as middle or high schools; and the ancient Al-Qarawiyyin University in Fez, the Ben Youssef Mosque in Rabat, and the Youssefiya Mosque in Marrakech, which provided for higher education (Benahnia, 1996). In most of these mosques, students were supposed to memorize the entire Quran as well as a considerable number of Hadiths (sayings of Prophet Mohamed) as a prerequisite to studying more Islamic and scientific subjects. Throughout this period, Arabic was the language of instruction and the language of debate and discussions.

In 1912, the treaty of Fez was signed by the Sultan of Morocco Moulay Abdelhafid and the French. The treaty guaranteed the protection of the Sultan and, in return, Morocco would become ruled under the French Protectorate. The French Protectorate was responsible for introducing the Western model of education and establishing formal schools in Morocco. Ennaji (2005) pointed out that:

French colonization created schools for indigenous children based on the Moroccan social hierarchy. Thus, for children of aristocrats, the French colonial authorities created “les écoles des notables”, for the urban class they created “les écoles urbaines” and for the rural class “les écoles rurales”, however; these types of schools were very limited in numbers. (p. 202)

The French school curricula were designed to establish certain Western beliefs as the main focus of education. The French educators carried their curricula via two basic means: “La Mission Française,” a general missionary school which was to ensure the spread of the Christian belief; and the vocational centers in some selected cities and towns. Moroccan children were not usually accepted in schools reserved for the children of the colonizers. The French introduced modern education, but only in favor of their own children and at best in favor of the children of
the Moroccan elite and collaborators. For lack of large numbers of university graduates, primary certificate holders were appointed in high positions. According to Waterbury (1970, p. 84), between 1912 and 1954, only 530 Moroccan students passed the end of the high school certificate (French Baccalauréat).

According to Ashford (1964), the French sought via their educational and administrative means to not only encourage and emphasize these sociolinguistic variants, but also to promote national division instead of cohesion. This continued to be emphasized and explicitly advocated through what is known in Moroccan history as “Dahir al-Barbari” (Berber Decree) in 1930, which aimed to split the country culturally. While some of the persons who supported the proposal may not have foreseen its ultimate political effect, it served to magnify and preserve behavior that would delay, if not prevent, Moroccan unification (Ashford, 1964, p. 47). The French colonial administration attempted, under the Berber Decree, to set up a Berber school system in which the indigenous Berber language was to be taught systematically and perhaps used as a medium of instruction, whereas Standard Arabic was to be totally discouraged. The idea was totally rejected by the nationalist movement in Morocco and was dismissed as just another strategy in the French divide-and-rule colonial policy (Hammoud, 1982).

As a response to the imposed colonial schools, which had barely any concern for Moroccan civilization and its people, nationalist and religious leaders created free Islamic schools. These free traditional Arabic schools were called “madaris hurra” (free schools). They were created to teach Classical Arabic and Islamic thought in order to preserve the Arab-Islamic traditions and values, and to compete with the French public schools which were available to French people or to a few children of the Moroccan upper classes. Moroccan demands succeeded in overturning French plans to offer a predominately Arabic and Islamic education in French-run
schools, but the resulting French-based programs offered Moroccan elites barely any opportunities within the dominating French colonial society. The negotiated plans made by the French during this period led to a distorted educational environment that incited new grievances and new plans of Moroccan resistance. Indeed, Benahnia (1996) in his dissertation when quoting Hammoud (1989) stated that:

The nationalist movement came as a rebellion against the “Dahir Al-barbari” and also as a request for a general reform in 1934, with education as a main focus, and for independence from the French hostility. The impact of World War II on France made it easier for this movement to flourish and gain strength, a fact which made France react severely by locking up most political leaders and expelling King Mohammed V. As a reaction to that, the well-known armed revolution “Harakat Al-Fida” (militia movement) started in 1954. The rebels developed later into a revolutionary army and started to have connections with the Algerian one. Under such severe circumstances, France didn’t have a choice but to free all political leaders and bring back the King Mohamed V from exile and enter into independence negotiations with the Moroccan authorities. (pp. 82-83)

After Morocco’s independence the French language was considered as a means of social promotion and upward mobility. By contrast, Classical Arabic, in this context, is strongly associated with cultural independence and the upholding of the Arab Islamic identity, the only identity justifiable in the post-colonial era (Gill, 1999). Ennaji (2005) pointed out that:

Morocco and the rest of the Maghreb [The Maghreb, commonly termed Northern Africa comprises the nations of Algeria, Libya, Mauritania, Morocco and Tunisia] cannot attain modernity before the people are immersed profoundly in their own culture; that is modernity presupposes first accepting one’s culture before indulging in or embracing a foreign one. (p. 41)

As long as this idea is not fully adopted, bilingualism and biculturalism will continue to be hot issues (Fitouri, 1983, p. 78). One of the policies adopted by Morocco post-French Protectorate is Arabisation (eradication of French colonial language and use of Arabic language only). The aim of Arabisation is to introduce Standard Arabic, the symbol of cultural independence in all fields of activity, and to progressively consolidate Modern Standard Arabic in place of French as the language of education. Arabisation’s purpose is to preserve cultural
identity and reconsolidate Morocco’s alignment with the rest of the Arab world. However, in the article entitled “Les langues au Maroc: Réalités, changements et évolutions linguistiques,” De Ruiter and Ziamari (2016) stated:

Ainsi, après plus de cinquante ans, l’arabisation a offert un enseignement chaotique et une politique éducative définitivement problématique. Concrètement, l’enseignement au Maroc est complètement arabisé dans le primaire et le secondaire. La langue de l’enseignement des matières scientifiques et littéraires est l’arabe. Tandis que le français est une matière comme les autres. Or, dans le supérieur, les matières scientifiques des filières scientifiques sont dispensées en français. (para. 48)

[Author translation]

After more than fifty years, Arabisation has offered a chaotic teaching and a definitely problematic educational policy. Concretely, education in Morocco is completely Arabised in primary and secondary education. The language of teaching of scientific and literary subjects is Arabic while French is a subject like the others. In higher education, scientific subjects in scientific fields are taught in French. (para. 48)

Indeed, Bourdereau (2006) stated, “S’il est au moins un constat qui fait l’unanimité au sein de la communauté éducative, c’est que ce hiatus linguistique entre l’enseignement secondaire arabisé et l’enseignement supérieur en français constitue l’un des premiers problèmes à résoudre” (p. 27). [Author translation: If there is at least one finding that is unanimous within the educational community, it is that this linguistic gap between Arabised secondary education and higher education in French is one of the first problems to be solved] (p. 27). Post-French Protectorate, two different educational systems in Morocco have always coexisted. The first one is the Islamic model of instruction at Quranic schools, which concentrates on Islamic studies and Arabic literature. The second is the modern model, adapted from the French type, to serve the needs of Modern Morocco. Although only a small percentage of students follow the original track (Islamic model), the government stresses its importance as a means of maintaining a sense of national and regional identity (Wagner & Lotfi, 1980). Indeed, this new reform resulted in a system that was divided into three main tracks: modern, original, and technical. The modern
track was a simple reflection of the French primary and secondary programs that had been customary during the Protectorate and used French language as a medium of instruction. The original track focused on Islamic culture and civilization and used Arabic language as a medium of instruction. The technical track used French language as a medium of instruction and offered pupils a choice of three specializations: Language and Arts, Experimental Sciences, and Mathematics. The technical track appeared to be continuously deteriorating and the struggle to maintain it is a subject in most educational debates. This divided system reflected, to a certain extent, the long and constant conflict between Arabisation and Francization in order to expand their respective spaces of use. Indeed, Ennaji (2009) quoting himself (cf. Ennaji, 2004) stated:

A judicious reform of education is badly needed in order to achieve sustainable development, tolerance, social cohesion, and the preservation of Moroccan cultural identity. Integrating multiculturalism and citizenship issues may develop critical thinking, empower students to take action for problem-solving, and develop their awareness of citizen issues and global issues. (p. 22)

Mass education started after Morocco’s independence in 1956; only 25,000 students were registered in primary education in 1955, and 130,000 new students entered the primary cycle in 1956. Popular enthusiasm for modern education grew as the link between socioeconomic mobility and educational achievement was strong. In post-Moroccan independence, French is widely used in education, the sciences, and technology. Morocco has particularly taken steps to free mathematics and its education from decades instilled by the French educational system. However, the dual system of schooling inherited from decades imposed during the French Protectorate continues to dictate student success and performance till today.

Most of the authors who have written about cultural identity and multilingualism in Morocco described the decline and threat to the extinction of the indigenous Berber language and how Moroccan Berbers are struggling to reclaim their language and indigenous culture. Yet the
story of the Berber project and the challenges it has faced from politicians, parents, and Berber natives is in many ways symbolic of the broader struggle Morocco faces as it tries to balance the competing interests of a multicultural country of over 30 million people (Schwartz, 2008). Most of the focus of these authors in their writing is on how post-French Protectorate Moroccans are torn between the Western way of life and Islamic conservatism, among many other issues.

This study is needed to highlight significant events and milestones about multilingualism, cultural identity, and mathematics education in Morocco pre, during, and post the French Protectorate. In prior research, most authors have described how multilingualism and cultural identity affected education in general, but involved mathematics education only in passing. The focus needs to be shifted solely to how multilingualism and cultural identity affect the progress of mathematics education and its reform.

Arabisation has always been at the center of debates in the educational community, but the challenges it poses to teaching and learning of mathematics at the secondary and the tertiary levels have been understudied. Various policy recommendations call for changes in high school mathematics that reflect concerns about rigor, relevance, reasoning, and sense making in high school mathematics.

After independence, the establishment of an educational system that would take into consideration the deeply rooted Arab-Islamic culture and language and, at the same time, make use of the imposed Western system was a priority. Arabisation received more attention, and the selection of Arabic as a national language was a form of countering the colonizer’s language policy. Morocco has a particularly complex language situation, where French predominates in most postsecondary institutions, despite attempts to restore Arabic. The indigenous Berber language also plays a role in local culture and education. A great number of reforms by the
Moroccan government were attempted to reconcile the language issues in relation to mathematics instruction.

Insights into Arab pedagogy can be found in some recently published works, few of them specific to mathematics instruction. Nonetheless, Abdeljaouad’s (2006) work *Issues in the History of Mathematics Teaching in Arab Countries* remains a great source of information for those interested in learning about mathematics instruction in the old Arabic schools. In the same vein, Ennaji’s (2005) book entitled *Multilingualism, Cultural Identity, and Education in Morocco* is another great source of information and a treasure of successful ideas for those interested in learning about multilingualism, cultural identity, and education in Morocco.

The issues affecting the education of today that are found in this research are focused on the nature of curriculum, the nature of instruction, and beliefs about mathematics, and are central to any mathematics reform effort and may serve as a catalyst for today’s various societies that are experiencing emerging multilingualism and cultural diversity.

**Purpose of the Study**

The purpose of this study was to explore Morocco’s attempt to restore its cultural identity post-French Protectorate and how that attempt influenced the Moroccan mathematical educational system. In addition, this study focused on the Arabic and Tamazight languages of instruction in mathematics in Morocco to investigate if teaching and learning mathematics in Arabic and Tamazight languages in the secondary schools are preparing students adequately for the tertiary level. Finally, this study attempted to see if multilingualism and cultural identity are at the center of mathematical educational reform and to develop insights into the state of mathematics education reforms suggested by the Moroccan government to remedy the language challenge.
Research Questions

1. How did the attempt to restore the Moroccan identity post-French Protectorate influence the Moroccan mathematical teaching and learning in primary and secondary schools?

2. Were learning and teaching mathematics in Arabic and Tamazight languages at the secondary level preparing students adequately for the tertiary level and how?

3. Given that multilingualism and cultural identity are central issues in Morocco’s mathematical educational reform, what are some of the remedies suggested by the Moroccan government to deal with the language and cultural dynamics?

Procedures of the Study

In order to develop a comprehensive picture of how multilingualism and cultural identity have historically influenced mathematics education in Morocco and answer the research questions of the study, we employed a historical research methodology based mainly on a careful analysis of historical books, textbooks, reviews, publications, reports, and documents preserved in official archives such as centers, libraries, and the Ministry of Education, Rabat, Morocco. Where applicable, events were explored by referring to contemporary reviews, publications, and reports provided by organizations such as UNESCO and studies done by various scholars. Supplementary knowledge was acquired and evidence was supported by quantitative data in official archives supplied by UNESCO, TIMSS, MENA, and PIRLS studies.

1. How did the attempt to restore the Moroccan identity post-French Protectorate influence the Moroccan mathematical teaching and learning in primary and secondary schools?
To answer this question, the focus will be on the Arabisation of mathematics and the challenges it poses to teaching and learning mathematics at the secondary and the tertiary levels by examining primary and secondary mathematics textbooks. This includes analyzing the phenomenon of code switching (the practice of alternating between two or more languages or varieties of language in a conversation), symbol mirroring, and symbol borrowing from Latin language to Arabic language and how they influence students’ learning and teaching of mathematics when transitioning from the primary and secondary level to the tertiary level. A brief analysis of how the Arabisation of mathematics is performed in other Arabic countries compared to the Arabisation of mathematics in Morocco is provided.

2. Were learning and teaching mathematics in Arabic and Tamazight languages in the secondary level preparing students adequately for the tertiary level and how?

Data in official archives supplied by UNESCO, TIMSS, MENA, and PIRLS studies are analyzed to compare the rate of success and/or failure of students transitioning from Arabic and Berber languages at the secondary level to the French language at the tertiary level when learning mathematics. In this part, the Arabisation implementation at the secondary level and some of the major sources of difficulty for learners in schools because of the conflicting roles of Arabic and French are analyzed. Student progress in mathematics and science and the level of academic achievement in mathematics by school grade and gender through the impact and use of TIMSS and PIRLS studies are compared.

3. Given that multilingualism and cultural identity are central issues in Morocco’s mathematical educational reform, what are some of the remedies suggested by the Moroccan government to deal with the language and cultural dynamics?
In order to develop a comprehensive picture of how multilingualism and cultural identity have historically influenced the mathematics education system in Morocco and explain the assumption made in the first part of this research question of the study, a historical research methodology based mainly on a careful analysis of students’ and teachers’ attitudes toward languages is explored by referring to prior studies by several scholars such as Ennaji, Bouzidi, and others. Evidence is supported by qualitative and quantitative available data in their studies.

To answer and discuss the second part of this question, I refer to Morocco’s Ministry of Education, among other sources, to investigate its major efforts to improve the teaching of mathematics over the years, especially by improving the curriculum and establishing regional centers for teachers training and professional development. The history of educational reform in Morocco includes a series of programs that have been launched by the Moroccan government to improve the quality of education and the way the education sector has been administered.
Chapter II

LITERATURE REVIEW OF MULTILINGUALISM, CULTURAL IDENTITY, 
AND MATHEMATICS EDUCATION

This chapter is an attempt to define culture and language. It also introduces a brief historical overview of bilingual education from the early days when transfer of language rarely took place; to where multilingualism branched into frameworks; to advanced research dealing with language ideologies, orientations, translinguaging/code switching, diglossia, dual language, and other programs. In order to understand current research on bilingual teaching and learning and to appreciate its role in shaping this new area of inquiry, it is useful to go back in time and examine some of the most influential works published over the years. A focus on the elements of innovations these studies proposed can help us see how changes were progressively introduced. This was done by invoking and organizing numerous scholars’ opinions in the sociolinguistic field and examining how the use of different theories and methodologies by different researchers has affected the ways in which they viewed identity. Furthermore, this chapter attempts to explore how cultural identity and multilingualism affect mathematics education. In addition, this chapter reviews how language and culture work together and highlight the role of mother tongues for identity building. Finally, the chapter concludes with an emphasis on multilingualism from the Moroccan perspective.

**Cultural Identity**

In order to understand the nature of human language and how culture and language work together, we need to define both. However, the definitions of culture and multilingualism are a problematic and subject to debate as the definition of language fluency. The question of cultural
identity lies at the heart of current debates in cultural studies and social theory. According to Everett (2012):

Language is how we talk; culture is how we live. Language includes grammar, stories, sounds, meaning, and signs. Culture is the set of values shared by a group and the relationship between these values, along with all the knowledge shared by a community of people, transmitted according to their traditions. (p. 6)

According to Ennaji (2005), definitions of the term “culture” abound (pp. 19-21). Some are sociological, psychological, or philosophical; others are political or historical. Culture as a concept is difficult to define. For Goodenough (1957, cited in Hudson, 1980), a society’s culture consists of whatever it is one has to know or believe in order to operate in a manner acceptable to its members. Brown (1980) argued that culture is a way of life. It is the content within which we exist, think, feel, and relate to others. It is the glue that binds a group of people together. Furthermore, Hall (1996) pointed out two principal ways of thinking about (cultural) identity. The traditional model views identity “in terms of one, shared culture, a sort of collective ‘one true self, hiding inside the many other, more superficial or artificially imposed ‘selves’, which people with a shared history and ancestry hold in common” (p. 393). Culture can also be viewed as an important part of one’s knowledge of the world. Duranti (1997) stated that if language is learned, then much of it can be thought of in terms of knowledge of the world. This does not only mean that members of a culture must know certain facts or to be able to recognize objects, places, and people. It also means that they must share certain patterns of thought, ways of understanding the world, and making inferences and predictions.

The use of different theories and methodologies by different researchers has affected the ways in which they viewed identity, and it has also resulted in the simultaneous surfacing of different terms that describe identity as a sociocultural construct. In the same vein, the term cultural identity has been defined as “an individual’s realization of his or her place in the
spectrum of cultures and purposeful behavior directed on his or her enrollment and acceptance into a particular group, as well as certain characteristic features of a particular group that automatically assign an individual’s group membership” (Sysoyev, 2001, pp. 37-38). In this respect, individuals’ cultural identity as a construct consists of a countless number of facets. Most commonly referred to and described in literature are the following facets or types of one’s cultural identity: racial, ethnic, social, economic, geopolitical, gender, religious, ability/disability, language, professional, among others.

Each of these facets represents a specific category, within which a person has specific membership(s). In his turn, Ennaji (2009) insisted that the “language-culture interface is commonly acknowledged as an important symbol of citizenship and group identity, often engendering solidarity among communities and feeling of belonging to larger population” (p. 5). Evidently, national and cultural identity is entrenched by the inter-linkage of language and culture. For instance, one language can negatively impact another in a context where assimilation or processes of oppression occur. In addition, learning another language/culture can hamper the very foundation of indigenous identities. The Moroccan educational foundations usually link the teaching of Arabic and Tamazight with the safeguarding of the country’s cultural legitimacy, while French and other European languages are viewed as gears to maintain acquaintance with the modern world. Hall’s (1996) thesis is that rather than thinking of identity as an “already accomplished fact, which the new cultural practices then represent” (p. 145), we should think instead of “identity as a ‘production’ which is never complete, always in process, and always constituted within, not outside, representation” (p. 167).
Bilingual Teaching and Learning

In order to understand current research on bilingual teaching and learning and to appreciate its role in shaping this new area of inquiry, it is useful to go back in time and examine some of the most influential works published over the years. A focus on the elements of innovations these studies proposed can help us see how changes were progressively introduced.

During the 1950s and 1960s, scarcely any studies on language transfer from non-native languages were conducted. However, at least three noteworthy publications deserve to be mentioned: Weinreich (1963), Peal and Lambert (1962), and Vildomec (1963).

Weinreich's (1963) book *Languages in Contact* focused on bilingualism rather than multilingualism, but his theories form the pedestal of later proposals of significance to multilingualism and to language transfer research. For example, he was behind the coordinate, compound, and subordinate distinction, which informed influential hypotheses such as the word association and concept mediation hypotheses (Potter, So, Von Eckardt, & Feldman, 1984), initially proposed for bilinguals but later tested with multilinguals as well. He was also behind the intuition that “transfer sometimes does not involve the outright transfer of elements at all” (Weinreich, 1963, p. 7).

Perhaps Vildomec’s (1963) work was less influential than Weinreich's (1963), even though his book *Multilingualism* remains one of the most far-reaching accounts of multilingual phenomena ever assembled to date. To our knowledge, Vildomec was the first to discuss non-native language transfer in a systematic manner as well as to argue that some instances of non-native language transfer can be informed by the emotional value connected to them. Moreover, Vildomec was the first to point out that more than one language can simultaneously influence a target language, as the following statement suggested: “If two or more tongues which a subject
has mastered are similar (both linguistically and psychologically) they may ‘co-operate’ in interfering with other tongues” (p. 212). While Vildomec’s ideas were without doubt revolutionary at the time—and were in fact mostly neglected—less than half a century later, they proved to be highly novel, original, and mostly accurate. Some limitations lie perhaps in the carefully evocative nature of his work, which somewhat clashes with recent approaches more concerned with defining fundamental cognitive processes rather than focusing exclusively on end products. Nonetheless, Vildomec’s work remains a treasure of successful ideas for those interested in language transfer and multilingualism.

The Peal and Lambert (1962) study was not directly linked to multilingualism, but is mentioned here because of its vital role in combating the view that prior language knowledge, and bilingualism in particular, was unfavorable and damaging to the human mind. In the 1960s, it was a delicate matter to speak about bilingualism or multilingualism in a productive manner, as most researchers were persuaded that the knowledge of non-native languages was an impediment rather than an asset for the individual. Peal and Lambert helped change these views by showing that, in fact, bilinguals had some definite advantages in terms of cognitive suppleness in comparison to monolinguals. Hence, researchers began to view bilinguals differently, which led to a gradual shift in research focus. Moreover, Peal and Lambert’s ample criticism of subject selection procedures used in previous studies on bilingualism generally contributed to the introduction of more rigorous practices in experimental research. For instance, Romaine (1994) stated that “Language has no existence apart from the social reality of its users. Although language is a precondition for social life, it does not exist on its own and does not simply reflect some pre-existing reality” (p. 221).
To this end, the present research examined the key topics of how and when the discipline dealing with multilingualism effectively branched out to frameworks not previously examined. One of the frameworks worth pointing out is that of Cummins (1978). His model was designed for aiding thinking when designing learning for children with English as a Second language (ESL), but as is often the case, a good practice designed for minority groups is also a good practice for all learners. Cummins split learning into four quadrants of activity (see Figure 1). The vertical scale moves from cognitively undemanding tasks, those which learners find easy, to cognitively demanding tasks, which they will find hard. The horizontal moves from tasks with a high context—for instance, using material or content the learners will find familiar and relate to abstract concepts that are much more challenging to relate to real experience, but are often the “objectives” that have been defined for them to learn. Any activity that learners take part in can sit somewhere in these quadrants.

Cummins made the distinction between two differing kinds of language proficiency, BICS and CALP (see Figure 1). BICS are Basic Interpersonal Communication Skills, the “surface” skills of listening and speaking which are typically acquired quickly by many students, particularly by those from language backgrounds similar to English who spend a lot of their school time interacting with native speakers. CALP is Cognitive Academic Language Proficiency and, as the name suggests, is the basis for a child’s ability to cope with the academic demands placed upon him/her in the various subjects. Cummins stated that while many children develop native speaker fluency (i.e., BICS) within 2 years of immersion in the target language, it takes between 5-7 years for a child to be working on a level with native speakers as far as academic language is concerned.
Figure 1. Cummins’s framework
This framework shows how children move from BICS to CALP, with increasingly high demands placed upon them.

While Cummins’s BICS/CALP distinction won over many educators against prematurely mainstreaming English learners, “a number of researchers responded with criticism (Eldesky et al., 1983; Genesee 1984; Spolsky 1984; Troike 1984; Martin-Jones and Romaine 1986; Wiley 1996)” (MacSwan & Rolstad, 2003, p. 331). Moreover, MacSwan and Rolstad added that, “A frequent concern was that conflating knowledge of language and academic knowledge as ‘cognitive-academic language proficiency’ produced a conception of language proficiency that
MacSwan and Rolstad further argued that:

Cummins’s view that schooling has the effect of improving our language implies that the language of the educated classes is in certain respects intrinsically richer than—or an improved version of—the language of the unschooled or working class. Further, we argue that because the BICS/CALP distinction is applied in the context of native language development—not just second language—it is conceptually indistinguishable from prescriptivism and related deficit views of working-class language. (p. 331)

Numerous scholars have characterized the BICS/CALP distinction and related ideas as a kind of deficit theory (MacSwan, 2000; Martin-Jones & Romaine, 1986; Wiley, 1996). Valencia (1997) defined a deficit theory as one of which posits “that the student who fails in school does so because of internal deficits or deficiencies” manifested “in limited intellectual abilities, linguistic shortcomings, lack of motivation to learn and immoral behavior” (p. 2).

Indeed, MacSwan and Rolstad (2003) offered another way of refining Cummins’s BICS/CALP when they elegantly suggested the following:

Once children have learned English sufficiently well to understand content through all English instruction, they have developed second language instructional competence, or SLIC. Unlike CALP, SLIC does not apply to native language development, and does not ascribe any special status to the language of school. Also, while CALP appears to equate cognitive and academic development, SLIC simply denotes the stage of L2 development in which the learner is able to understand instruction and perform grade-level school activities using the L2 alone, in the local educational setting. A child who has not developed SLIC is not considered cognitively less developed; he/she simply has not yet learned enough L2 to effectively learn through it. The SLIC concept thus avoids the implication that the child is deficient, and still allows us to stress the need for the child to continue to receive interesting, cognitively challenging instructions that he/she can understand during the time needed to achieve L2 instructional competence. (p. 338)

David (2006) stressed that language is undoubtedly one of the most important areas of the curriculum. In order to help students with minority languages, some educators tend to use translanguaging and code switching in bilingual classrooms, two concepts that are defined in the following section.
Translanguaging and Code Switching

The two concepts of translanguaging and code switching used in bilingual classrooms are often confused. However, they are different in terms of language interference and the individuals involved in a language practice.

“Translanguaging is the act performed by bilinguals of accessing different linguistic features or various modes of what are described as autonomous languages, in order to maximize communicative potential” (Ofelia García, 2009, p. 140). With the emphasis on translanguaging in the classroom, Lewis, Jones, and Baker (2011) suggested that:

Translanguaging often uses the stronger language to develop the weaker language, thereby contributing towards a potentially balanced development of a child’s two languages. This translates into a strategy for retaining and developing bilingualism rather than the initial teaching of a second language. (p. 644)

These relatively new ways of understanding the dynamics of bilingualism and multilingualism, particularly within the classroom context, are creating alternative opportunities for language learning and teaching, and that this translanguage approach, according to Creese and Blackledge (2010, as stated by Garcia, 2014, p. 112), is increasingly used to sustain the dynamic language of students.

Code switching, broadly defined as the “alternate use of two or more languages in the same utterance of conversation” (Fishman 1999, p. 147), is extensively studied by sociolinguists. The colonial era has left its traces in Moroccan society, resulting in extensive code switching between the colloquial Arabic varieties and French. As Sayahi (2011) suggested, “The continuing presence of French in Tunisia, Algeria, and Morocco have contributed to considerable competence in French that has allowed colloquial Arabic and French to coexist in several domains and, inevitably, often end up being used in the same conversation” (p. 114). Morocco is characterized by Arabic-French code switching, which occurs when there is a juxtaposition of
strings of words formed according to the patterns and grammatical systems of both languages. It should be noted that only balanced or fluent bilinguals are able to use real code switching. Less fluent bilinguals do not code switch per se: they borrow. Code switching occurs mainly in informal situations among people with high competence in both their languages. In formal settings, however, Moroccan bilinguals use only one of these codes since formal contexts call for the use of one language only.

According to many scholars, Moroccan Arabic-French code switching is pilloried (cf. Caubet, 1998; Ennaji, 1988; Lahlou, 1991). Despite being negatively viewed by most Moroccans, code switching is still a common practice and part of the multilingual fiber of Morocco. In education, code switching is quite common, especially in science classes; many teachers mix Moroccan Arabic and French to explain scientific and technical phenomena.

French-Arabic educated people, mainly from urban areas, tend to be in favor of code switching and regard it as a symbol of high social status (see El biad, 1991; Lahlou, 1991; Moatassime, 1992). However, Arabic-educated intellectuals oppose this form of speech, which they consider corrupt and a sign of loss of identity. Moatassime (1974) qualified code switching as a poor form of expression. For many intellectuals, code switching is one of the residues of cultural colonization and sign of lack of pride in Arabic language and culture.

**Language Ideology: Definitions and Perspectives**

Silverstein (1979) was among the first linguistic anthropologists to define language ideology as a “sets of beliefs about language articulated by users as a rationalization or justification of perceived language structure and use” (p. 193). Conceived as a general belief about language use, Silverstein’s conceptualization of language ideology embraces human consciousness and subjectivity in the interpretation of language and language practices. While
Woolard (1998) claimed that language ideologies include “representations, whether explicit or implicit, that construe the intersection of language and human beings in a social world” (p. 3). Kroskrity (2009) argued that language ideologies “represent the perception of language and discourse that is constructed in the interest of a specific social or cultural group” (pp. 72-73). Both Woolard (1998) and Kroskrity (2009) considered language ideology as a multiple and contested sociopolitical construct. In the meantime, Jaffe (2009), Leeman (2014), and Sayer (2015) viewed language ideologies not as autonomous and isolated a priori assumptions about language and language practices but instead as evolving; they exist in a continual tension between the local and global, the dominant and the dominated.

In sum, language ideologies should be an integral component of teacher education programs and language policy discussions with regard to creating equitable multilingual education. More importantly, teacher education programs should focus on engaging teachers in collaborative ethnographies of language socialization and translingual practices and an ideological analysis of those language practices in relation to multilingual education. Language policy and planning (LPP) are influenced by these language ideologies as they are by language orientations. These last topics are the focus of the next section.

**Orientations in Language Planning**

“In 1984, Richard Ruiz set forth three orientations to language planning: language as problem, language as right, and language as resource. Since that time, the orientations have only become more powerful, rising to the level of paradigm in the field of language policy and planning (LPP)” (Hult & Hornberger, 2016, p. 30). This section focuses on language as a resource, language as a problem and language as a right.
Language as a Resource

Language as a resource in its strongest form is aligned with program models that foster the development of life—long bi-/multilingualism (Hult, 2014, p. 169). Clenfield (1998) observed that children learn language through all the language experiences they have, such as discussion, conversation, lectures, scolding, stories, reading, reporting trips, parties, songs, and games. This can mean, as Ruiz (2010) suggested, raising awareness about linguistic minority communities among members of the dominant majority. He added that this is not about what the linguistic minority can do for a society as a whole, but about building greater understanding and compassion for the lives and experiences of minority communities (p. 162). In this way, dominant majority language speakers may gain a deeper appreciation of how minority languages serve important functions for identity construction, community relations, and cultural continuity (p. 164). Enclosing the discussions around language as a resource may be helpful in engaging majority and minority communities in conversations surrounding the need for bilingual education (Ruiz, 1984). An orientation toward language as a resource questions language hierarchies by valuing and encouraging bilingualism.

Language as a Problem

When people become assimilated into a new culture, they may lose some of their original language. Some people try to hold onto the language, but often young people want to adopt the new one. Other times, in places where indigenous children go to a school with a teacher who does not speak the language, there are problems such as the threat of losing the indigenous language. These people need their language to identify with their family’s history to get a sense of who they are. Language plays a role in understanding the meaning of someone’s life and if a person is forced to abandon his own indigenous language, he at risk of losing this meaning.
Language as problem orientation is a set of values that stem from a monolingual ideal and an assimilationist mindset (Hornberger, 1990, p. 24). In this view, linguistic diversity is a threat to national unity which is best achieved with a single common language (Ruiz, 1984, p. 21). The vitality of linguistic minority languages, in turn, weakens the status of a national language by competing with it in various domains of society (Horner, 2011, p. 502). Policies of this orientation tend to limit or entirely eliminate multilingualism in society in favor of encouraging the development of the dominant majority language (Ruiz, 2010, p. 166).

An orientation toward language as a problem creates a hierarchy, namely, one language dominates communication while devaluing other non-dominant languages. This orientation emphasizes lack of proficiency in the community’s dominant language as a handicap and, ultimately, marginalizes users of non-dominant languages.

**Language as a Right**

Language as a right can be defined in terms of personal, human, and legal or constitutional rights. Language as a personal right encompasses the freedom of an individual to speak in and preserve his or her heritage language. Language as a human right refers to individuals receiving protection from discrimination based on their language choice, just as people would for the religion they practice. In a broad sense, language rights can be understood as what is legally codified about language use, often with special attention to the human and civil rights of minorities to use and maintain their languages (Hornberger, 1990, p. 24; Hult, 2014, p. 164). Language is a fundamental factor in one’s ability to access the life chances afforded by a society through, *inter alia*, employment, healthcare, jurisprudence, voting, education, and media (Ruiz, 1984, p. 22). Like language as a problem, the language as a right orientation is compensatory in nature, although with entirely different core grounds. Whereas the language as a
right orientation seeks to address linguistically-based inequities using compensatory legal mechanisms, the language as a problem orientation rests on the idea of compensating for a linguistic deficit by focusing on assimilation and transition to a dominant majority language.

Although Ruiz (1984) took into account the international scope of language rights in his original formulation of this orientation, it is worth noting that his perspective was particularly informed by the U.S. policy context, where language-related rights have been advanced with respect to civil rights rather than language rights per se. More cynically, in some policies, legal rights to language might be related to advancing primarily the acquisition and use of a national/official dominant language rather than to protecting minority languages (Horner, 2011). For instance, the Tamazight language was recognized as an official language only recently in 2011 while Arabic enjoyed that role in all major fields for centuries. Language rights can be expansive or limited in scope (Ruiz, 1984, p. 24). Indeed, in the case of Morocco, Tamazight was expanded into other fields such as media, but was limited in scope to other areas such as administration and education.

**Language Situation: Case of Morocco**

Morocco’s strategic location at the crossroads of Africa, Europe, and the Middle East has made it open to an array of linguistic influences: those of the Phoenicians, the Greeks, the Arabs, the Spaniards, the Portuguese, and the French. A brief history of Morocco demonstrates that the country has never been homogeneous, culturally or linguistically. As Moroccan feminist scholar Fatima Sadiqi (2003) stated quite simply, “Morocco is a Berber, Arab, Muslim, Mediterranean and African country” (p. 17). Louis-Jean Calvet (1998) called attention to Morocco’s “multilingualism with minority dominant languages,” in which “the languages that are statistically dominant are in fact languages that are politically and culturally subordinate” (p. 40). Ennaji (2005) stated that for many authors, the Maghreb as a region emerged with the Arab-
Islamic era (647 A.D.) and developed later with the French colonization (1830 A.D.). He added that, according to Fitouri’s (1983) assumption, the Maghreb as a cultural and political community appeared during the Berber era prior to 215 B.C. after the Maghreb became Roman until 440 A.D. with the arrival of Vandals. In 534 A.D., the Maghreb became Byzantine until 647 A.D. when the Arab-Islamic phase began (Agnouch, 1987; Chafik, 1989; Julien, 1986, all cited in Ennaji, 2005).

The cultural and linguistic contexts of Morocco have been characterized by the use of Classical Arabic/Standard Arabic as well as by the presence of Berber, Moroccan Arabic, French, Spanish, and English, which have been seen as a proof of the country’s existing multilingualism. The Moroccan language arena is divided into two categories. The first includes Moroccan Arabic and Berber, which constitute feeble social and symbolic capital. The second category involves French, Standard Arabic, and English, which are the institutional languages and have strong social capital. Therefore, there exists a competition and power struggle between languages, as much within the same category as between the two separate categories (Boukous, 2009).

**Classical Arabic/Standard Arabic Language**

Classical Arabic is also referred to as Quranic Arabic as it is the written language of the Quran, the main spiritual text of Islam and the religious language of all Muslims. In the Arab world, little distinction is made between Classical Arabic and Standard Arabic, and both are normally called *al-fushá* (الفصيح) in Arabic, meaning “the most eloquent.”

Multilingualism in Morocco has been the result of the various cultural and linguistic influences left by the European and Middle Eastern invasion in the country. From the indigenous Tamazight tongue, the natives of Morocco were introduced to Arabic in the 8th century. Since then, Arabic has been established as the unifying language till today. Classical Arabic has always
been a language of prestige in Morocco. It is used for religious, educational, and official functions (Wagner, 1993). It has functioned as the language of unity and Islamic identity (Sadiqi, 2003). The religious relationship between Arabic and Islam brought the Berbers to acknowledge the Arabic language and to have a positive attitude towards it for their own religious purposes. This positive attitude, in turn, helped the Arabs and Berbers to live in harmony. However, the Berbers maintained their own traditions and native language.

Despite the many contributions the Berber language has made to the Moroccan linguistic situation and sociocultural life, it was the Arabic language that has left the most significant impact on the Moroccan sociolinguistics and has dominated the Moroccan linguistic arena.

In reference to language policy and education before the French colonization of Morocco, learning was performed mainly in the Quranic schools or mosques. According to Boyle (2000), the curriculum of these traditional schools consisted of memorizing the Quran as well as learning to read and write. Quranic schools “play important parts in teaching children how to assume their traditional roles in the Muslim community of practice” (p. 2). Wagner (1993) argued that Quranic schooling “has a significant effect on serial memory and does not generalize to other kinds of memory of cognitive skills such as discourse and pictorial memory” (p. 278). He also asserted that the Quranic pre-schooled children outperformed non-pre-schooled children (p. 279). However, Ennaji (2005) argued the opposite and stated that Quranic schools “impose a mechanical and monotonous form of learning on the child whose interest is not aroused by such a form of study, which reduces the learner’s intellectual and cognitive motivation” (p. 216).

Modern Standard Arabic is an updated version of the newspapers and magazines, modern literature, descriptions, and instructions printed on packaged products. The functional range of Modern Standard Arabic is being expanded in the course of its modernization and
standardization. Although the grammatical categories of Modern Standard Arabic and Moroccan Arabic are generally similar, the two languages may be described as “distinct languages with many differences in segmental phonology, canonical-shape norms, and morpheme structure” (Heath, 1983, p. 63).

**Moroccan Arabic Language**

Moroccan Arabic is the native language of the majority of the population in Morocco. According to Gravel (1979), Moroccan Arabic was “brought to Morocco during the nomadic invasions of the Beni Hilal Arabs” (p. 92). It shares many properties with Classical Arabic. However, it differs from it on phonological, morphological, and syntactic levels. Boukous (1979) distinguished three types of Moroccan Arabic, according to the ethnic origins of their speakers, which he termed *city Arabic*, *mountain Arabic*, and *Bedouin Arabic*. Despite such variations in phonological, morphological, and lexical levels, these subdialects are essentially comparable.

Moroccans, like most Arab speakers, tend to see their dialects as different from Classical Arabic. There are structural similarities and differences between Moroccan Arabic and Standard Arabic in terms of phonology, morphology, and syntax (see Sirles, 1985).

No one speaks Classical Arabic as a mother tongue, but Classical Arabic is used in major domains like education, religion, and government. The sociolinguistic and religious importance of Arabic gave Classical Arabic a dominating role. Berbers and Arabs viewed it as a divine language. It is the association between Classical Arabic and religion that stands out as the major factor to which Moroccan Arabic owes its prestige, given that Moroccan Arabic is a deviant of Classical Arabic. It is safe, therefore, to say that there was no linguistic conflict between Berber, Classical Arabic, and Moroccan Arabic in the precolonial era. However, the linguistic situation
changed in the colonial era, when French and Spanish were introduced by the respective authorities to an already bilingual Moroccan society.

**Berber Language**

Many civilizations, among which were the Phoenician, the Carthaginian, the Greek, the Roman, the Vandal, the Byzantine, and the Arab, influenced the Berber civilization. It is, however, the Arab civilization that has had the greatest impact and has been the most influential in the history of Morocco. Berber is considered the indigenous spoken language in Morocco. The term *Berber* originated with Greeks and Romans as they came into contact with the people of North Africa. It is etymologically derived from the Latin word *Barbaros*, which was first used by the Greeks to refer to anyone who did not speak their language. Europeans use the term *Berber* to refer to the indigenous languages of the Maghreb. The term *Berber* is so general that it covers all the Berber dialects spoken inside and outside Morocco (Boukous, 1995; Sadiqi, 1997).

The origin of Berber as a language has not been absolutely identified. According to Ennaji (2005):

The origin of Berber goes back thousands of years. There are three major hypotheses about the origin of the Berber language. The first hypothesis assumes that Berber stems from ancient Egyptian. The second stipulates that it belongs to the Afro-Asiatic language family. The third hypothesis affiliates Berber with Indo-European and Amerindian languages; however, the most plausible theory is to state that Berber is an Afro-Asiatic language, which is mainly spoken in the north of the Great Sahara and in North-West Africa. (p. 72)

According to Abbassi (1977), many hypotheses have been advanced concerning the origin of the Berbers themselves. It is claimed that the Berbers were a mixture of people from Europe and Asia in successive prehistoric migrations. Another hypothesis postulated that the Berbers were from “a Mediterranean stock which originated in West Asia and penetrated North Africa at an early Neolithic period” (Abbassi, 1977, p. 10). They live in scattered communities across
Morocco, Algeria, Tunisia, Libya, and Egypt. Some of them were also in the northern portions of Mauritania, Mali, and Niger. Berbers tended to be concentrated in the mountains and desert regions.

Between three to a dozen varieties of the Berber language are spoken in Morocco but the three most predominant ones are: (a) Tamazight in the middle Atlas Mountains in Morocco (speakers of Tamazight are the largest group of speakers of Berber in Morocco, both in terms of native speakers and of geographic region [Sirles, 1985]); (b) Tarifit in the Northern Morocco; and (c) Tashelhit spoken in Southern Morocco. The genetic relationship between Tashelhit and Tamazight is closer than between Tamazight and Tarifit (Sirles, 1985). Therefore, a particularly serious problem facing linguists dealing with comparative Berber is the question of the structural unity of autonomy among the different varieties of Berber. According to Ennaji (2005), three major problems hinder the codification of Berber: (a) its official status as a regional dialect, (b) the fact that it is only spoken, and (c) the dilemma of choosing an adequate script for Berber.

**French Language**

In 1912, Morocco was divided into French and Spanish Protectorates, precipitating the imposed spread of two other major colonial languages: French and Spanish. Among all the languages, French was the most deep-rooted in the country, owing to its status as the language of instruction in the Moroccan schools. Indeed, French education was believed to make vulnerable the Islamic tradition and national unity. The French language became inseparable from Moroccan spoken Arabic as it appeared in the frequent use of code switching and domestication of French. This French policy changed the Moroccan lifestyle and introduced a new set of values. Knowledge of French was essential to obtaining and maintaining power. According to Wagner (1993), French is “undeniably the language of social promotion, as it provides access to
job security and to a high social status” (p. 22). This supremacy was part of the broader ideology of the French colonialism. The language policy followed the divide-and-rule concept through the establishment of the Berber Decree in 1930. The intent behind this Decree was to set up Berber schools to shield the Arabic and Islamic culture and to prepare a new generation of Berbers integrated into the French culture. As Pennycook (2001) put it, “It is useful, therefore, to view colonialism as about far more than just economic and political exploitation; it was also a massive movement that both produced and in turn was produced by colonial cultures and ideologies” (p. 67). The Francophone policy, which has been continued by postcolonial governments, created a two-sided country with often contradictory ideological and political orientations (Youssi, 1995).

Multilingualism is a central characteristic of Morocco and, for many Moroccans, “language loyalty constitutes a core value of their ethno-cultural identity” (Ennaji 2005, p. 1). Moroccans (Berbers and Arabs) revolted against this policy of divide-and-rule as it attempted to break down the cultural and linguistic solidarity existing between Arabs and Berbers. In 1954, religious leaders and conservative parties advocated the implementation of Arabisation, by which they meant “replacing French, the language of the colonizer, with Arabic, the language of tradition and authenticity” (Marley, 2004, p. 29). The presence of different ethnolinguistic groups in Morocco and the social interactions among them have created a multilingual society. The Arab politico-religious conquest brought Arabic in contact with the Berber language, and the French colonial occupation introduced the French language to an already bilingual society (Abbassi, 1977).

Although both Berber and Moroccan Arabic were prevalent as vernaculars, they did not reach the prestige of French, which strongly competes with Classical Arabic in numerous social
and professional fields. One can argue that the experience of colonization was dramatic because it highlighted a strong conflict between the values and beliefs of two different cultures, Muslim and Western. Today, tension exists not only between French-Western values and Arabic-Islamic beliefs, but also within the Moroccan context, between Berber and Arabic languages and cultures. As a matter of fact, Moroccan speakers of French, English, and Spanish who are well-informed of cultural issues are proud of their Moroccan cultural heritage and identity. However, in this age of globalization, they realize that it would be impractical to keep relying simply on their untainted indigenous cultures and it would be a mistake to strip the core culture of these imposed languages. Sirles (1985) attributed this to economic factors. He pointed out that the acquisition of French was tantamount to social elevation.

**Diglossic Mixing in Arabic Language in Morocco**

As cited in Ennaji (2005, pp. 48-49), the term *diglossia* was first referred to by Marcais (1930-1931) to depict the Arabic language. He defined diglossia as:

La concurrence entre une langue savant écrite et une langue vulgaire, parfois exclusivement parlee. [The competition between a learned codified language and a vernacular, which is at times spoken only.] (pp. 48-49)

Marcais characterized diglossia in the Arabic language by comparing two varieties of Arabic, one codified and the other vernacular. Ferguson (1959) stated that the Arab world, in general, is characterized by diglossia in the sense that two varieties of Arabic (one high and the other low) coexist, namely Classical Arabic and dialectical Arabic. Classical Arabic is considered high and codified because of its association with great literacy embodiment and the Holy Quran. The Moroccan Arabic (Dialectal) is considered low because of its association with daily conversations at home and the street and it is neither codified nor standardized. Figure 2 describes diglossia in Morocco.
However, Ferguson’s (1959) classification of Arabic varieties into high and low does not really correspond to the linguistic situation in Morocco and the Maghreb at large, for we have three varieties that are in triglossic relation: Classical Arabic, Standard Arabic, and Moroccan Arabic. Thus, three distinct varieties coexist so that we have today triglossia, as mentioned in Ennaji (1991, 2001, cited in Ennaji 2005, pp. 48-49) (see Figure 3).

Following, Ennaji (2001), one may argue for the existence of quadriglossia in Morocco and the Arab world, in the sense that, in addition to the three varieties above, a fourth variety—educated Spoken Arabic (or Modern Moroccan Arabic)—is used in the everyday colloquial style of learned people. Educated Spoken Arabic, an elevated form of colloquial Arabic, is much influenced by the vocabulary and expressions of Standard Arabic (Ennaji, 2005, p. 49) (see Figure 4).
Education is one of the most important areas of public life where languages, either taught or as the medium of communication, have an obvious impact. In multilingual societies, the policy is to use the language of the majority for teaching (Romaine, 1994, 1995). Yore, Pimm, and Tuan (2007) stated that “natural language is only a starting point toward acquiring the disciplinary discourses or languages of mathematics and science”; that it is essential to engage with the “three-language problems of moving from home language to school language and onto scientific and mathematical language” to become “mathematical and scientific literate” (pp. 565-566).

Policymakers tend to use lines or inquiry of relevance to multilingualism in the learning process including studies on immersion programs, and education’s aim is to broadly help minority children assimilate into the dominant culture. However, such programs are more likely to be disruptive as teaching in the majority language might reduce the minority-language speakers’ ability in their native language (Ennaji, 2005). Minority-linguistic group children enrolled in submersion programs tend to achieve at a lower level in school than the majority-language group. Cummins (1984) reported that Latina/o children in the United States had fallen over 3 years behind average academic attainment by year 12. Thus, in addition to a language gap, there was an age gap as well (Hoffman, 1991, p. 331). Besides, Bialystok (2001) argued that
such learners tend to not become completely proficient in either the majority or the minority languages, and hence their overall ability to communicate is negatively affected.

Going further, Wright (2008) claimed that such learners’ general cognitive development might be slower as they need to learn but fail to learn the “threshold level” (a certain level of competence) in their mother tongue. Therefore, such learners might not gain a “positive self-image” as having a sense of cultural identity requires valuing one’s own language (Cummins, 1978). Moreover, the shock that comes from switching between not only school and home languages but also cultures can affect the learners’ psychological development (Javier, 2007, p. 61).

In addition, research has shown that languages are considered the most important cause of school failure among minority children as usually schools around the world give significant weight, in terms of student success, to proficiency in the language of their society (Saib, 2001). Grossjean (1999, cited in Javier, 2007, p. 16), claimed that part of the problem is due to the fact that the educational system in such communities is ill prepared to address the demands of a bilingual educational program. In a similar vein, Potowski (2007) argued that there are numerous reasons for the poor achievement of minority group children, some of which are the lack of exposure to the school language, a linguistic/cultural mismatch between home and school, and students’ socioeconomic status.

**Multilingualism and Mathematics Education**

This section aims to shed light on some of the effects that multilingualism and linguistic diversity might have at the societal level. In doing so, a particular focus is paid to how multilingualism, including mother tongue, can have a major effect on social life, especially in education.
The language of mathematics is a collection of signs or symbols, abbreviations, axioms, lemmas, methods, formulas, and units. Understanding the language is essential in mathematics teaching and learning. Obodo (1997) affirmed that the failure of learners to master mathematical language leads to poor performance. Mathematics can be recognized as a language in its own right, a language that has its own vocabulary, grammar, symbols, and punctuation (Ellerton & Clarkson, 1996). The teaching of mathematics, however, takes place within a spoken language (Zevenbergen, 2001). This spoken language is an essential element of the teaching and learning of the subject (Gorgorío & Planas, 2001). It is the vehicle for communication within a mathematics classroom and provides the tool for teacher-student interactions (Smith & Ennis, 1961).

The uniqueness of mathematics language has distinguished mathematics from other subjects. Anyone who cannot cope with imperial and native language which is based on verbal reasoning may easily get lost in quantitative reasoning where the use of mathematics language is necessary. Spatial and mathematical reasoning will help students to generate, retain, retrieve and transform well-structured visual images with the aid of mathematics language. (Lohman, 2005)

Language permits mathematics learners to ask and answer questions, to convey their understanding, and to discuss their thinking with others. It also plays a significant role in the processing of mathematical text and the interpretation of questions (Hoosain, 1991). Thought and language are together as an entity. One is dependent on the other for its existence. They grow and decay together; the child thinks and dreams in the language through which he acquires the firsthand experience of life. This naturally happens to be the mother tongue and, for this reason, the mother tongue becomes the first condition of schooling and the intellectual development of children. Fafunwa (1975) stressed that children should be given early education in the mother tongue because it will last longer in their memory than any other tongue. Even the United
Nations Education, Scientific, and Cultural Organization (UNESCO, 1953) found out that children excel more when taught in their local language.

The greater emphasis on solving mathematical word problems and applications has led many teachers to express concern about students’ struggle with this issue. They feel that students with low literacy levels and particularly international students for whom English is not a first language are struggling with comprehension of the material and the wordy nature of some of the questions (Cosgrove, Perkins, Shiel, Fish, & McGuinness, 2012). “The language used when phrasing a question poses a major problem for students whose literacy skills would be weak; they can therefore not answer a question they are mathematically capable of doing! This is a major issue!” (p. 72). Many students (including those studying at a higher level) have also experienced difficulties with interpreting word-based problems and with providing written explanations for their solutions to mathematical problems (Jeffes et al., 2013). Students also appear to lack confidence when asked to draw conclusions from a considerable amount of written information (Jeffes et al., 2013). Abiri (2003) stated that mathematics taught in a child’s mother tongue has a lot of advantages, such as overcoming limited knowledge of foreign mathematical vocabulary. Teaching in a mother tongue also brings children closer to mathematics examples and concepts; it helps the children develop a mathematical vocabulary in the mother tongue. It equally helps adults who are not literate in English (or any other language) to understand and appreciate mathematics (Lohman, 2005). Lohman added that basic arithmetic operations (addition, subtraction, multiplication, and division) are commonly used in occupational and educational settings where it is essential. Yet, the knowledge of arithmetic is not enough for learners to think reflectively and creatively. There is need for the mastery of mathematical language and verbal ability (Lohman, 2005).
Mathematics and Language-Related Orientations

Mathematics teachers in bilingual classrooms deal with competing language-related orientations. While some orientations regard bilingualism as a problem to avoid or overcome, others regard it as a resource. Mathematics education researchers have drawn on what Ruíz (1984) called language as-problem and language-as-resource (Planas, 2014; Planas & Civil, 2013; Setati, Molefe, & Langa, 2008). An orientation toward language as a problem creates a hierarchy; namely, one language dominates communication while devaluing other non-dominant languages. This orientation emphasizes lack of proficiency in the community’s dominant language as a handicap and, ultimately, marginalizes users of non-dominant languages.

In contrast, an orientation toward language as a resource questions language hierarchies by valuing and encouraging bilingualism. Mathematics education researchers have analyzed implications of a language-as-resource orientation to mathematics classrooms (Planas & Civil, 2013; Planas & Setati-Phakeng, 2014). These studies have focused on student-student interactions, describing the benefits of allowing students to speak in their preferred languages.

Linguistic Challenges of Mathematics Discourse

In a recent research review addressing language in mathematics teaching and learning, Schleppegrell (2011) points out, “The words language and mathematics can be thought of in two different ways: as referring to their relationship as systems of meaning-making and as referring to the role of language in the pedagogical context of mathematics classrooms” (p. 74). Raiker (2002) pointed out the problem with the use of everyday language in mathematics, which, if used imprecisely and inappropriately, may hinder students’ learning. Spanos et al. (1998) went beyond vocabulary and sentence-level analysis, defining linguistic challenges as either syntactic, semantic, or pragmatic in nature. Adams (2003), in advocating a more active role of reading in
math learning, enumerated the following as possible areas of difficulty: formal definitions; multiple meanings of words (particularly those that are both used in everyday interactions and in mathematics discourse with different meanings); homophones; the interaction between words, numerals, and symbols; and the significance of order in math. Challenges of the language of mathematics include specialized vocabulary and discourse features along with everyday vocabulary that acquires a different meaning in mathematics (Dale & Cuevas, 1992).

**Parents Involvement in Education**

Darling and Steinberg (1993) defined parenting style as the overall climate of parent-child interactions. Parenting style is a determinant factor in child development. It affects psychological and social functioning of the children. The widely cited model of Hoover-Dempsey and Sandler (1995) emphasizes the importance of distinguishing between home- and school-based forms of involvement. The first includes activities such as reading to the child or monitoring his or her homework, whereas the latter refers to activities such as contacts with teachers and volunteering for school. Based on the typology of parental involvement developed by Epstein (1986), school-based involvement is sometimes further divided into parent-teacher contact (e.g., talking with the child's teacher or attending a PTA conference) and involvement in school activities (e.g., volunteering or accompanying a school trip). We can understand the effectiveness of parenting style by considering two dimension of parenting, as depicted in Figure 5 (Sigelman, 1999, p. 401)
Parental acceptance / responsiveness (also referred to as parental warmth or supportiveness) refers to the extent to which parents purposely adopt individuality, self-regulation, and self-assertion by being attuned, supportive, and acquiescent to children’s special needs and demands (Baumrind, 1991). Parental demandingness (also referred to as behavioral control) refers to the claims parents make on children to become integrated into the family whole, by their maturity demands, supervision, disciplinary efforts and willingness to face up to the child who refuse to comply (Baumrind, 1991). By crossing these two dimensions, four basic patterns of parenting styles should be considered (see Table 1).

Table 1.

Patterns of parenting styles

<table>
<thead>
<tr>
<th>Authoritarian Parenting</th>
<th>Authoritative parenting</th>
<th>Permissive parenting</th>
<th>Uninvolved parenting</th>
</tr>
</thead>
<tbody>
<tr>
<td>High demandingness/ control and low acceptance/ responsiveness. Engagement is strictly adult-centred. These parents often fear losing control over children, and they discourage open communication.</td>
<td>Moderate demandingness/ control, and acceptance/ responsiveness. Open communication, trust and acceptance and encouragement of psychological autonomy are typical to this pattern.</td>
<td>High acceptance/ responsiveness, but non-demanding. These parents lack parental control.</td>
<td>Neither responsive nor demanding. These parents often fail to monitor or supervise the child’s behaviour. They are uninvolved.</td>
</tr>
</tbody>
</table>

Source: Klein & Ballantine (2001)
Early Learning in Morocco

Research has also demonstrated the importance of parents’ involvement in their children’s cognitive development. An OECD (Organization for Economic Cooperation and Development) study found that parents who play and talk to their children from their early days, who read books to them and help them with their homework, have better chances that their children will do well at school. In Morocco, such cognitive stimulation from parents is rare, especially in disadvantaged families, due to parents’ lack of education, large household size, or even a lack of information among parents about the behaviors that can help their children succeed.

One of the reasons for poor academic performance in Morocco is the neglect, by parents and policymakers, of children’s cognitive development in the years before school entry (Young, 2009). Indeed, the development of young children is generally considered a private concern in the Middle East and North Africa (MENA) region, a view that limits public investment in children’s intellectual development (Zellman, Ryan, Karam, Constant, Salem, Gonzalez, Goldman, Al-Thani, & Al-Obaidli, 2009; Zellman, Martini, & Perlman, 2011). As a result, there is a very limited supply of early-childhood programs, and those that are available may not provide high-quality care (Young, 2009; Faour, 2010). Pre-K program enrollments are low (Faour, 2010); only sub-Saharan Africa posts lower preschool enrollment UNESCO (2006). This lack of investment ignores important research on brain development, which identifies the earliest years of a child’s life as a critical period for developing the foundation for later learning (Fox, Levitt, & Nelson, 2010; Heckman, 2011).

Recent qualitative work in Casablanca, Morocco found that parents often do not view the first years of a child’s life as a time of learning. A few parents went further, arguing that there
was a risk of overexposure; they thought it was inappropriate to expose children to too much
stimulation in their first year of life because they would be unable to process that information.
(Zellman, Perlman, & Karam, 2014).

Such views contradict a large body of research that finds that parents play a critical role
in shaping their children’s capabilities in the earliest years; parents influence the development of
both cognitive and non-cognitive skills including perseverance, self-control, and self-esteem that
may affect academic success and adult achievement (Heckman, 2011; Duckworth, & Quinn,
2009; Peterson, & Seligman, 2004). Research on brain development identifies the earliest years
of a child’s life as a critical period for developing the foundation for later learning (Fox, Levitt,
& Nelson, 2010; Melhuish, 2010; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart,
2010). Coming from a home with more books also predicts better literacy outcomes for children
(Totsika, & Sylva, 2004). Limited research in Morocco supports these findings. A longitudinal
study of parental involvement and child achievement in Morocco (Wagner, & Spratt, 1988)
found that parents who had more positive attitudes about their involvement as teachers of their
children had children who were better readers at ages 6 and 7, independent of their own level of
literacy.

In order to focus on the Moroccan mathematical educational system during the French
Protectorate (1912-1956), it is important to understand the background of that same system
before the colonial era. In the next chapter, a brief historical overview of the Moroccan
mathematical tradition in the precolonial era is presented.
Chapter III

BRIEF HISTORY OF MOROCCAN MATHEMATICS EDUCATION
BEFORE THE FRENCH PROTECTORATE

This chapter provides a brief historical overview of the Moroccan mathematical tradition and how education was carried out in the precolonial era. This was done by gathering and organizing a rich collection of historical events in one place. It includes some of the old schools in Morocco, such as Al-Qarawiyyin University, and describes some of the basic methods of teaching and instruction of mathematics and the general sciences, including the pedagogy used in the old Moroccan schools. In addition, this chapter shows in an organized timeline some of the old pioneering mathematics scholars in Morocco and their contributions to the mathematics field, including Ibn al-Banna al-Marrakushi. Finally, this chapter reveals the interest of Morocco in the modernization and appropriation of European science and technology prior to the colonial era.

Old Moroccan Schools Including Al-Qarawiyyin University

Before both the French and Spanish Protectorates began in 1912, education in the Kingdom of Morocco was carried out mainly in the Quranic schools, which consisted of three stages: the Quranic schools which served as elementary schools; the Madrasa and Zawiyah, which served as middle or high schools; and the ancient Al-Qarawiyyin University in Fez, the Ben Youssef Mosque in Rabat, and the Youssefiya Mosque in Marrakech, which provided for higher education (Benahnia, 1996). In most of these mosques, students were supposed to memorize the entire Quran as well as a considerable number of Hadiths (sayings of Prophet Mohamed) as a prerequisite to studying more Islamic and scientific subjects. Throughout this period, Arabic was the language of instruction and of debate and discussions.
The University of Al-Qarawiyyin mosque-religious school was founded in 859 by Fatima al-Fihria and it has been one of the leading spiritual and educational centers of the Muslim world. The university also played a leading role in the cultural exchange and transfer of knowledge between the Islamic world and Europe during medieval times.

Not only does education at Al-Qarawiyyin concentrate on the Islamic religious and legal sciences, but the university also offers other studies such as theology, law, philosophy, mathematics, astrology, music, chemistry, history, astronomy, and languages including French and English. The Al-Qarawiyyin Mosque soon became the chief center of scholasticism in Africa and one of the leading ones in the Islamic world. It is considered the oldest scholastic foundation ever established and witnessed such distinguished teachers and students as Ibn Khaldun, Ibn Rushd, and even Gerbert of Auvergne, the future Pope Sylvester II (Landau, 1958, p. 105). It was famed for its fabulously large library, a repository of knowledge comprised of thousands of scrolls and volumes, such as an original copy of History by Ibn Khaldun and works by al-Bukhari (Landau, 1958, p. 105).

**Basic Instruction of Mathematics in Old Moroccan Schools**

In Arab and Islamic cities, the basic education of children, especially boys, does not seem to have changed from the early days of Islam till quite recently. Codified in the 10th century by Ibn Sahnun (817-870) in his book *Kitab adab al-Muallimmin (Duties and Obligations of Teachers)*, Ibn Khaldun (d. 1406) (cited in Abdeljaouad, 2006) briefly presented the problem in his *al Muqaddimah (The Muqaddimah, also known as The Muqaddimah of Ibn Khaldun or Ibn Khaldun’s Prolegomena*, is a book written by the Arab historian Ibn Khaldun in 1377 which recorded an early view of universal history):

Instructing children in the Quran is a symbol of Islam…. In his Rihla (Study Travel), Judge Abu Bakr b. al- Arabi makes a noteworthy statement about instruction…. He
places instruction in Arabic and poetry ahead of all other sciences, as in the [Andalusian]
method…. From there the student should go onto arithmetic and study it assiduously,
until he knows its basic norms. He should then go to the study of the Quran because with
his previous preparation, it will be easy for him. (p. 637)

In Morocco, during the Almohad dynasty (1130-1269), basic education was compulsory
for both girls and boys, but as it was clearly ideologically oriented, it relied on specific aspects of
doctrine requiring literacy in the Arabic or the Berber language. There was no room for
calculation (Mannouni, 1977, p. 28).

While the initial instruction of children was institutionalized because it was considered
crucial for the training of faithful believers, the education of adolescents was not. Ibn Sina
(d. 1037) in the Orient (East Asia) and Ibn Hazm (d. 1064) in Andalusia separately described this
phase of adolescent instruction.

Ibn Sina (980-1037) (cited in Abdeljaouad, 2006), who is better known in Europe by the
Latinized name “Avicenna,” is probably the most significant philosopher in the Islamic tradition
and arguably the most influential philosopher of the premodern era. He suggested that:

Subsequent to basic instruction in the elementary school, the child should move on to
specialized training. He recommended starting by deciding to what calling we wish to
direct the child. Hence, if we prepare him to be a secretary, we teach him, in addition to
language, correspondence and speech writing. Some children are thus directed to the
science of reckoning, others to geometry, and others to medicine. (p. 638)

The multitalented theologian, poet, and scientist of Cordoba, Ibn Hazm al-Andalusi (993-
1064) (cited in Abdeljaouad, 2006), advocated a broad curriculum:

Once he has mastered grammar and language, the adolescent should tackle the science
of numbers and start mastering multiplication, division, addition, subtraction, and
denomination. Thereafter he will learn part of the science of areas (misaha) and will study
arithmetika, i.e. the science exploring the nature of numbers. He should read Euclid’s
book in a manner that allows for comprehending the text by addressing its objectives and
understanding its significance; it is a lofty science which allows for knowing the situation
of Earth and its area, the organization of the stars, their movements, their centers, and
their distances; it also allows for reviewing evidence of all results…. Studying the
Almagest will enable him to predict eclipses, determine distances between countries, and
calculate time, tides…. Studying the geometry of areas (handasa) will help him attract waters, elevate weights, draw buildings and design machines. (p. 638)

For young adults, higher education could last many years, and students wishing to receive specialized instruction in mathematics had to arrange study travels (Rihla) to find specialists. There was no age limit but, at each stage of his journey, the candidate had to demonstrate that he had the scientific skills needed to attend the master’s courses. As a rule, courses in mathematics were given in the Great Mosque in the capital, and sometimes in madrasas or in private homes. This was basically the master’s choice and depended on his rank within the academic community. For instance, Ibn al-Banna (d. 1321) taught all his courses in the Marrakesh Mosque and received only special students at home (Brunschvig, 1940).

**Teaching and Pedagogy for Mathematics in Old Moroccan Schools**

Although it is difficult to determine the beginning of the history of mathematics in Morocco, one can say that mathematical sciences were among other subjects taught in Morocco early in time. The curriculum was formed gradually starting from the 2nd century A.H. (719 A.D.-816 A.D.) with the advent of the Islamic literary and legislative sciences and reference material from the sciences of earlier civilizations. The academic content in the old Moroccan schools was characterized by an encyclopedic nature in addition to a variety of disciplines that combined logical and descriptive sciences. In his letter “The teachers’ etiquette” published in the 3rd century AH, a Moroccan scholar by the name of Mohammad Bin Abdessalam Sahnoun (d. 256) emphasized the teaching of mathematics among other educational disciplines (Hajji, 1976). People needed mathematics to conduct business transactions, bequests, and division of inheritances. In addition, students in Morocco studied the geometry of lines, surfaces, and solids. They also mastered the drawing of various geometric shapes, circles, angles, and engineering issues involving surfaces.
It is natural that mathematics was developed beyond the degree mentioned in Ibn Sahnoun’s letter. It soon reached the level alluded to by Ibn al-Kadi during the Saadi era. Mathematics students in Morocco at this time studied algebra, calculation by completion, and balancing, including calculations with integers and roots. They used the Arabic numerals known today; they called these numerals “dust letters.” To reinforce the science of mathematics, Moroccan mathematicians published several books in mathematics demonstrating the exceptional efforts in this area according to each mathematician’s era.

The academic curricula consisted of basic units, mathematics, physics, and other branches of the sciences. Students could choose the discipline they wanted, according to a number of considerations. Lessons were conducted via reading books and skimming through texts with explanation, interpretation and clarification, and discussion of ideas, rules, and concepts, through reviewing problems by study and analysis. This was done by invoking scholars’ opinions on each particular problem and giving examples in order to extract a number of provisions and rules. Often, the teacher or the scholar would provide summaries of masterpieces in the arts and sciences in order to pass them on to their students to learn and preserve, whether they comprehended them or not. This means that education in these schools was based on memorization and inculcation as well as on the summary of original texts, books, and classifications of précis, explanations, marginal comments, and records.

Insights into Arab pedagogy can be found in some recently published works, a few of them specific to mathematics instruction. Nonetheless, Abdeljaouad’s (2006) work *Issues in the History of Mathematics Teaching in Arab Countries* remains a great source of information and a treasure of successful ideas for those interested in learning about mathematics instruction in the
old Arabic schools. According to Abdeljaouad (2006), three features were predominant in mathematics instruction: (a) memorizing, (b) note taking, and (c) “dust board” calculating.

**Memorizing in Mathematics Instruction**

Makdisi (1981) noted two important features of Arab education: “The development of the memory is a constant feature of medieval education in Islam” (p. 99). He added, “Memorizing, not meant to be unreasoning rote learning, was [to be] reinforced with intelligence and understanding” (p. 103). The entire process of learning had been organized so as to take into account memorizing as the most important pedagogical means. During the lesson, students were seated around the teacher in a halqa (a circle of study) to listen to the recitation of the day’s course by a professor’s assistant, then to listen to some commentaries by the professor. Going back to his room, the student had to learn the course by heart; he eventually wrote it down in a notebook, so it might serve as a reference. Some of the student’s senior classmates would help him repeat the lesson many times, to make him firm in recalling it. To be able to understand the lesson, the student was supposed to study his professor’s commentaries on the subject matter, analyze them, and prepare for either being quizzed by his professor or for asking questions.

**Note Taking in Mathematics Instruction**

Many Arab scholars have said in their autobiographies that they used to record their own professors’ commentaries on the day’s lesson on an erasable board, in order to learn the content during the night and then wipe the board so that it was ready for use the next day. Advanced students, however, were expected to take notes on paper: “Once the lesson has been learned by heart, the student should write it down from memory. The written record of the lesson is to serve as a reference when recall fails…. Committing subject matter to writing was considered most important in the process of learning” (Makdisi, 1981, p. 104).
“Dust Board” Calculating

The Arab users of Indian arithmetic associated with it the takht, a kind of dust board described in the following terms by al-Hassar (cited in Abdeljaouad, 2006), a textbook author of the 12th century:

It is called ‘Ghubar’ or Indian. They have given it this name because they used at the very beginning a wooden lawha (board) on which thin dust was spread. Then the apprentice reckoner would take a small stick whose form is that of a stiletto, draw the ciphers on the dust and execute the intended calculations. Once the work was done, he would wipe up the dust and store it. Efficiency of this tool stems from the fact that one can execute calculations without having to constantly use ink, board and wiping out of ink. They used dust instead of ink. (p. 660)

It was also the case later for multiplication of two polynomial expressions, as noted by Berggren (1986): “Al-Samaw’al’s procedure is obviously intended to be used on the dust board, where erasure is easy, but space is at a premium, and it proceeds by a series of charts. It adapts easily, however, paper, where erasure is not easy, but space is ample” (p. 115).

Some of the Old Leading Scholars in Mathematics in Morocco and Their Contributions

Since the 8th century, an Islamic traditional system existed in Morocco. From the 9th century to the 10th century, Islam gradually spread through North Africa to the west and south of the Sahara, along the Red Sea, and up the northern cost of the Indian Ocean. Before the French conquest, education played an important role in Moroccan society. Quranic and religious schools offered an Islamic traditional style of education. Islam as the main religion and Arabic as the language were two factors contributing to the identity of Morocco. “The remarkable relation between Arabic and Islam, as mentioned in the Quran itself made the spread and dominance of Arabic unavoidable. In fact, to understand the Quran, one has to be literate in Arabic” (Ennaji, 2005, p. 10).
Morocco inherited a prestigious mathematical tradition and a number of scientific books were written by the leading mathematician of the era. In the 10th century A.D., Maslamah ben Ahmed ben Bassim (d. 1007), described by his biographers as the “Astronomer and Mathematician,” introduced different terms algebraic terms and standard resolutions of all six canonical equations. His works included a poem on the functions of roots and “Pollination of Ideas, Working with the Dust Letters in Mathematics,” a copy of which is in the Public Library in Rabat; all of his books are still in manuscript form. This mathematical tradition was illustrated also by the emerging of Ibn al-Yasamin (1204) and Ibn Mun’im (1228). In the Marinid period were a number of eminent scholars as well, among them the famous Abu Al Abbas Ahmed bin Mohammed al-Marrakushi, known as “Ibn al-Banna” (1321), a mathematician and astronomer. Among his printed books are *Summarizing Computation Operations* and *Lifting the Veil on the Summary of Computation*. Samsó (2007) stated:

Ibn al-Banna studied a variety of subjects as reportedly with at least 17 masters. He was one of the last innovators of the great North African mathematical tradition and at the same time one of the initiators of a new tradition of teaching of mathematics, based on the commentaries produced by senior teachers. (pp. 551-552)

As examples, Samsó explained:

He wrote short works on the two varieties of universal astrolabes (shakkāziyya and zarqāliyya)…as well as an astronomical handbook with tables (zīj) derived ultimately from the research of Zārqālī. The title of this zīj is *Minhāj al-ṭālibfīta ‘dīl al-kawākib* (*The student’s method for the computation of planetary positions*), and it became extremely popular in the Maghrib. (pp. 551-552)

Ibn al-Banna’s works were extremely popular and inspired an enormous number of commentaries, which were still being written until the beginning of the 20th century. Ibn al-Banna’s works include *Talkhis Amal al-Hisab* (*Concise Exposition of Arithmetic Operations*).

This famous book has been explored by researchers including Renaud (1937), Siouissi (1969), Vernet (1980), Aballagh (1994), Djebbar and Aballagh (2001), among many more.
The catalog of Ibn al-Bannāʾ’s works comprises about 100 titles, out of which some 50 are dedicated to mathematics and astronomy (including astrology), but the list also includes Quranic studies, theology (uṣūl al-dīn), logic, law (fiqh), rhetoric, prosody, Sufism, the division of inheritances (farāʾīd), weights and measures, measurement of surfaces (misāḥa), talismanic magic, and medicine. His reputation is based mainly on his mathematical works (especially arithmetic and algebra); he has been considered the last creative mathematician in the Maghreb, meaning that he approached new problems and gave original solutions. (Samsó, 2007, pp. 551-552)

For example:

Ibn al-Bannāʾ’s Minhāj contains a selection of Ibn Ishāq’s tables accompanied by a collection of canons that are easy to understand, which makes the zīj accessible for the computation of planetary longitudes. This is accompanied by some modifications of the structure of the tables, designed to make calculations easier. Both the tables of the solar equation and those of the planetary and lunar equations of the center are “displaced” (a constant is added to every entry of the table in order to avoid negative values), a technique used for the first time in the Maghrib. Although Ibn al-Bannāʾ used the standard structure, derived from the Handy Tables, for the tables of the equation of the anomaly of Mars, Venus, and Mercury, he changed them entirely in the cases of Jupiter and Saturn—planets that have small epicycles—for which the equation of the anomaly is calculated in the same way as for the Moon. (pp. 551-552)

This mathematical tradition continued in Morocco and has been proudly maintained over the centuries by scholars such as Ibn Haydūr al-Tādilī (1413), Ibrahim al-Samlâlī (1477), and other famous mathematicians such as Abu Hassan Ali bin Mohammed, known as Al Qalsadi (d. 1486 A.D.). The latter was considered a model of the pioneers of the Muslim West in pure science, especially in mathematics. His books include *Unraveling the Science of Computation* and *Revealing Secrets About the Dust Letters*, the latter an excerpt from an earlier work. Other pioneers of pure science in Morocco were Ibn Ghazi al-Miknasi (1513) and Ahmad al-Rasmuki (1721).

In the 19th century, Morocco always kept pace with scientific movements. Ageron (2015) pointed out that long before the establishment of the French Protectorate, the sultans of Morocco had pushed for the modernization and appropriation of European science and technology. The translation of scientific books from mathematics, astronomy, and other fields was flourishing,
following the footprints of the ancestors in their interest in the diverse knowledge of the time, including mathematics and its teaching (Aqil, Babekri, & Nadmi, 2016, pp. 193-194). In addition, Ageron (2015) stated that in 1890, about 36 European books on the exact sciences had been translated into Arabic in Morocco. These texts are preserved in manuscripts at the Hasaniyya Royal Library (BH) or in private collections. By exploring the manuscript collection of the Hasaniyya Royal Library within the walls of the Royal Palace, Ageron stated that he was able to identify nine French, Italian, or English works of mathematics or astronomy translated into Arabic from 1825 to 1875, which are as follows:

1. *The Astronomy of Lalande*
2. *The Uses of the Sphere of Delamarche*
3. *The Lezioni Elementari Di Matematiche, from the Abbe Marie*
4. *The Treatise of Trigonometry and Application of Algebra to Geometry, of Lacroix*
5. *Straight and Spherical Trigonometry, of Ozanam*
7. *Dollond’s Improved Reflecting and Repeating Circle*
8. *Calculation of the Time of the Full Sea*
9. *The Instruction to Serve as the Arithmometer of Thomas*

The discovery and identification of these translations of European mathematical works revealed the extent of the selective attempts at appropriation of the modern sciences which were undertaken in Morocco during the 19th century. Exploring the translations of these books is not the focus in this thesis. However, it is worth showing figures that reveal the interest of Moroccans in the sciences and technology of Europe at the time. For example, Figure 6 depicts a copy from Lacroix’s *Treatise of Trigonometry and Application of Algebra to Geometry* in 1827.
and Figure 7 depicts a copy of its translation in Arabic found in a manuscript belonging to the collection of the Hasaniyya Royal Library in Morocco. These figures may seem unimportant, but they do bear witness to the Moroccan interest in advancing the Moroccan mathematical tradition, whether through translation or innovation.


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Figure 6. S. F. Lacroix, *Treatise of Trigonometry and Application of Algebra to Geometry*, 8th edition, Paris, 1827, p. 293
Traditionally, the Moroccan mathematical educational system offered an Islamic traditional style of education in the transmission of its culture and, at the same time, was open to modernization. However, at the beginning of the 20th century, the French occupation which lasted from 1912 to 1956 set out to eradicate this culture systematically by introducing a new language and a Western type of education, as the next chapter explores.

Manuscrit 135 de la bibliothèque Hasaniyya, p. 406 : cette page contient la traduction arabe de la p. 293 du Traité de Lacroix (cf. reproduction précédente)

Figure 7. Manuscript 135 of the Hasaniyya Royal Library, p. 406
This page contains the translation in Arabic of page 293 of Lacroix Treatise.
Chapter IV

BRIEF HISTORY OF THE MOROCCAN MATHEMATICS EDUCATION DURING THE FRENCH PROTECTORATE

Prior to the French colonization, Morocco had a long-established history of Quranic-based education. This traditional Moroccan education had religious and legal components and included basic mathematics. In 1912, the French Protectorate authorities established a new educational system which greatly impacted the traditional education to the extent that also led to profound changes in the economic, social, and cultural structure of the country. This chapter briefly describes the vision of and planning towards education of the locals in Morocco adopted by Lyautey, a French Army general and colonial administrator who, after serving in Indochina and Madagascar, became the first French Resident-General in Morocco from 1912 to 1925. In addition, a summary of the resulting ramifications that impacted the Moroccan educational system due to the creation of new French schools by the French colonial administration is presented. Finally, this chapter describes briefly how nationalists and religious leaders reacted to this imposed change to Morocco’s educational system by creating “free schools” in order to preserve the Moroccan traditional education system.

Lyautey’s Vision and Planning

The French colonial leadership interested in the education of the locals in Morocco was led by an army of French officers. The French resident General Lyautey was the first to embark on the mission of setting up the Protectorate’s administration. He adopted an “implicit assimilation” theory, i.e., a theory that emphasized the high respect and value of the indigenous local culture with all its different characteristics including education. For General Lyautey, as for General Bugeaud who created the “Bureaux des Affaires Indigènes” (Bureaus of Indigenous
Affairs) in Algeria 80 years before, the main questions were how to use the traditional elite to control society, and how to recognize an honorific role to the local elite in order to keep them peaceful and respectful of the new authorities (Azan, 1948). The colonial administration was explicit about these cultural issues, as confirmed by the testimony of Lyautey to Albert De Mun on October 10, 1912: “This country must not be ruled by force alone. The traditional method, and the only effective one—the one, moreover, for which I have been sent to carry out here, and no one else—is the continued and combined game of political preparation and military strength” (Scham, 1970, p. 14).

General Lyautey tried, as much as possible, to separate the European and the Muslim ways (Rivet, 1988). He created some “fils de notables” schools for locals in the main cities. After obtaining the primary school certificate, students could go to the “College Musulman” in Fez or Rabat (Merrouni, 1983). Furthermore, Vermeren (2009) stated that:

After six years, they could get a certificate in Islamic studies, on the basis of which General Lyautey tried to allocate some honorific positions. However, if families were ambitious and realistic, they understood that the only way to gain access to the university was by obtaining the ‘Baccalauréat’. Some wealthy and powerful families, therefore, enrolled their children in the ‘Lycee Gouraud’ in Rabat, the French High School in Morocco. (p. 53)

After some years, the Protectorate created a special education section for the sons of tribal and Berber leaders and chiefs. This was the Berber College of Azrou in the Middle Atlas region (Benhlal, 2005), which prepared students for the Military Officer’s School of Dar El Baida in Meknes. This case was unique in the French Colonial Empire, preparing a real competition between the Arabic and Nationalist Elite in the cities, and the Berber officers at the head of the colonial forces (Vermeren, 2009, pp. 53-54).

General Lyautey believed that the only way to guarantee better administrative functioning was through exploiting the elite segment of the population and putting it to use according to the
Western agenda. Even though General Lyautey’s mission was to preserve the honor of, and the responsibility towards, his native nation, he realized that winning the mind and the heart is more powerful than conquering the land through military force. Lyautey said, according to Hoisington (1984), that winning over the heart and soul of the people was the best way to serve France and affirm its solid presence in this country. Lyautey followed a more passive philosophy instead of setting rules and giving orders to eradicate whatever might be related to Moroccan customs and traditions. He, in fact, showed great respect for Moroccan scholars and people of knowledge.

Lyautey and his top educational administrators sought to use education as a tool to maintain Moroccan traditions and social hierarchies, and as means to avert the political discontents associated with uncontrolled modernization. French education for Moroccan Muslims was intended to maintain social stability and to protect the traditional elites upon whose collaboration the French depended (Segalla, 2006).

However, there was a tension between Lyautey’s aims of modernizing the Moroccan state and of preserving the tradition of Moroccan society. Creating a new elite of diploma-bearing functionaries could threaten French goals, either directly, if these educated elite adopted European notions, or indirectly, if Moroccan notables were to feel menaced by lower-class Moroccan pursuing social mobility through French education (Segalla, 2006). The French leadership sought to avoid these risks by increasing the separation of social classes through the educational system, especially in the schools for elites. Class segregation was to be ensured by charging tuition fees at these elite schools.

**Impact of the French Colonial Period on the Moroccan Mathematical Education System**

The French knew that Morocco had a long history of education and the oldest university in the Arab world, the Al-Qarawiyyin University in Fez. During the Protectorate, the French
attempted to administer a reform of Al-Qarawiyyin University, the traditional educational institution. France’s primary policy aim was to limit education and narrow its development. The French perceived that educational freedom would be a threat to their presence in Morocco. This is one of the reasons why France did not intend for Morocco to participate in scientific and literary progress. One can gain some insight into French thinking in this matter by reading some communications of Hardy, a French official who headed the education departments of Afrique Occidentale Française (AOF) (1912-1919) and the Moroccan Protectorate (1920-1926) (Gamble, 2009). Hardy (1931) summed up his “adaptation” process towards localized education this way:

The limiting of vocabulary, the selection of examples and subjects for exercises, the systematic invocation of folklore, the place given to local history and geography, etc.—everything seeks to disorient as little as possible the child’s mind and it is assuredly this grand idea of adaptation that dominates the entire pedagogical movement in France’s African colonies. (pp. 334-335)

Furthermore, Hardy (1921) warned them ten years ago against giving students too much knowledge or too much taste of analysis:

French literature, mathematics, physical and natural sciences; all these, which already so unbalance European heads, should be measured out parsimoniously to Muslim heads, and above all should be distanced from all rationalism: it is not the school that teaches reason…. It is life—and I would like our French instruction in the College Musulman to be limited to wholly practical elementary knowledge in constant relation with concrete. (p. 8)

After the consolidation of colonial power, new institutions emerged. Furthermore, under French rule, enrollment in business, science, and mathematics courses was reserved exclusively for the French community, with a limited number of places for wealthy Moroccan families and officials who ran the country. The aim of the colonial administration was not to generalize education to all Moroccans, but to limit it to children of wealthy families, who collaborated with the colonial authorities and whose children were prepared for taking lower-level jobs in the administration (Drouilh, 1948). However, only a few rare indigenous students benefited from this
training due to the lack of sufficient schools, a selective admissions policy which gave priority to the families of settlers, and the refusal of a large cross-section of the Moroccan population to send their children to the new schools in protest against the occupation.

With the marginalization of the Arabic language, French gradually became not only the language of the sciences, but the official language in education and public administration. Classical Arabic was considered a secondary language. It became mainly limited to the teaching of religion and Islamic thought. The French authorities offered such limited access to education that the illiteracy rate was 94% among women and 90% among men (Ennaji, 2005, p. 202).

In both the elite and the non-elite school systems, French instruction was to take up a large portion of the school day, for this was to be the basis of economic modernization and collaboration with the French. In the schools of Sons of Notables, the new programs included three to five hours of French for every hour of Arabic” (Hardy, 1920, pp. 398-399)

The French Protectorate was responsible for introducing the Western model of education and establishing formal schools in Morocco. Ennaji (2005) pointed out that French colonization created schools for indigenous children based on the Moroccan social hierarchy. Thus, for children of aristocrats, the French colonial authorities created “les écoles des notables”; for the urban class, they created “les écoles urbaines”; for the rural class, they had “les écoles rurales.” However, these types of schools were very limited in number (p. 202). The French school curricula were designed to establish certain Western beliefs as the main focus of education. The French educators carried their curricula via two basic means: “La Mission Française,” a general missionary school which was to ensure the spread of the Christian belief, and the vocational centers in some selected cities and towns. Moroccan children were not usually accepted in schools reserved for the children of the colonizers.
The situation of education in Morocco during the Protectorate period produced few educational advances. In fact, education declined in the traditional Muslim schools in number of enrolled students, quality, and also prestige. Before both the French Protectorate in 1912, education in the Kingdom of Morocco was carried out mainly in the great mosques under the nominal supervision of the ancient Al-Qarawiyyin University and Mosque in Fez. However, during the French Protectorate in 1912, Al-Qarawiyyin had witnessed a decline as a religious center of learning. Despite a number of attempts by the French administration to reform Al-Qarawiyyin between 1914 and 1947, these reforms did not modernize the content of learning and teaching. The French Protectorate met resistance and Al-Qarawiyyin education remained dominated by traditional world views of the Ulama (religious scholars). Significantly, under the new system, a very limited number could enroll in secondary and higher education. According to Howe (2005):

Official French statistics confirmed that in 1952, only 163,000, or 10 percent, of Moroccans of school age were enrolled in public schools and barely one-quarter of them were girls. Most of these were in primary or vocational schools; there were only two girls at university level. (These figures do not include Moroccan Jewish, who were almost all educated in schools of the Alliance Israelite.) (p. 147)

Furthermore, Damis (1970) stated that statistically, the number of Moroccan students registered in French schools reached 2,387 in 1920 and rose to 9,760 in 1929, the majority of whom were from the aristocracy. He added that from the period 1920-1934, only 50 Moroccans obtained their Baccalaureate (secondary school certificate), which implies that approximately three students per year accomplished their secondary education out of a population of 5 million Moroccans. According to Waterbury (1970), between 1912 and 1954, only 530 Moroccan students passed the end of high school certificate (French Baccalauréat) (p. 84). The internal problems and apparent disorders at the beginning of the Protectorate were soon followed by the
beginning and outbreak of the First World War. At the outbreak of the war, all state schools had no more than 794 Moroccan Muslim pupils (Tibawi, 1972). According to Ashford (1964),

The French sought via their educational and administrative means to not only encourage and emphasize these socio-linguistic variants, but also to promote national division instead of cohesion. This continued to be emphasized and explicitly advocated through what is known in Moroccan history as “Dahir Al-Barbari” (Berber Decree) in 1930, which aimed to culturally split the country. While some of the persons who supported the proposal may not have foreseen its ultimate political effect, it served to magnify and to preserve behavior that would delay, if not prevent, Moroccan unification. (p. 47)

The French colonial administration attempted, under the “Dahir al Barbari,” to set up a Berber school system in which the Tamazight language was to be taught systematically and perhaps used as a medium of instruction, whereas Standard Arabic was to be totally discouraged. The idea was totally rejected by the nationalist movement in Morocco and dismissed as just another strategy in the French divide-and-rule colonial policy (Hammoud, 1982).

The French administration established French and Franco-Berber schools like le Lycée Franco-Berbere in Azrou in the Middle Atlas Mountains and Lycée Moulay Ismail in Meknes, which taught French as the first language and Berber as the second language. Other French schools included Lycée Moulay Youssef in Rabat and Lycée Moulay Idriss in Fez.

In addition to the Berbers, a smaller native Jewish minority had settled in Morocco after leaving Spain. According to Tibawi (1972), before the French Protectorate, “the Alliance Israelite Universel based in Paris had established French schools for this Jewish community, and under the protectorate these schools received grants from the state treasury. More schools known as the ‘Frases-Israelite’, were established as state schools under the protectorate” (p. 171). In these Jewish schools as well, French was the main language of instruction.
According to Ennaji (2005), Franco-Arab schools helped to spread the modernist and Western views of the world, as well as the mastery of French especially among the urban elite. Ennaji (2005) added:

The French system of education did not give much weight to Classical Arabic and Islamic thought, which were taught as secondary subjects…. The time allotted to the teaching of Arabic represented about 9% of the overall school teaching load (at a rate of 2 hours per week). Arabic was not sanctioned by an examination and most of it focused on grammar and theory. The teaching of the Quran, which took place after the basic classes, was optional, while Islamic thought was taught in French for one hour per week (Damis, 1970). (Ennaji, 2005, p. 203)

Nationalist Period

According to Benahnia (1996), “the nationalist movement came as a rebellion against the ‘Dahir Al-Barbari’ and also as a request for a general reform in 1934, with education as a main focus, and for independence from the French hostility” (p. 82). As French schooling gained importance, the changing nature of the schools was seen as a growing menace to the cultural identity of the Moroccan elite. At first, the Muslim elite resisted French efforts to make French-run schools the custodians of traditional Moroccan identity, seeking instead to use the colonial schools to gain access to power within French colonial society (Segalla, 2006). In the view of the settlers, the indigenous population had to be controlled and education was not necessary for them. Locals were considered as the working class, providing manual labor. The European settlers, who were a minority among the indigenous population, had always been afraid of an Arab threat. They were physically afraid of being submerged and politically threatened by the principle of democracy. They knew that schooling would make the Moroccans aware of the democratic principles of equality and freedom. If the Muslims claimed their right to equality, the settlers would lose their leadership. It was therefore necessary for the colonialists to exclude the locals not only from the French citizenship, but also from state schools. The best locals could
hope for was vocational schooling. Hence, locals had to be taught minimum knowledge and learn some basic technical skills only.

As a response to the imposed colonial schools, which had barely any concern for Moroccan civilization and its people, nationalist and religious leaders created free Islamic schools. These traditional Arabic schools were called “madaris hurra” (free schools). They were created by nationalists to teach Classical Arabic and Islamic thought in order to preserve Arab-Islamic traditions and values and to compete with the French public schools which were available to French people or to a few children of the Moroccan upper classes. Moroccan demands succeeded in overturning French plans to offer a predominately Arabic and Islamic education in French-run schools, but the resulting French-based programs offered Moroccan elites barely any opportunities within the dominating French colonial society. The negotiated plans made by the French during this period led to a distorted educational environment that incited new grievances and new plans of Moroccan resistance.

After World War II, the free schools created by nationalist and religious leaders stretched out rapidly and became increasingly significant, given their tie with Moroccan nationalism. The first free school was created in 1919, that is, 7 years after the Protectorate established itself in Morocco. Among these schools, we can cite, for example, Annahda in Fez, Al-Abdallawiya in Casablanca, Madaris Mohammed El Khamis in Rabat, and many more all over the country, especially in urban areas. According to Damis (1970), the number of students increased from 5,000 in the 1930s to 25,000 in the 1940s. Likewise, the number of schools reached 121 in the late 1940s.

The creation and support of these traditional free schools were encouraged by the late King and Sultan Mohammed V throughout the country. The free schools had several aims: first,
to teach Classical Arabic as a subject and to introduce it as language of instruction; second, to teach Islamic thought, which was nearly nonexistent in French schools; third, to encourage national feelings in students; and fourth, to fight illiteracy which was prevalent at the time.

Indeed, Benahnia (1996) in his dissertation when quoting Hammoud (1989) stated that:

The nationalist movement came as a rebellion against the “Dahir Al-barbari” and also as a request for a general reform in 1934, with education as a main focus, and for independence from the French hostility. The impact of World War II on France made it easier for this movement to flourish and gain strength, a fact which made France react severely by locking up most political leaders and expelling King Mohammed V. As a reaction to that, the well-known armed revolution “Harakat Al-Fida” (militia movement) started in 1954. The rebels developed later into a revolutionary army and started to have connections with the Algerian one. Under such severe circumstances, France didn’t have a choice but to free all political leaders and bring back the King Mohamed V from exile and enter into independence negotiations with the Moroccan authorities. (pp. 82-83)

After independence, the establishment of an educational system that would take into consideration the deeply rooted Arab-Islamic culture and language and, at the same time, make use of the imposed Western system was a priority. Arabisation received more attention, and the selection of Arabic as a national language was a form of countering the colonizer’s language policy, as the next chapter explores.
Chapter V

LANGUAGE CONFLICT AND ITS IMPACT ON EDUCATION

POST-FRENCH PROTECTORATE

After independence, the establishment of an educational system that would aim to preserve the Arab-Islamic culture and language and, at the same time, make use of the inflicted Western system was a main concern. Therefore, in 1957, the Moroccan government established a Royal Committee for Educational Reform, which adopted four educational principles: universalization of education, unification of the diverse educational systems existing at independence, Arabisation of public education, and the Moroccanization of the teaching staff (Bentaouet, 1999). Among the four principles, Arabisation received more attention, and the selection of Arabic as a national language was a form of countering the colonizer’s language policy. The aim of Arabisation was to introduce Standard Arabic, the symbol of cultural independence in all fields of activity, and to progressively consolidate Modern Standard Arabic in place of French as the language of education. Arabisation’s purpose was to preserve cultural identity and reconsolidate Morocco’s alignment with the rest of the Arab world. In contemporary Maghreb, the question of languages is crucial. J.-R. Henry (1986) noted, “The relationship with language is the most exhibited and symbolic stake of the Maghreb cultural field” (p. 15). This chapter focuses on Arabisation and its ramifications on the Moroccan educational system. Beside Arabisation, this chapter focuses on French-Arabic bilingual education. An analysis of students’ and teachers’ attitudes towards Arabisation and Arabic-French Bilingual education based on studies done by various scholars such as Moha Ennaji and others is offered and new interpretations are provided.
After independence in 1956, Morocco’s primary goal was to establish a monolingual educational approach, an Arabic-only policy. In 1957, Mohammed El Fassi, the first Minister of Education in independent Morocco, attempted to Arabise the primary schools, but he faced much criticism and subsequently resigned. Much of this criticism came from Amazigh leaders who felt threatened by Arab nationalism and saw the Arabisation project as an attempt to diminish the use of their language in Morocco (Marley, 2004). Later in 1958, a “Commission Royale de l’Enseignement” [Royal Commission of Education] was held to discuss the main impediments to Arabisation. This Commission decided to hire Arabic teachers from Egypt and the Middle East to compensate for the shortage of Moroccan teachers proficient in the use of Standard Arabic. Hence, a number of teachers arrived from Egypt and Syria in 1958 (Grandguillaume, 1983).

In the early 1960s, however, the Moroccan government launched the Arabisation policy to revitalize Standard Arabic and consolidate its teaching in the Moroccan school system as well as promote it in official state institutions and the media (Benitez, 2012, p. 71). This Arabisation policy, according to Gallagher (1968), was a “re-affirmation of national identity which has been obscured for years under the French Protectorate” (p. 139). The aim was to eradicate the French language and achieve “cultural independence” from Morocco’s former colonizers (Boukous, 2011, p. 33). However, according to Marley (2005), the popularity of this idea masked an unfair cost:

To the illiterate masses [Arabisation] was largely symbolic, since they had never learnt to read French or Classical Arabic, but they believed it would lead to greater equality of opportunity for them. In actual fact, this has not necessary been the case, and a number of commentators have observed that a powerful motivation behind the policy is the pursuit and maintenance of power: the elite promote Arabisation from virtuous ideological motives, but they know that French continues to be necessary for social and professional success, and thus [elite] ensure that their own children are educated bilingually. (p. 1489)
Indeed, some have argued that in addition to forcing Morocco into an unrealistic monolingual box, Arabisation was intended to separate the elite from the middle and lower classes in order to reduce competition for the prestigious and highly paid careers guaranteed to French speakers (Kachoub, 2012).

Decision makers adopted a gradual implementation of Arabisation, replacing French with Arabic in the public education system. Primary schools were targeted first and were completely Arabised by the end of 1960s (Ennaji, 2002, p. 7). While the shared goal is the full implementation of Arabic, they faced many challenges. Notable obstacles were the shortage of materials written in Arabic, the shortage of qualified teachers, and the decrease of students’ achievement in sciences. Accordingly, in 1965, the Minister of National Education Mohamed Benhima declared that Arabisation failed to make improvements in the standards; he argued that French should be kept for “instrumental purposes to meet the needs of modernity, science and technology” and decided to stop the project of Arabisation and to restore the French system of education instead (Ennaji, 2002). This event was a major setback to the Arabisation project and required many years to revive it.

In 1966, the new Minister of Education, the Istiqlal party, and other purist opposition parties reacted strongly to the “pause of Arabisation,” insisting that replacing French with Arabic in public institutions was “an inevitable step toward preserving the Moroccan cultural identity” (Ennaji, 2002, p. 7). In response, decision makers reinstated the Arabisation project in the late 1970s to ease social tensions. This led to what Boukous (2009) to characterize this as a “power struggle” (p. 28), in which Moroccan Arabic and Standard Arabic represented weak social and symbolic capital. French was kept as the primary language of science instruction at Moroccan universities.
Between 1973 and 1975, Standard Arabic was introduced as the medium of instruction for literary subjects, including philosophy, history and geography (Benitez, de Ruiter, & Tamer, 2012, p. 84). The new Minister of Education Azzedine Laraki famously said, “Nous sommes condamnés à Arabiser” [We are condemned to Arabise] (Grandguillaume, 1983, p. 86). Under Laraki’s leadership, the sciences, mathematics, and physics in primary and secondary schools were Arabised between 1982 and 1988, and Standard Arabic was completely implemented in the spheres of education and administration (Benitez, Jaap, and Tamer, 2012, p. 84).

The year 2000 brought significant changes to the Moroccan language policy. The Ministry of National Education launched the National Charter for Education, which aimed, among other things, to reform the status of languages in education. It provided a set of mandates to improve the use of Standard Arabic in Moroccan schools. However, the Charter was condemned by critics as nebulous and lacking clearly-defined objectives. Moroccan scholars, for instance, stated that the eradication of the term Arabisation from the Charter reflected the awareness of authorities of the negative connotations it held among students and teachers (Berdouzi, 2000). Observers have noted that this lack of clarity of the goals of the Charter has had a negative effect on the status of Standard Arabic in education, particularly in the science disciplines.

In 2008, the Ministry of National Education launched the Emergency Plan for the period 2009-2012 to increase the effectiveness of the Charter. Enacted using a $60 million grant from the World Bank’s Board of Directors, this plan urged teachers to use new materials and approaches in teaching Standard Arabic and encouraged its use as a medium of science instruction (World Bank, 2010). Nevertheless, the goals of this plan to advance Arabisation in
education were impeded by the widespread use of French as a medium of science instruction at the university, the problematic practices of teachers in classrooms, and the negative attitudes of students towards Standard Arabic.

**Arabisation and French-Standard Arabic Bilingualism Conflict**

Many scholars believe that language and culture are inseparable. Fairclough (1992) affirmed that “language use reflects culture and it is impossible to dissociate the two in any real sense” (p. 6). Indeed, Fairclough was not the first to speak about the reflectivity of culture through language. Tsui and Tollefson (2007) argued that “the relationship between language policy and national cultural identity is dialectical” (p. 7). That is to say, any change in language policy is supposed to have a decisive impact on the national and cultural identities. Given the connection among Standard Arabic, Islam, and nationalism, Arabisation may be considered a sign of the revival of the Arabic language and culture.

Morocco is confronted with the need to become bilingual to some extent, whether as a matter of choice or not, and, like many other emerging countries, is consciously applying programs of bilingual education. However, there appears to be a conflict between the desires to preserve its identity, Arab authenticity, by preserving language and culture and the need to live up to the expectation of the modern world by adapting a foreign language—most frequently, French.

Arabisation is not only a language problem, but also a political and ideological one. It is used often by opposition parties and Islamists as a tool in their fight for power. Furthermore, some scholars have spoken about the ideological foundation of Arabisation. They argued that Arabisation policy aims at creating inequality of opportunities among students. Moustaouï
(2007) considered that the choice of Arabic as an official language of the country was not a linguistic act, but a political one (p. 129). Fitouri (1983), in studying the problem posed by bilingualism in education, defended the thesis that this bilingualism brings into being the acculturation whose symptom is French and he insisted on the idea that this system of education is fostered by a bilingual and bicultural elite that levies a monolingual mass on French. He added that such a system leads to school failures and, ultimately, to the reproduction of the elite as in colonial times. Thus, the debate about Arabisation and bilingual education implies a larger debate on citizenship, government policy, ideology, politics, religion, culture, and identity. Arabisation is a hidden fight for social promotion used by opposition political parties, religious leaders, and the lower social classes in the hope that Arabisation will re-establish collective rights, social justice, and equal opportunities for all. However, French-educated Moroccans hold positive attitudes toward French-Standard Arabic bilingualism. They argue that Arabisants are welcoming “traditional ideas that perpetuate backward and irrational thinking in the country” (Ennaji, 2005, p. 2). French-educated Moroccans believe that some form of French-Arabic bilingualism will actually strengthen Arabisation by adding terminology through translation or transfer. Indeed, the eminent lexicographer and ex-director of the Institute of Arabisation in Rabat, Ahmed Lakhdar-Ghazal (1976), argued that bilingualism is essential for making Standard Arabic a modern language. Arabic, he wrote, “should ideally be modeled on French and follow its example as a language of modernity” (p. 64). In his article “Language Contact, Arabisation Policy and Education in Morocco,” Ennaji (2002) stated:

A linguistic conflict exists between Classical/Standard Arabic and French, the two prestigious languages in the country. The predominance of French is manifested essentially in education, administration, industry, banking, and commerce. French has been maintained for instrumental purposes and for building contacts with the West in
general. It is the vehicle of science, technology, and modern culture. The predominance of French implies that the chances of strengthening the place of Classical/Standard Arabic are reduced; as a matter of fact, it is still confined to restricted domains like formal traditional speeches, religious discourse, as well as literary and cultural aspects.... The supremacy of French in the modern sector has not resulted in negative reactions by the Moroccans, most of whom believe the French-Standard Arabic bilingualism is the best option for the development of the country. (p. 3)

Even the late king of Morocco Hassan II shared the opinion that bilingualism is a prerequisite for the success of Arabisation. In a 1978 speech in Ifrane, he stated that “If Arabisation is a duty, bilingualism is a necessity.” Furthermore Ennaji (2009) stated that:

Despite decades of Arabisation, French is still used in education, administration, and the private sector. The efforts of Arabising the educational system have not succeeded for three main reasons: (i) the place of French is still very strong in key socioeconomic sectors; (ii) the ruling elite holds negative attitudes toward Arabisation and the way it has been politicized and implemented, and (iii) the official language policy has been inconsistent, and as a result there seems to be no plan to Arabise higher education. (p. 17)

**Students’ and Teachers’ Attitudes Toward Arabisation and French-Arabic Bilingualism**

Based on Ennaji (2002, cited in Ennaji, 2005), students’ and teachers’ attitudes slightly differed: while 58% of students thought that Arabic was not good enough for teaching science, no less than 64% of teachers had the same attitude. The interpretation one can make regarding the attitudes in Table 1 is twofold: first, respondents’ positive attitudes toward Standard Arabic may be expressive of their aspiration to reform the status of Standard Arabic and develop it as a language of science; second, the priority they gave to French as the medium of instruction may be an indication of their belief that Standard Arabic was still unfit to replace French in scientific and technical subjects.

The findings in Table 2 show that 39% of students were for extending Arabic to the university level; this contrasted with teachers who believed that Arabisation would not serve higher education (81%). These contradictory attitudes may be accounted for by the fact that, having been taught scientific subjects in Standard Arabic in primary and secondary schools,
Table 2

Students’ and Teachers’ Attitudes Toward Arabic as a Language of Science

<table>
<thead>
<tr>
<th></th>
<th>Arabic is not a science language</th>
<th>Arabic is a science language</th>
<th>Science textbooks in Arabic are lacking</th>
<th>Arabic is a language of literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>58%</td>
<td>42%</td>
<td>46%</td>
<td>51%</td>
</tr>
<tr>
<td>Teachers</td>
<td>64%</td>
<td>36%</td>
<td>75%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Source: Ennaji (2002)

Students preferred to continue with Standard Arabic rather than switch to French, in which their competence generally left much to be desired. This was all the more confirmed by their claim that Arabisation had somehow improved their learning achievements. However, teachers disagreed with this claim, as only 28% stated that Arabisation can improve school standards. Their teaching/learning experience led them to conclude that Arabisation had not improved standards, given the shortage of scientific reference books in Arabic. As a result, many students and teachers resorted to Moroccan Arabic in the classroom. Thus, most of the respondents thought that the Arabisation policy was implemented in primary and secondary education in an over-hasty way without considering the multilingual context or taking into account the attitudes of the overall Moroccan population.

Table 3

Attitudes Toward Arabisation and Education

<table>
<thead>
<tr>
<th></th>
<th>For Arabisation in Higher Education</th>
<th>Against Arabisation in Higher Education</th>
<th>Arabisation improved learning standards</th>
<th>Arabisation has clear objectives</th>
<th>No answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>39%</td>
<td>61%</td>
<td>38%</td>
<td>21%</td>
<td>1%</td>
</tr>
<tr>
<td>Teachers</td>
<td>19%</td>
<td>81%</td>
<td>28%</td>
<td>44%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Source: Ennaji (2002)
Table 3 reveals that both students and teachers favored French/Standard Arabic bilingualism in education. This reaction could be perceived as a positive attitude toward French. Bilingualism was thus viewed by many as having a fundamental role in strengthening the cultural and economic contacts with Europe and the West.

Table 4

<table>
<thead>
<tr>
<th></th>
<th>Favorable</th>
<th>Unfavorable</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>73%</td>
<td>14%</td>
<td>13%</td>
</tr>
<tr>
<td>Teachers</td>
<td>78%</td>
<td>19%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: Ennaji (2002)

Most respondents preferred bilingualism, which they viewed as a good basis for the development of the Moroccan system of education. French was to be kept as the medium of instruction for the sciences and standard Arabic for the humanities. This kind of bicultural aspect would bring about a double culture (Arab-Muslim and Western), which would enable the country as a whole to catch up with the modern world; French was considered an appropriate tool for meeting the modern needs of society and broadening the cultural horizons of Moroccans.

According to Ennaji (2005), the data collection and the findings mentioned reveal/ed ambivalent attitudes toward language contact, Arabisation, bilingualism, and education in Morocco. This ambivalence reflected a great deal of concern among the young for ethnic identity and cultural authenticity. Furthermore, Ennaji stated:

In fact, the answers embody two types of attitude and motivation. The first one which is integrative seeks to revive cultural authenticity and national identity (through the revival of the national languages). It seeks to reinforce the unification of the people and their sense of belonging to one nation. The second one, which is instrumental, expresses the desire to achieve development and progress (through the use of foreign languages, namely, French and English). (Ennaji, 2005)
Even years ago, in his thesis, Bouzidi (1989, p. 212) showed similarly negative attitudes towards Arabisation (see Table 4). Notice that when respondents were asked to comment about the statement “The teacher will find it difficult to give a lesson of mathematics in Standard Arabic,” 33% strongly agreed and 23% agreed, making it 56% out of a total of 90%. Most troubling was that some of the responses for the rest of statements had even higher percentages and showed that Arabisation was certainly in decline.

Furthermore, in “French neo-colonial influence on Moroccan language education policy: a study of current status of standard Arabic in science disciplines,” according to Zakhir and O’Brien (2017). They added:

Attitudes of teachers and students in this study indicate a realization of French’s elevated status at university as an impediment to embrace its full acceptance in secondary schools. A majority (61.3 %) of public-school students interviewed saw Standard Arabic as an impetus to future success while clear majorities of science teachers (95.4 % public; 100 % private) predict that Standard Arabic’s use will decline in the future. Coupled with the finding that 80 % of teachers surveyed see the use of Standard Arabic as impeding students’ integration in the job market, Standard Arabic as a medium of instruction seems likely to face consistent resistance until these attitudes change. Possibly the most troubling finding for those who support the Arabisation project is that a majority (63.6 % public; 100 % private) of Arabic teachers themselves see the language as in a period of decline. (pp. 39-58)

Efforts were made for Standard Arabic to compete with French; however, some feared that “French will always be predominant, and Standard Arabic marginalized” (Ennaji, 2002, p. 8). On that note, Chakrani’s (2013) study of language attitudes showed that:

The higher the social class, the more likely respondents are to hold favorable attitudes towards French and the increasing use of English and move away from the local code of Moroccan Arabic, Standard Arabic, and Berber. The impact of the ideology of modernity on Moroccan youth shows that the valorization of Western languages, a product of the French colonial era, maintains a linguistically and socially asymmetrical position between speakers of local codes and those of foreign languages. Members of the Moroccan elite play the role of ‘ideology brokers’ (Jaffe 1999), whose linguistic practices, language attitudes, and ascription to the ideology of modernity serve to reinforce a system of privileges, class structure, and lines of power on the basis of linguistic segregation. (p. 431)
Table 5

*Response Percentages: Attitudes Towards the Process of Arabisation (Summary Data)*

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Arabisation will improve the status of the Arabic language</td>
<td>43</td>
<td>25</td>
<td>15</td>
<td>0</td>
<td>15</td>
<td>98%</td>
</tr>
<tr>
<td>2) Students enjoy their courses in French more than they do in SA.</td>
<td>25</td>
<td>17</td>
<td>7</td>
<td>35</td>
<td>12</td>
<td>96%</td>
</tr>
<tr>
<td>3) Students will understand better in SA.</td>
<td>38</td>
<td>23</td>
<td>25</td>
<td>2</td>
<td>7</td>
<td>95%</td>
</tr>
<tr>
<td>4) The teacher will find it difficult to give a lesson of maths in SA.</td>
<td>33</td>
<td>23</td>
<td>12</td>
<td>17</td>
<td>5</td>
<td>90%</td>
</tr>
<tr>
<td>5) SA is as rich in technical terms as is French, for example.</td>
<td>28</td>
<td>28</td>
<td>17</td>
<td>20</td>
<td>0</td>
<td>93%</td>
</tr>
<tr>
<td>6) Arabisation will serve its purposes and will contribute towards progress in Morocco.</td>
<td>25</td>
<td>25</td>
<td>33</td>
<td>2</td>
<td>10</td>
<td>95%</td>
</tr>
</tbody>
</table>

Scale: A = Strongly agree; B = Agree; C = Neutral; D = Disagree; E = Strongly disagree. Total% (right side of table) represents the total number of responses of participants.

*Note.* The results of Zakhir and O’Brien’s study indicated above are based on a questionnaire involving students, science teachers and Standard Arabic teachers from both public and private schools (see Appendices A, B, and C).

Source: Bouzidi (1989), p. 212

Chapter VI next turns to an analysis and discussion followed by Chapter VII which includes summary, conclusions and recommendations.
Chapter VI

ANALYSIS AND DISCUSSION

This chapter is an attempt to understand the intricate diversity and plurality of the Moroccan language situation and the role of the state in implementing language policy and dealing with the language dynamics. It also examines the invisible politics behind implementing the policy. This chapter offers the major contribution of this study. Unlike many other cases, it is not about collecting more data but about systematic analysis. Much data exist, but were never analyzed systematically and never brought together in a way that made the issues and problems visible.

In order to develop a comprehensive picture of how multilingualism and cultural identity have historically influenced mathematics education system in Morocco and answer the research questions of the study, a historical research methodology based mainly on a careful analysis was employed and new interpretations were supplied. Supplementary knowledge was acquired and evidence was supported by available quantitative data.

The first research question of this study was: How did the attempt to restore the Moroccan identity post-French Protectorate influence the Moroccan mathematical teaching and learning in primary and secondary schools?

To answer this question, we focus on the Arabisation policy, which was a direct consequence of the French colonization. Arabisation’s failure led to a rampant privatization of schools affecting the social fiber of the Moroccan society and its educational system. Furthermore, a brief analysis of Moroccan secondary mathematics books and how Arabisation’s unforeseen negative consequences still hinder students’ success today is presented.
Arabisation Policy

One of the major consequences of colonization was the development of language policy as a field of inquiry seeking preservation of cultural identity. Without colonization, there was no attempt at Arabisation. In other words, without Francisation, there was Arabisation. As Ennaji (2003b, cited in Ennaji, 2005) put it, Arabisation was a postcolonial reaction to how the French Protectorate had considered that Arabic was a foreign language without a proper place in school. Political parties used Arabisation as a way of consolidating political independence and social justice.

Unfortunately, the process of Arabisation had many unforeseen negative consequences on some of Morocco’s population and brought about a host of educational and cultural problems. For instance, it ignored the multilingual and multicultural nature of the Moroccan society. In addition, it made it impossible for educators to serve students’ primary language needs adequately, given the requirements to adhere to a strict Arabisation policy. Furthermore, students whose parents had the financial means continued to send them to bilingual private schools so that their children would learn French and other languages. However, students who could not afford private schools were either relegated to substandard public schools or simply dropped out. Lastly, and most importantly, 95% of the Moroccan school population consisted of second language learners who were being taught by teachers who were equipped with no appropriate methodology to help students negotiate learning in a second language. Most troubling is that most of these teachers themselves learned mathematics in the French language and it was hard for them to adjust by switching to Standard Arabic. If Moroccan Arabic speakers had to adjust to a more or less identical and sophisticated Arabic, the Amazigh population (more than 50%) had to learn a new language as a prerequisite for success at schools. Besides, the Arabisation process
did not cover tertiary education, which led to remarkable failures in the areas of science and technology.

In the secondary cycle, the courses in sciences were exclusively taught in Arabic. Once graduating high school, the students found themselves faced with another reality: all scientific tertiary level courses were taught in the French language. Once the students got their secondary certificate “baccalauréat,” they faced the obstacle of the language. Thus, certain students avoided scientific disciplines or changed their major, having not met the level required in French to pursue their studies.

Arabisation at the secondary level was implemented during the era of Azzeddine Laraki serving as Minister of Education from the Istiqlal party (1986-1992). The process was not extended to the tertiary level. Consequently, students found themselves in a problematic situation which took a heavy toll on their future. The Arabisation of the teaching of scientific courses in the secondary level created a real social fracture.

Students from financially secure families attended private schools and French mission establishments (mission française) which dispensed quality bilingual teaching. The others registered in public schools which were totally Arabised. Therefore, students from private schools, by mastering the French language, could figure out their study in the university with a maximum of success, while the ones coming from public school were at a disadvantage.

According to the view of a good number of university professors, certain students graduating with scientific major were registering in human sciences, social studies, political sciences, or literature while they were supposed to be studying the exact sciences. Another category of students took a chance registering in economic sciences in the first year and when they did not succeed, they changed their major to political sciences in the Arabic language, but a large
number finished by abandoning their study, realizing they could not continue. Evidently the dropout percentage was very high. In effect, over recent years, for every 100 graduates from high school, only three succeed in getting their bachelor’s degree. This perfectly illustrates the absence of the principle of equality of chances between the citizens. This social inequality is manifest also at the level of the employment market, given that French is the language of employment and social mobility.

**Rampant Emergence of Private Schools**

The Moroccan university also has many shortcomings. Linguistic policy in Morocco experienced a period of aborted Arabisation. As a result, Moroccan students must now follow a basic education whose language of learning is predominantly Arabic and then postsecondary education in French in most fields (Amargui, 2006). This has encouraged the emergence of bilingual private schools (having a learning language in French or English or Spanish) that are expensive and selective, but which provide a comparative advantage in accessing higher education. Since these schools are difficult to access, for the financial and other reasons mentioned above, the situation is therefore discriminatory for children from poor or marginalized families who have not been able to access such private schools and who are less likely to access quality higher education (Bourdereau, 2006).

The development of private schools also has indirect negative effects on the right to education by affecting the quality of public schools, especially at the secondary level. It has been reported that many public teachers at the secondary level also teach in the private sector and spend more time and energy in providing higher quality courses in private schools than in public schools (Igamane, 2013). These support courses not only indirectly affect the quality of public education, but also constitute a privatization of education, which has been described as “rampant
privatization of public education,” which is a further factor of inequality and social divide between the poorest and the richest.

The closure of many public schools, at the primary and secondary levels, in particular in Casablanca and Rabat, is an alarming indicator of the decline in state commitment to free, quality education. These closures involved almost 191 schools between 2008 and the end of 2013. Many public schools, such as the Chawki High School in Casablanca, are now threatened with closure (Al Annahar Maghribya Journal, 2014).

According to the UNESCO Institute for Statistics, as a consequence of the above-mentioned policies, private primary school enrollment has more than tripled in less than 15 years, from 4% in 1999 to 14% in 2013 (see Figure 8). Although the government claimed that

![Introduction of the National Charter of Education](image)

*Figure 8. Percentage of students enrolled in private schools at primary level*

*Source: l’Institut pour les Statistiques de l’UNESCO.*
14% constitutes a small proportion of enrolled pupils at the private school, this figure increased rapidly over a short period of time. The percentage of pupils enrolled in private primary education has more than tripled in 13 years (between 2000 and 2013), with an average annual increase in the proportion of children attending private primary school by 8% of the proportion of children in primary education (see Figure 9).

![Figure 9. Increase in annual enrollment at the primary level for public and private schools 1999-2012. Source: l’Institut pour les Statistiques de l’UNESCO](image)

Without attempting to make projections but, by way of illustration, keeping the same pace of growth in private education as in the years 2000-2013—and without taking account of the acceleration of the phenomenon since 2005—the proportion of primary school pupils in the private sector could reach a third in a decade. By 2030, more than one out of two primary pupils could be enrolled in the private sector (see Table 5).

Using one language as the medium of instruction seems to be inevitably successful in some countries. However, in multilingual societies such as Morocco, basing education on one
Table 6

*Projection of Private Enrollment Percentages at the Primary Level (2014-2038)*
*Based on Applying the Average Growth Over the Period 2000-2013*

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
<th>2013</th>
<th>2020</th>
<th>2023</th>
<th>2030</th>
<th>2038</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of children in private primary school</td>
<td>4.2%</td>
<td>5.5%</td>
<td>10%</td>
<td>13%</td>
<td>24%</td>
<td>30%</td>
<td>52%</td>
<td>97%</td>
</tr>
</tbody>
</table>

Source: l’Institut pour les Statistiques de l’UNESCO (nd)

**Analysis of Primary and Secondary Mathematics Textbooks**

medium of instruction results in the failure of the whole educational system. While the Arabisation policy was aimed at the spread of the use of Arabic through the suppression of French and other local languages, such as colloquial Arabic and Tamazight, its weakness was still visible and did not seem to work well. Authorities should have considered the fact that Arabic needed to coin a thoroughly new terminology for the teaching of science and technology before proceeding to the implementation of the Arabisation policy.

To give examples of the Arabic lack of symbols and terminology in mathematics, we provide excerpts from primary and secondary mathematics textbooks (see Figures 10, 11, 12, and 13). A quick glimpse at the high school’s Arabic mathematics textbooks shows that most of the content and illustrations are basically expressed in the French language. By examining primary and secondary mathematics books, we notice many anomalies that are described in the few pages extracted from mathematics books used in secondary level. Arabic is read from right to left and French is read from left to right. This so-called “Arabised” primary and secondary mathematics is filled with code switching, and symbol borrowing. Furthermore, Arabic is mainly used in a descriptive way as connection words and most of the mathematical content is expressed in the French language. For example, equations and functions are maintained as they are usually
written in French. This is abnormal and a total Moroccan aberration. The reader, whether teacher
or student, must read Arabic from right to left, then read the French from left to right. So, what
kind of Arabisation is this?

Figure 10. Mustapha jayid (2012 edition)
What’s interesting in mathematics, the book of the student, third year secondary preparatory]
Source: Abdessalam Hakani, Mustapha Fahmi, Mohamed Ghazaili, Nourredine Bouzite, p. 63
Let’s, for example, read the last sentence depicted in Figure 9. To help the reader, we will use arrows to show the direction in which this sentence will be read (LR: left to right and RL: right to left):

\[
29 < \text{ABC} < 180 \quad \text{ثاني } \text{ABC} \quad \text{ثاني } \text{ABC} < 180
\]

If the same sentence is to be written in English, it would be written as follows:

Therefore: \(29 < x\) since \(ABC\) a triangle then \(29 < \text{ABC} < 180\)

To read this sentence, which supposedly is considered Arabic Mathematics, we need to start reading from right to left. However, in between if the word(s) is(are) written in Arabic, we need to read from right to left. If the word(s) is(are) written in French, we need to read from left to right. All this is done to just include a few Arabic words to describe the mathematical French content.

Instead of the teacher/student focusing on the content, they have to go through this unnecessary and exhausting process to figure out how to read the material and make sense of how the two languages are correlated. Keep in mind that this is only one sentence; now consider how each topic, as well as the entire book, following this same protocol. This phenomenon is apparent on every single page of Arabised mathematics books on both primary and secondary levels. We have selected only a few random pages from different mathematics books to illustrate this aberration (see Figures 10, 11, and 12).

In the lower rectangle of Figure 10, the beginning the sentence reads from right to left. Then as we arrive at the braces, we need to read from left to right because of the “imply” symbol. Mathematically, it makes sense, but then this is a clear violation of how Arabic reads
(right to left). In this case, it seems that whenever Arabic is between French words, one needs to read from left to right. This is just another example of how inconsistent the process of so-called “Arabisation” is. Each time, the reader, whether student or teacher, needs to figure out how to first read the material instead of focusing on the content itself. To avoid this type of problem, the material should be written in one language—Arabic or French, but not both.

Figure 11: الرياضيات التحليل تماثيل وحلول السنة الأولى من سلك البكالوريا [Mathematics Analysis, Problems and Solutions, 1st year of baccalaureate]. Source: Abdessalam Hakani, Mohamed Ghazaili. (2012 Edition), p. 123
Another inconsistency appears in Figure 11. In the exercise labeled #75, Arabic is read from right to left and French is read from left to right. However, in the exercise labeled #75, Arabic commas are used between the sides AC, BC and ED and a period is placed at the end of ED, which forces the reader to read the whole question from right to left, including the French language. This is another violation of how French supposedly reads. These inconsistencies lead to confusion and definitely hinder students’ learning. Furthermore, the interaction between Arabic and French causes students to be confused and less proficient in either language and, most importantly, less proficient in the content itself.

*Figure 1. المفيد في الرياضيات كتاب التلميذ (ة) السنة الثالثة من التعليم الثانوي الاعدادي 12 [What’s interesting in mathematics, the book of the student, 3rd year secondary preparatory]. Source: Abdessalam Hakani, Mustapha Fahmi, Mohamed Ghazaili, Nourredine Bouzite. Mustapha jayid (2012 Edition), p. 45*
Exercises 5 and 6 in Figure 13 are easier to decipher and French and Arabic are used jointly; however, this is not the case in many pages we analyzed in these books. Notice that other Arab countries, while Arabising their mathematics, borrowed Latin symbols and switched their direction (mirrored Latin symbols) in order to read them from right to left as Arabic reads. For Arabisation to be efficient, more work needs to be done. For Arabisation to be complete, it should have its own symbols free of any Latin alphabets and symbols, including the mirrored ones (see Figure 14).

Figure 13. الرياضيات التحليل تمارين وحلول السنة الأولى من سلك البكالوريا [Mathematics Analysis, Problems and Solutions, 1st year of baccalaureate]
Mathematical Symbols and Notations Mirroring

Right-to-left mathematical directionality is related to mirroring, with respect to the Latin notations. By mirroring, we mean that mathematical symbols and notations, as a consequence of right-to-left writing, are accordingly adapted. For example:

<table>
<thead>
<tr>
<th>LTR symbol</th>
<th>Mirrored RTL symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\in$</td>
<td>$\exists$</td>
</tr>
<tr>
<td>$\rightarrow$</td>
<td>$\leftarrow$</td>
</tr>
<tr>
<td>$\leq$</td>
<td>$\geq$</td>
</tr>
<tr>
<td>$\int$</td>
<td>$\iint$</td>
</tr>
<tr>
<td>$\sum$</td>
<td>$\sum$</td>
</tr>
</tbody>
</table>

Below is an example of mathematics in Arabic using mirrored symbols, which allows everything to be read from right to left as Arabic reads.
Other Arab countries have made progress in Arabised mathematical notations. Figure 17 depicts some Arabic mathematical notations for limits, functions, partial derivatives, and integrals, including mirrored symbols for partial derivatives and integrals. Figure 18 shows Latin inverse trigonometric functions and Arabic inverse trigonometric functions. These last ones are free of any mirrored Latin notations. However, in the case of Morocco French, use of the mathematical language is maintained in conjunction with Arabic.

<table>
<thead>
<tr>
<th>Description</th>
<th>Arabic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit</td>
<td>نـ</td>
</tr>
<tr>
<td>Function</td>
<td>(س)</td>
</tr>
<tr>
<td>Derivatives</td>
<td>د'(س)، 6د، 5د، 4د</td>
</tr>
<tr>
<td>Integrals</td>
<td>∫، ∫، ∫، ∫</td>
</tr>
</tbody>
</table>

*Figure 16. Mathematics in Arabic using mirrored symbols*

*Figure 17. Arabic mathematical limits, functions, derivatives and integrals notations*
One of the main differences with the European languages is that the Arabic language is written from right to left (RTL), with the exception of numbers which are written from left to right (LTR). While Modern Standard Arabic is the official or national language in most Arabic countries and yields uniformity in the writing system, how to write formulas is not well standardized. In Morocco, formulas are written LTR, but in the other Arabic countries, they are written RTL. For example:

Saudi Arabia

\[
\sqrt{x + 3} + 3
\]

Morocco

\[-3x + 3\]

Notice that Morocco uses European numerals while Saudi Arabia uses the Arabic-Indic numerals. The three set of numbers are considered:

<table>
<thead>
<tr>
<th>European</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabic-Indic</td>
<td>٠</td>
<td>١</td>
<td>٢</td>
<td>٣</td>
<td>٤</td>
<td>٥</td>
<td>٦</td>
<td>٧</td>
<td>٨</td>
<td>٩</td>
</tr>
<tr>
<td>Eastern Arabic-Indic</td>
<td>٠</td>
<td>١</td>
<td>٢</td>
<td>٣</td>
<td>٤</td>
<td>٥</td>
<td>٦</td>
<td>٧</td>
<td>٨</td>
<td>٩</td>
</tr>
</tbody>
</table>

Figure 18. Arabic inverse trigonometric functions

Figure 19. Formulas in Saudi Arabia and Morocco

Figure 20. Three sets of numbers
Consequently, the inability of Arabic to fulfill the needs of education led Moroccans to maintain the use of French in conjunction with Arabic. Similarly, by the time the first Arabised student cohort reached higher education, Morocco’s Ministry of Education had no other choice but to decree a new law that allowed the use of French in universities, despite the pressure exerted in elementary schools. As a response, attempts were made to enrich Arabic’s vocabulary, but the fact that Arabic required the use of many words to express one word in French or English led to more confusion and impreciseness. This made the Arabisation policy an unbalanced, inconsistent, and incomplete one, which resulted in the low proficiency of many students in both languages—Standard Arabic and French.

If the issue of Arabisation is about preserving cultural identity, certainly these figures do not represent that. Policymakers know very well that students in the 1960s and 1970s were successful, knowledgeable, and intelligent bilinguals. Therefore, why not return to that era when mathematics was strictly taught in the French language and Arabic was used in literary and social subjects? Learning mathematics with the Arabic and French languages combined is totally inappropriate, if only because they read in opposite directions.

The disaster was the unpreparedness of students to deal with French as they were not allowed to become proficient enough in it to pursue more complex fields of studies such as mathematics, engineering, or biology. As a result, the standards of the institutions declined dramatically because students struggled first and foremost with French and then with the content.

Some people claimed that Arabisation was intended to separate the elite and other social classes in order to reduce competition for the prestigious and highly paid careers. Thus, the elite made sure that their children grew up more proficient in French than Arabic since French has always been the language of commerce in Morocco. It is a well-respected Moroccan norm to
speak French better than Arabic because of its social capital. The other aim behind Arabisation was to strive for a monolingual nation and an Arab-Islamic identity that was independent from all western influence. Arabisation policy leaders have ignored the fact that Morocco is linguistically diverse. Consequently, Tamazight speakers started to be very active about the consideration and use of their languages and won the battle only at the end of 2011, when Tamazight became an official language after an amendment to the Moroccan constitution.

The elite did not want to have many competitors for jobs that paid large salaries and they were smart enough to educate their children either in French schools or prestigious private schools. This interpretation could also be extended and related to current events with the claim that authorities wanted to reduce the percentage of educated people because the government may not be able to employ all the youth and unemployment would be a challenge to resolve.

Leaving French as the medium of instruction in higher education was perhaps meant to be an impediment, forcing students to face problems and challenges which would result in their low qualification for the job market. However, some of the students managed to become proficient in French by practice and the hard work they devoted to the language along with the course content.

The second research question was: Were learning and teaching mathematics in Arabic and Tamazight languages at the secondary level preparing students adequately for the tertiary level and how? This is addressed in the next section.

**Languages of Instruction**

According to the 2011 Constitution, Arabic and Tamazight are the two official languages of the Kingdom of Morocco. The Tamazight language uses the Neo-Tifinagh alphabets (see
Figure 21. Arabic is the medium of instruction for mathematics and science at the fourth and eighth grades.

The Tifinagh alphabet is thought to have derived from the ancient Berber script. The name Tifinagh possibly means “the Phoenician letters,” or possibly comes from the phrase *tifinnegh*, which means “our invention.” Since September 2003, children in Moroccan primary schools have been taught to write Tamazight with the Tifinagh alphabet. It is also used by the Tuareg, particularly the women, for private notes and love letters as well as in decoration. For public purposes, the Arabic alphabet is normally used (see Figure 22).

The 1999 Charter for Education and Training stipulated that an open approach toward the Amazigh language (Tamazight) would be endorsed (La Commission Spéciale Éducation Formation [COSEF], 1999). To this end, the Royal Institute for the Amazigh Culture (IRCAM), created in 2001 under provisions of the Royal Dahir, has been designing various teaching
Figure 22. Arabic alphabet

materials and teacher training programs in Tamazight jointly with the Ministry of Education.

Some 12,000 teachers, 300 inspectors, and 558 school principals have so far received Tamazight teacher training through IRCAM. The inclusion of Tamazight in the school curriculum was a remarkable event within Morocco’s educational spheres.

The 2011 Constitution supports learning foreign languages and stipulates that the most widely used foreign languages shall be taught as means of communication, integration, and interaction with other societies in the spirit of openness to other cultures and civilizations (Moroccan Constitution 2011, Article 5, 2011). French, which is taught in kindergarten and the
first and second grades of public primary schools, is often used as the language of government, diplomacy, technology, and economics in Morocco. French also is the medium of instruction for some technical disciplines in the upper secondary schools, as well as for higher education institutes and engineering schools. English also is gaining ground as the most popular foreign second language and is used as the medium of instruction in a small number of higher education institutes and engineering schools. Spanish, Italian, and German also are taught as foreign languages beginning in Grade 9.

**Language of Instruction Issues and Challenges**

Research and current practices in multilingual societies have long pointed out the benefit of learning in the students’ first language, especially in the first years of primary school. This presents a significant problem for language of instruction policies and approaches. The first language of Moroccan children is either Moroccan colloquial Arabic (commonly known as *Darija*) or Amazigh, while the primary language taught at schools from first grade is Standard Arabic – no one’s first language. For many, Standard Arabic is a linguistic obstacle impeding success in school, especially for monolingual Amazigh students who live in largely Amazigh-populated areas and who rarely speak *Darija*, let alone Standard Arabic, upon arrival at primary school.

The directionality of French and standard Arabic languages in Arabised mathematics text books represent a major source of difficulty, especially at the secondary level when sophisticated and advanced mathematical symbols are required. After decades of implementing the Arabisation policy, the challenges with language education in Morocco have yet to be fully addressed. Questions about approaches and progress towards evidence-based curriculum and teaching, as well as preparation of teachers continue. Beyond the challenges with curricula, learning materials
also suffered from various flaws. A cursory look at Arabic textbooks used since 2006 for the first three years of primary school, reveals decontextualized, non-sequenced, and in some cases non-developmentally appropriate language. This includes complicated grammatical concepts and highly formal vocabulary. In recent years, the textbooks received denunciation from the public due to their content and inaccuracies. The critiques highlighted the role these issues played to discourage, confuse, and intimidate students. In response to the dissatisfaction of students and parents, the Ministry of Education announced in August 2017 that by the year 2018, textbooks in all subjects will be updated across primary and secondary levels. It is not known with certitude what updates the new editions will convey and how the changes would accomplish the goal of multilingualism and proficiency in Arabic simultaneously.

The Arabisation process, which took nearly 3 decades to fully implement across primary and secondary curricula thus seemed destined to fail. This was not due to the characteristics or demands of the Arabic language per se, but rather to structural and system-wide challenges that vexed the effort from its start. Textbooks will be changed, but little is known about the criteria directing the changes, or how these changes align with the new curricular goals. To put in effect true change and movement towards multilingualism, the entire approach towards teaching language must shift from a grammar-oriented approach to a meaningful competencies-based approach. For now, however, the question of how the 2015-2030 reform will impact Arabic, as well as the sociolinguistic practices in Morocco, remains open-ended. Whether this proposal will work to shift attitudes in favor of learning Arabic is doubtful, especially in light of reforms suggested by the Strategic Vision of Reform 2015-2030, which pushes for embracing a multilingual identity.
Monitoring Student Progress in Mathematics and Science

The Ministry of National Education in Morocco has implemented policies that require students to pass exit examinations at each level of education in order to obtain a leaving certificate and, by implication, continue to the next level. However, within primary school, students are automatically promoted from one grade to the next. Correspondingly, dropout rates have declined during the last 10 years, particularly for primary school students. At each educational cycle, the following exit examinations are administered:

- **Primary School Exit Examination**—this examination is given across the 16 regions and is developed by commissions of experienced teachers and inspectors from the Délégations (Regional Administrations helping with education matters) and the Academies for Education and Training, respectively. Students are required to pass this examination to be eligible for admission to lower secondary school.

- **Lower Secondary School Exit Examination**—this examination is also given across the 16 regions and is developed by commissions of experienced teachers and inspectors from the Délégations and the Academies for Education and Training, respectively. Successful students are awarded a leaving certificate and are eligible for enrollment in upper secondary schools.

- **The Baccalaureate Examination**—this is a national achievement examination developed at the National Center for Examinations. The examination takes 3 or 4 days to complete and covers the content and objectives outlined in the syllabi for upper secondary education. The content included in the Baccalaureate depends on the specific coursework taken by the student. Some subjects are tested either through school assessment at the end of the first or second year of Baccalaureate-track.
education or through the regional Academia, an examination given in the second semester of the first year of Baccalaureate-track education. Students who achieve an overall average of 10 or better on a 20-point scale are awarded the Baccalaureate Diploma. The National Charter for Education and Training stipulates that all students who pass the Baccalaureate examination are eligible (in the year in which they pass the examination) for tuition-free studies at one of the public universities across the country.

Formative assessment is an important source of feedback for teachers and is geared toward helping them to gauge the effectiveness of their teaching strategies in relation to the curriculum as well as to orient teaching style to student learning style. Teachers use formative assessment aligned with ministerial circulars and pedagogical guidelines as a source of information about student progress and ability (Ministry of National Education, Higher Education, Staff Training and Scientific Research, 2010). Formative assessments are curriculum-based tests of student competencies, which provide opportunities for remediation (Ministry of National Education, Higher Education, Staff Training and Scientific Research, undated).

Teachers administer formative assessments at the end of the first semester and the end of the school year. These school-based tests are administered under standardized testing conditions. Their purpose is to determine how well students have achieved the overall syllabus objectives for the semester or year. Tests are broad in coverage and assess a representative sample of content from the syllabus covered during the semester or year. Teachers also administer short quizzes at different stages of instruction.

The 1999 Charter for Education and Training stipulated that Morocco’s assessment and certification system should be overhauled. In response, the National Center for Evaluation and
Examinations has led significant reform of the assessment and certification system. In an effort to ensure uniformity and standardization in the evaluation process, the center developed frameworks and guides for the design, administration, and scoring of examination papers. Moreover, in collaboration with the Higher Council for Education, the center launched the National Program for the Evaluation of Acquired Learning Outcomes (Programme National d’Evaluation des Acquis, or PNEA) to implement a periodic assessment of student learning. The PNEA nationwide system of assessment makes it possible to gauge whether or not learning outcomes have been met, and to define a benchmark against which to systematically evaluate the quality of education being provided. The executive summary of PNEA 2008 includes a series of recommendations to improve the teaching and learning of languages, mathematics, and science (Higher Council for Education and Training, 2008).

An in-depth diagnosis of the school examinations and certification systems is underway within the National Center for Evaluation and Examinations with the aim of redefining the system within a national policy framework for evaluating learning outcomes. The National Education Emergency Support Program is, in part, the outcome of a variety of studies and assessments, and aims to further build the credibility of the assessment and certification system.

**Impact and Use of TIMSS**

The Trends in International Mathematics and Science Study (TIMSS) is an international comparative study of student achievement. The reliable, valid, and detailed data that TIMSS provides about Moroccan student achievement in mathematics and science has been beneficial to education reform in Morocco. Equally important are the TIMSS data about the educational environment within which students learn these two subjects at the primary and lower secondary
levels. Through the international perspective provided by TIMSS, Moroccan educators have gained deeper insights into ways to further improve mathematics and science teaching.

The National Center for Evaluation and Examinations, in collaboration with the Regional Academies of Education and Training, organized 16 nationwide seminars geared toward implementing the provisions of the National Education Emergency Support Program regarding student assessment. These seminars were an opportunity to disseminate data about Moroccan student achievement in mathematics and science (as well as reading) and identify the areas and skills needing further attention. Educators, parents, and other stakeholders were called upon to develop improvement plans to help students enhance their competency in mathematics and science.

In light of Morocco’s TIMSS results, the Ministry of National Education has launched the Evaluation of Prerequisites program (L’Evaluation des Prérequis) designed to nurture a culture of assessment in mathematics and science, and particularly to diagnose key competencies (and resources) students should master within the new science and mathematics curriculum. This program, administered nationwide at the very beginning of each school year, enables teachers to identify students’ areas of strength or areas needing improvement during instruction and according to each student’s individual learning pace (UNICEF MENA-RO, 2010). Within the framework of the assessment program, diagnostic tests are administered and scored at the very beginning of the school year. Students with similar learning difficulties are grouped and specific remedial work programs are designed and implemented for these student groups. One of the major benefits of this program is that when teachers cannot easily resolve students’ difficulties on their own, headmasters, inspectors, pedagogical advisors, and school management councils
are all called on to develop a context-specific improvement plan to provide more extracurricular student support.

**The Level of Academic Achievement in Mathematics by School Grade**

The level of academic achievement in mathematics differs from one level to another, ranging from a minimum of 25% in the second year preparatory and 44% maximum in the sixth year elementary. Also, the proportion achieving program goals in primary school fluctuates between 34% in the fourth level and 44% in the sixth level, while this ratio does not exceed 25% in the secondary preparatory school during the second year and 29% the third year (see Figure 23).

It seems clear that primary students’ achievement in mathematics is much better than the level of achievement of their colleagues in the secondary preparatory level, where the difference has reached 9 points between the fourth level primary and the second level preparatory, and 15 points between the sixth level primary and the third level preparatory.

*Figure 23. Achievement in mathematics by school grade
Source: Supreme Education Council*
Overall, there have been no significant differences in terms of the level of academic achievement in mathematics between males and females since there was only 1-point difference in the fourth level primary in favor of females (see Figure 24). Furthermore, as the school level became higher, the difference between the genders was a 1 point increase in favor of males while decreasing significantly for both genders compared to the primary level.

**Student Achievement per the PIRLS Study**

The 2006 Progress in International Literacy Study (PIRLS) compared achievement for students in the fourth grade across many participating countries. Data revealed significant decreases in average reading achievement in Morocco since 2003. The PIRLS (2006) report documented that in all the countries submitting data, there was “a positive relationship between an absence of school resource shortages and average school achievement” (p. 11), and that the average difference between students from homes with more than 100 books, as compared to those with less than 10 books, was “91 score points or almost one standard deviation lower”
Not surprisingly, average reading achievement was higher for children whose parents were frequent readers in all countries that reported statistics.

Evidence from PIRLS presented encouraging results for educational trends in Morocco. Net enrollment in school increased from 39.1% in 1970 to 92% in 2003, repetition rates decreased from 29.8% to 13.8%, and students reaching fifth grade increased from 65.8% to 75.6%. In the same 33-year period, the total number of students enrolled in secondary schools jumped from 12.6% to 47.6% (PIRLS, 2006). The figure that most suggests that Morocco is on the right track is the one which reflected the number of students who attended university. In this same 33-year period, there was over a 700% increase in the number of students who went on to study past secondary school.

Illiteracy rates for males and females also merit emphasis. In Morocco, women’s role is more limited to the home and, therefore, in the past, fewer women than men received an education. A comparison of illiteracy rates for women in 1980 vs. 2003 showed a drop of 20.1%. For men, the decrease totaled 23.6%. Still, this reflected an educational need, in that 60.4% of the women of Morocco and 34.3% of the men are functionally illiterate. Although 95% of the schools in Morocco are free and public, there are an insufficient number of schools to meet existing needs. Not all school-age children are enrolled in school (Ameziane & Lietz, 2001).

**TIMSS Results**

The TIMSS survey investigates the achievement in mathematics of students enrolled in the fourth and eighth grade. Regarding fourth grade test content, a wide range of subjects is offered while the questions are either in multiple-choice framework or just open questions. In 2007, TIMSS revealed Morocco’s lower ranking (31th/36) in mathematics. The average score in mathematics was around 341 points (6 points less than 2003). Compared to other countries
belonging to MENA (Middle East and North Africa), Morocco obtained the third highest score (341) in mathematics, lower than Iran (402) and Algeria (378) and above the MENA average (326) (see Figure 25).

**Figure 25.** TIMSS mathematics results for the fourth grade.
Source: TIMSS 2003 and TIMSS 2007

For eighth grade students, Morocco scored 381 in mathematics, which is below the MENA average (387), while 14 MENA countries obtained a score below the international average (500) (see Figure 26).

**Figure 26.** TIMSS mathematics results for the eighth grade
Figures 25 and 26 reveal that the highest performing countries are located in Asia, doing significantly better than European countries and the United States.

**Analysis of Retention and Dropouts at the Primary and Secondary Levels in Morocco**

Many factors contribute to retention and dropout at the primary and secondary levels in Morocco. Bilingualism and biculturalism are two of the major sources of difficulty for learners in schools because of the different, and at times conflicting, roles of Arabic and French. This difficulty is translated into reality by the high rate of failure and dropouts in primary, secondary, and higher education—hence the adoption of the Arabisation policy, whose aim is to reduce the number of dropouts and the failure rate at school (Grandguillaume, 1983). Thus, the linguistic discontinuity between secondary and higher education and language policy adopted for education is partly responsible for a massive failure in school.

According to UNESCO in its regional report *Out of School Children Initiative*, children who have repeated grades are far more likely to leave school than children who have not repeated grades (Lewin, 2011). In the MENA region, grade retention is a persistent problem. At the primary level, close to half of the countries in the region with data had repetition rates at 7% or above (see Figure 27). The retention rates were the highest in Djibouti and Morocco, where an average of 9% of pupils were repeaters at the primary levels in 2012. The pattern at the lower secondary level differed from that of the primary level in several ways: In all but two countries, the retention rates at the lower secondary levels were higher than at the primary level. Hence, in most MENA countries, retention is a much bigger problem at the lower secondary than at the primary level.
Figure 27. Retention rate by school level in 2011, by country

Figure 28 shows a decreasing school age population and significant retention during the whole primary cycle and this seemed to be more of a problem for boys than for girls. Below Grade 3, many more children were enrolled than there were in the age group. Above Grade 4, it was clear there was a substantial dropout as enrollments declined linearly until the high-stakes selection point at the end of the lower secondary level, after which there was a considerable number of children leaving school.

In the case of Morocco, the secondary dropout rate was 7.4% for boys and 5.2% for girls (see Figure 29). For comparison, Figure 29 also shows data for some of the MENA countries, Algeria and Tunisia among others. Comparing such countries’ results may open new avenues and ideas for researchers to explore. Since both Algeria and Tunisia were colonies of France, it is worth comparing their results to those of Morocco. Notice that the similarities in the situations in Algeria and Tunisia are striking. The origins of dropout phenomenon go back to the same period, the beginning of the 2000s. Primary dropout rates were near zero and average dropout rates during the first 2 years of secondary education were above 10% for boys and below 6% for girls.
in both countries. The reason put forward in the two cases and the responses in terms of education policy are also similar.

An overview of the scope of the problem at the primary level and how it has evolved over time appears in Figure 30. At the primary level, early school leaving is a major concern in the region’s poorest countries. Nearly one quarter of those children who entered Grade 1 in Djibouti and Sudan leave school before reaching the final grade of the primary cycle. Figure 30 also shows that early school leaving at the primary level was not only restricted to the poorest countries in the region. In Algeria, Lebanon, Morocco, and Syria, between 7% and 8% of children at the primary level left school before the last grade.
In more than half of the countries with sufficient data, improvement had been made in reducing dropout rates at the primary level between 2000 and 2011, with Morocco making the greatest progress.

Early school leaving is a widespread and more serious problem at the lower secondary
Figure 30. Dropout rate before the last grade of primary education by country, 2000 and 2011

level than the primary level (see Figure 31). Half of the countries with data have dropout rates before the last grade of the lower secondary level of 10% or more. In Algeria, Tunisia, and Syria, the problem is even more serious, with dropouts ranging from 25% to 33%.

Figure 31. Dropout rate before the last grade of lower secondary education by country, 2000 and 2011
Source: UNESCO Institute of Statistics (2014)
Among the contributing factors causing dropout is the language of instruction. Language of instruction is often a factor in dropping out in countries where the mother tongue is not the language of instruction. Many languages are used in the countries in the MENA region. As referred to in Chapter II, where the medium of instruction is not the mother tongue of children, there will be issues of transition. Where an international language from outside the region becomes the language of instruction, there will also be transition issues. Language policy must be clear and developed with an awareness of the consequences for dropping out and becoming out of school because of poorly managed transitions. Other contributing factors causing dropouts from school and possible policy options are listed in Appendix D.

The third research question is: Given that multilingualism and cultural identity are central issues in Morocco’s mathematical educational reform, what are some of the remedies suggested by the Moroccan government to deal with the language and cultural dynamics? Before tackling the Moroccan government’s attempts to remedy the educational system, it is important to list some of the challenges that this system is facing.

**Challenges in the Education Sector**

Internal efficiency is low with high dropout and retention rates. There is also an unmet need for rising demand for middle schools after achieving high access rates in primary education. The problem is more acute in the rural schools due to an inadequate supply and quality of instructional materials. The poor quality of education becomes an even greater problem due to Arabic-Berber language issues because most of the Berber family children hardly know any Arabic, the medium of instruction in schools, when entering primary level.

Low literacy in the Maghreb region is also a major problem. In Morocco, the adult illiteracy rate was still at a high of around 40% in 2007, despite concerted efforts being made
since independence in 1956 to reduce the rate, which at that time was 87%. In absolute terms, illiterate adults have grown from 6 to 9 million persons. Morocco is one of five Arab countries in which 70% of some 70 million illiterate adults in the Arab world are concentrated. In rural areas and for females, the problem is even worse; three quarters of women were considered to be illiterate in 2004.

Then there has been a high emigration rate of skilled workers; that is, the ratio of highly skilled emigrants to the total number of educated people back home is high. Morocco is losing a substantial number of skilled workforce members to foreign countries; it is the source of the largest migrant population among North Africans in Europe.

**Post-Independence Reforms**

After independence in 1956, Morocco’s primary goal was to establish new reforms to develop an education system with more focus on mathematics and science. Moreover, decisions were made for training some teachers to qualify for the task of teaching in Arabic the various subjects of the curriculum, especially scientific subjects such as mathematics, natural sciences, physics, and chemistry. In 1960, Iraq and Egypt were asked to help in the training of teachers. Egypt tried to establish a college in Rabat in which a section was reserved for the training of teachers of science and mathematics in Arabic. Iraq set up an institute for the training of teachers of history and geography.

The number of teachers increased rapidly for primary schools. However, there was still a lack of competent Moroccan teachers for secondary education where mathematics and scientific disciplines were introduced. Moreover, Moroccan teachers were not qualified to teach scientific subjects as the terminology for these subjects was lacking in the Arabic language. Because
Morocco was short of mathematics and science teachers, Moroccan authorities recruited qualified teachers from eastern European countries, such as Romania and Bulgaria.

The outcome of this new reform resulted in a system that was divided into three main tracks: modern, original, and technical. The modern track was a simple reflection of the French primary and secondary programs that had been customary during the Protectorate and used French language as a medium of instruction. The original track focused on Islamic culture and civilization and used Arabic language as a medium of instruction. The technical track appears to be continuously deteriorating and the struggle to maintain it is a subject in most educational debates. This divided system reflected, to a certain extent, the long and constant conflict between Arabisation and Francization in order to expand their respective spaces of use.

In their article titled “Les langues au Maroc: Réalités, changements et évolutions linguistiques,” De Ruiter and Ziamari (2016) stated:

Ainsi, après plus de cinquante ans, l’arabisation a offert un enseignement chaotique et une politique educative définitivement problématique. Concrètement, l’enseignement au Maroc est complètement arabisé dans le primaire et le secondaire. La langue de l’enseignement des matières scientifiques et littéraires est l’arabe. Tandis que le français est une matière comme les autres. Or, dans le supérieur, les matières scientifiques des filières scientifiques sont dispenses en français. (para. 48)

[Author translation]

After more than fifty years, Arabisation has offered a chaotic teaching and a definitely problematic educational policy. Concretely, education in Morocco is completely Arabised in primary and secondary education. The language of teaching of scientific and literary subjects is Arabic while French is a subject like the others. In higher education, scientific subjects in scientific fields are taught in French. (para. 48)

Indeed, Bourdereau (2006) stated, “S’il est au moins un constat qui fait l’unanimité au sein de la communauté éducative, c’est que ce hiatus linguistique entre l’enseignement secondaire arabisé et l’enseignement supérieur en français constitue l’un des premiers problèmes à résoudre” (p. 27). [Author translation: "If there is at least one finding that is unanimous within
the educational community, it is that this linguistic gap between Arabised secondary education and higher education in French is one of the first problems to be solved” (p. 27).]

His Majesty King Mohamed VI’s Strategic Vision for the Reform of the Moroccan School: 2015-2030

Since Morocco’s independence in 1956, the educational system has been a major preoccupation for King, government, and population. As the successor of King Mohammed V, the Sovereign Hassan II emphasized that “Our major concern is the reform of the education system” (speech from throne, 1998). Arabisation of the education system was among the reforms. The development of Morocco cannot be achieved without effective knowledge of science and mathematics. For this reason, the education system of Morocco puts great importance on the study of mathematics education, science, and technology.

After his accession to the throne in 1999, his majesty King Mohammed VI (successor of King Hassan II) stressed that “The question of education is at the top of our present concerns because of the magnitude of its importance, its impact on the formation of generations, preparing them to take an active role in life, building the nation.” In other words, the new King Mohammed VI declared his concern for the reform of Moroccan education as a strategic move for the progress of society. To meet his objectives, the King named the period 1999-2009 as the “Education Decade” and decided to launch the National Charter for Education and Training. The Charter is designed to address the problem articulated above by De Ruiter and Ziamari (2016). Through level 9, the Charter recommended, among other things, the mastery of foreign languages. However, this is the Achilles heel of public education, where students have difficulty mastering foreign languages, especially French.

Another reform, however, gave a new lease on life to that advocated by the Charter. The emergency plan or Najah program (2009-2012) was designed, among other things, around the
linguistic issue. Several measures have been taken to succeed in this project, including more hours assigned to French in university courses. However, no satisfactory result was attained.

In 2009, the Moroccan government launched another program, the Taysir program, in order to increase the rate of school attendance. A summary of the Taysir program appeared in the 2014 UNESCO report:

To reduce the unequal access to social services, the government of Morocco launched a cash transfer programme where financial support is conditional on the presence of children in school. The programme, called Taysir, began in 2009 with a pilot phase involving the most vulnerable households, especially in rural areas and schools with high dropout rates. This first step involved some 88,000 primary age children in more than 47,000 households. Its extension in 2010 marks the satisfactory results noted at the school attendance of targeted students and lower dropout rates in schools concerned. More than 300,000 students from 160,000 households benefited from the programme in 2010, representing almost a tenth of the primary school age population. The cash transfers represent a preventive action against school dropout and are part of a broader effort to enhance Morocco’s national social policy for inclusion of vulnerable groups in society. (p. 60)

As mentioned before, one preoccupation of his Majesty King Mohammed VI was to reform Morocco’s system education and ensure restoration of confidence in the school. Delivered on the occasion of the 16th throne day, the Sovereign stated, “The future of the nation depends on the quality of education we provide for our children.” Various policy recommendations called for changes in the education system with more focus on mathematics—changes that reflected concerns about the rigor, relevance, reasoning, sense making, and habits of minds engendered in good mathematics education.

In addition, the Sovereign pointed out that Moroccans want an education system that was “based on open-mindedness, critical analysis and foreign language acquisition which will enable their children to access the job market and start their professional life.” However, extensive and appropriate research of curriculum, teacher training, assessment, and policymaking is critical in shaping the future of mathematics education, science, and technology.
The effective integration of ICT (Information and Communication Technology) into education and teaching mathematics fundamentally transforms mathematical activity. It improves student achievement on mathematics tests. For this reason, King Mohammed VI stressed that “the education reform must be aimed primarily at enabling students to acquire knowledge, skills and national and foreign languages, particularly in scientific and technical curricula, in order to be active members of society.”

In a speech on the occasion of August 20th, 2015, marking the 60th anniversary of the Revolution of the King and the People, King Mohammed VI declared that the Moroccan education system has faced challenges since its independence in 1956. The King described a new reform as one of fairness and equal opportunity, a quality education for all that will encourage individual and social progress; this educational system will combat poverty and isolation. This Strategic Vision for the Reform of the Moroccan education sector is set to take place 2015-2030.

**Mathematics Teacher Education**

**First Cycle of Basic Education**

Primary school teachers are trained at *centres de formation des instituteurs* (CFI). A *baccalauréat* is required for admission to 2-year teacher training programs and students must also pass an entrance examination. Holders of the DEUG (Diplôme d’Etude Universitaire General, which is equivalent to Associate Degree in the United States) or its equivalent can enter the second year of studies, which is mainly focused on pedagogical training. Graduates are awarded the *Diplôme d’Instituteur*.

**Second Cycle of Basic Education**

Lower secondary teachers are trained in one of two different programs at *centres pédagogiques régionaux*. The first is a 2-year program open to *baccalauréat* holders who have
passed an entrance examination. Training is offered in subject specialties as well as in theoretical and practical areas. This program is only offered in subject areas where there is a particular manpower shortage; most notably, this is the case in mathematics and French. One-year pedagogical training is also offered to DEUG (or equivalent) holders who have passed an entrance examination. Graduates are awarded a *Diplôme de Professeur de Premier Cycle*.

**Secondary Education**

Secondary school teachers in the general education stream are taught at “*écoles normales supérieurs*” (ENS, higher teacher training schools); technical school teachers are trained at “*écoles normales supérieurs de l’enseignement technique*” (ENSET). The Faculty of Education at Mohammed V University also trains secondary school teachers. Programs can be 1, 2, or 4 years in length depending on the student’s qualifications upon entry into the program. Four-year programs are open to holders of the “*baccalauréat*” who have passed an entrance examination. Two-year programs are open to graduates of the DEUG (or equivalent) and to teachers of the second cycle of basic education who have sufficient work experience and have passed an entrance examination. One-year pedagogical programs are available through the Faculty of Education to graduates of the CPGE or the *licence (Bachelor’s degree)*. Graduates from all programs are awarded a *Diplôme de Professeur de Deuxième Cycle*. Technical secondary teachers are trained exclusively in 4-year programs, which require an entrance examination for admission.

**Mathematics Education at Teachers’ Colleges and Teachers’ Higher Education**

Mathematics teachers play an important role in clarifying the mathematical concepts, shaping pupils’ cognitive experiences, and training them to acquire basic mathematics skills as well as in the design of experiences that motivate them to learn mathematics.
Since the 1970s, Morocco has been seeking tirelessly to improve academic achievement and qualify graduates to keep pace with progress in various aspects of human activity. However, this quest would not have happened had it not been for the recognition of the need for good teacher preparation and the building of a new social image that fits the huge responsibility placed on each teacher.

The National Covenant for Education and Training has stated in its 13th pillar (articles 134, 135, 136) the following:

- Providing teachers, educational supervisors, mentors, and administrators with a solid formation before they take on their duties. This is based in accordance with objectives, periods of time, formation systems, and training to be determined on a regular basis in light of the educational developments and pedagogical calendar.

- Verifying Training Centers Enrollment Standards and Graduation Standards.

- Reinforcing basic training and organizing continuous training sessions to make them capable of handling the learning requirements as well as the pedagogical and communicative skills required.

- Education and Training professionals, regardless of their different functions or the levels in which they are engaged, benefit from two types of continuous training and development: a 30-hour short annual session to upgrade and enhance skills and in-depth development sessions held at least once every 3 years. Table 6 sets forth weekly sessions for the study of mathematics at Mathematics Teachers’ Formation Centers: Years 1 and 2.

The history of educational reform in Morocco has known several initiatives and achievements through which much has been realized. Most children now benefit from primary education and many of them have opportunities to continue their education. Great efforts have
been made to establish gender equality in education by making education available to the entire population.

Table 7

*Weekly Sessions for the Study of Mathematics at Mathematics Teachers’ Formation Centers: Years 1 and 2*

<table>
<thead>
<tr>
<th>Subjects</th>
<th>1st Year</th>
<th>2nd Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory Courses</td>
<td>Guided Works</td>
</tr>
<tr>
<td>Algebra and Geometry</td>
<td>2 h 4 h</td>
<td></td>
</tr>
<tr>
<td>Mathematics Analysis</td>
<td>3 h 6 h</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>3 h 3 h 2 h</td>
<td></td>
</tr>
<tr>
<td>Arabic, Terminology and Islamic Culture</td>
<td>3 h</td>
<td></td>
</tr>
<tr>
<td>French</td>
<td>2 h</td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td></td>
<td>1 h</td>
</tr>
<tr>
<td>English</td>
<td></td>
<td>1.30 h</td>
</tr>
</tbody>
</table>

Source: Ministry of National Education

Clear progress towards gender equality has been achieved as well. The gap between boys in urban areas and girls in rural areas in primary school has been narrowed by 3.5% by the year 2012. A series of programs has been launched to increase the rate of school attendance, improve the quality of education, and reform the way the education sector has been administered.

The issues affecting education today that were found in this research are focused on the nature of curriculum, the nature of instruction, new forms of assessment, and beliefs about mathematics. Various policy recommendations call for changes in high school mathematics that reflect concerns about rigor, relevance, reasoning, and sense making in high school mathematics.

Morocco has made a major effort to improve the teaching of mathematics over the years, especially by improving the curriculum and establishing regional training centers for teachers, believing strongly that the teaching of mathematics is among the main pillars that prepare the individual to think, create, and show his/her abilities and confront problems. National teacher
preparation and education programs such as Genie, ICT, and others are thriving, but a bundle of challenges and important questions remain for research to explore. Mechanisms to support mathematics teachers in the classroom need to be promoted through systematic research. The Strategic Vision for the Reform of the Moroccan School 2015-2030 of his Majesty King Mohamed VI is on target and had laid a picturesque ground for the future horizons of Moroccan education that can only be bright and promising for future generations. In the next section, efforts made by Arabic countries, including some of the most recent programs to enhance the tertiary level education are presented.

**Arabic Countries’ Efforts to Enhance Tertiary Level Education**

Among the efforts made by Arabic countries to enhance the education at the primary secondary and tertiary level is the establishment of the MENA tertiary education network, the Systems Approach for Better Education Results (SABER) and the Partnership Approach program.

**MENA Tertiary Education Network**

A Regional Tertiary Education Network has been established as a platform to promote the exchange of information and lessons learned from the implementation of reforms, notably through the organization of annual conferences. Successive conferences have been organized in Cairo (2011), Rabat (2012), Tunis (2014), Beirut (2015), Algiers (2016) and Marseille (2017), demonstrating the increased regional interest in this collaborative agenda. At the multi-country level, it aims to create a solid knowledge base from which to foster collaboration and cooperation. At the country level, its objective is to support capacity building at individual tertiary education institutions, through a focus on six priority areas: (i) Institutional Governance, (ii) Internationalization of Tertiary Education, (iii) Financial Sustainability, (iv) Quality
Assurance, (v) Developing Innovation Systems, and (vi) Monitoring Results and Benchmarking, with the overall aim of improving tertiary education provision.

**The Systems Approach for Better Education Results (SABER) in Morocco**

The Systems Approach for Better Education Results (SABER) is designed to help countries reform and strengthen their education systems by providing them with a framework for analysis and access to an international knowledge base. The SABER program uses diagnostic and information-gathering tools to generate knowledge and comparative data on educational systems' institutions and policies. It also makes it possible to evaluate and compare educational policies against recognized international standards and highlights the main policy options deemed effective for improving sector performance.

To date, the SABER approach has been used in more than 140 countries and in a dozen different areas, including, for example, early childhood development, teachers, private sector participation, and school finances. Three SABER reports on Morocco were drafted between 2015 and 2017 in collaboration with the Ministry of National Education. These reports are publicly available at [http://saber.worldbank.org](http://saber.worldbank.org).

**SABER-Teachers Report, Morocco, 2017**: The study reveals that the policy on teachers could be strengthened to attract the best candidates, provide teachers with useful initial training, support them through continuous training to improve teaching practices, ensure that teachers are monitored and supervised by competent school principals, motivate teachers to perform, and ensure that the system for monitoring teaching and learning effectively contributes to improved classroom learning.

**SABER School Autonomy and Accountability Report, Morocco, 2015**: The report pointed out that the composition and method for electing the members of the School
Management Council did not allow for a balanced representation or effective participation of the various groups in the management of schools. The selection criteria, training, and the overall incentive system do not promote the development of real leadership at the level of school principal. There are also no formal criteria for evaluating the performance of school institutions or a comparative analysis of results based on standardized student tests; as a result, no evaluation is provided to institutions to improve learning.

**SABER Student Assessment Report, Morocco, 2015:** The study shows that classroom assessment is used more as an administrative tool than as a pedagogical resource. It also indicates that teachers' assessment practices are relatively weak, while mechanisms for verifying the quality of classroom assessments are limited. The formal quality assurance mechanisms for the baccalaureate examinations are also limited and cheating is a serious problem. Morocco has administered national, large-scale standardized assessments (National Program for the Assessment of Learning) and has participated in several international assessments (PIRLS, TIMSS). Morocco allocates regular funding to these activities and meets technical quality standards. However, the results are not analyzed at the school level and teachers do not have the opportunity to benefit from them to improve their practices.

**The Partnership Approach:** Key to the program has been the strong collaborative work between the World Bank and the Center for Mediterranean Integration, and with universities and quality assurance organizations and governments in the MENA region. In addition, the Program greatly benefits from the partnership with relevant regional and international organizations including the Association of Arab Universities (AARU), the Islamic Educational, Scientific and Cultural Organization (ISESCO), UNESCO, UNIMED, the International Association of Universities (IAU), OECD, EUA, AUF and the British Council, among others.
Finally, to conclude this discussion, it is worth pointing out that most of the research literature is in English. It is a known fact that even the French research relies heavily on it. Indeed, according to UNESCO, 65% of yearly scientific publications appear in English, while only 9.8% are published in French (Boukous, 2011, p. 41). Arabic research in turn relies on French research. Therefore, Arabic research receives less information from English research because of French transitioning.

The general policy adopted by both decision makers and educationalists in Morocco constituted a considerable force in the spread of English in this country. Arabisation enhanced the role of English to the detriment of French in the sense that French no longer retained widespread prominence for governmental, educational, and conversational purposes (Sadiqi, 1991). In a similar vein, Marley (2004) wondered whether Arabisation was complete or whether it is rather a reorientation based on different linguistic options, namely that of English. In fact, Zouhir (2013) stated that “it is fair to say that with the advent of globalization, linguistic authority is no longer placed by Classical Arabic or French as it used to be. Rather, the emergence of English as a strong language gave way to a drastic reduction of the space of French in education” (p. 276).

Moreover, from 2004, English has been integrated into public primary education while it was taught only in high school. Even more, an international baccalaureate option “English” was implemented in September 2014-2015. This will give more weight to this language in Morocco’s linguistic future. Concerning language choice and planning in Morocco, especially in the scientific field, English seems to be the only force that represents a threat to the French language.

**Mathematics and Language Related Orientations Discussion**

Researchers have argued for an orientation to language as a resource that values bilingualism in mathematics classrooms. However, little is known about what mathematics
teachers can do to translate a language-as-resource orientation into productive classroom practice. In this study, I analyzed textbooks to understand pedagogies that are possible in contexts where bilingualism is seen as a resource. I provided examples from the classrooms textbook excerpts and discussed implications for research in bilingual classrooms where a language-as-resource orientation dominates at the primary level and language-as-problem orientation dominates gradually at the secondary level when mathematical symbols become more sophisticated.

This study contributes insights on how language orientations at the societal level may play out at the classroom level as discursive practices. Language orientations play a role in whether teachers enhance or silence particular languages. At the same time, classroom discursive practices also inform language orientations at the societal level. Examples of bilingualism-as-enhancer may inform teachers in contexts where bilingualism is regarded as a problem to explore the benefits of specific bilingual discursive practices, developing their own pedagogies of possibility while supporting students’ inference of mathematical terminology.
Chapter VII

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

A historical perspective made it possible to highlight in this study significant events and milestones about multilingualism, cultural identity, and mathematics education in Morocco pre-, during, and post-French Protectorate. In prior research, most authors described how multilingualism and cultural identity affected education in general but involved mathematics education only in passing. In this study, the focus was shifted solely to how multilingualism and cultural identity affected the progress of mathematics education and its reform post the French Protectorate.

This study’s purpose was to explore Morocco’s attempt to restore its cultural identity post-French Protectorate and how that attempt influenced the Moroccan mathematical educational system. In addition, this study focused on the Arabic and Tamazight languages of instruction in mathematics in Morocco to investigate if teaching and learning mathematics in the Arabic and Tamazight languages in the secondary schools were preparing students adequately for the tertiary level. Finally, this study attempted to see if multilingualism and cultural identity are at the heart of mathematical educational reform and to develop insights into the state of mathematics education reforms suggested by the Moroccan government to remedy the language challenges.

In order to develop a comprehensive picture of how historically multilingualism and cultural identity influenced mathematics education in Morocco and answer the research questions of the study, we employed a historical research methodology based mainly on a careful analysis of historical books, textbooks, reviews, publications, reports, and documents preserved in official archives such as centers, libraries, and the Ministry of Education, Rabat-Morocco.
Where applicable, events were explored by referring to contemporary reviews, publications, and reports provided by organizations such as UNESCO and the World Bank, and studies done by various scholars. Supplementary knowledge was acquired, and evidence was supported by quantitative data in official archives supplied by UNESCO, TIMSS, MENA, and PIRLS studies.

Conclusions

Research Question 1: How did the attempt to restore the Moroccan identity post-French Protectorate influence the Moroccan mathematical teaching and learning in primary and secondary schools?

Morocco has taken steps to undo and liberate mathematics and its education from French influence. Arabisation was meant to restore the Moroccan identity, but unfortunately the process of Arabisation had many unforeseen negative consequences on portions of Morocco’s population and brought about a host of educational and cultural problems. For instance, it ignored the multilingual and multicultural nature of Moroccan society. In addition, it made it impossible for educators to serve students’ primary language needs adequately, given the requirements to adhere to a strict Arabisation policy. Furthermore, students whose parents had the financial means continued to send them to bilingual private schools so that their children would learn French and other languages. However, students who could not afford private schools were either relegated to substandard public schools or simply dropped out. In addition, Arabisation has not been expanded to the tertiary level and there is no future plan for its implementation at that level. Therefore, French still dictated the future of students at the tertiary level, resulting in a rampant emergence of private school enrollment and decline of enrollment in public schools. Furthermore, analysis of primary and secondary mathematics textbooks shows many flaws and inconsistencies that may hinder students’ learning of mathematics. In addition,
this study shows that Arabisation of mathematics in Morocco differs from other Arab nations in use of numerals, language borrowing and symbol mirroring.

Research Question 2. Were learning and teaching mathematics in Arabic and Tamazight languages at the secondary level preparing students adequately for the tertiary level and how?

Student achievement per TIMSS and PIRLS Studies show that the level of achievement in primary schools is better than at the secondary level. However, the levels of achievement in both primary and secondary school are below the MENA average and way below the international average. The level of academic achievement in mathematics by school grade and by school gender (Ministry of Education) show results similar to the TIMSS and PIRLS studies. Retention and dropouts at the primary and secondary levels are becoming a serious issues in Morocco, especially at the secondary level. Arabisation implementation at the secondary level may be one of the major sources of difficulty for learners in schools because of the different, and at times conflicting, roles of Arabic and French. It is important to mention the high rate of failure and dropouts in primary, secondary, and higher education. Hence, the linguistic discontinuity between secondary and higher education and the language policy adopted for education is partly responsible for a massive failure in school. Students find themselves less proficient in both French and Arabic at the tertiary level unless they attended private schools.

Research Question 3. Given that multilingualism and cultural identity are central issues in Morocco’s mathematical educational reform, what are some of the remedies suggested by the Moroccan government to deal with the language and cultural dynamics?

Tayseer program: In 2009, the Moroccan government launched a program, called the Taysir program, in order to reduce the unequal access to social services and increase the rate of
school attendance. The program began in 2009 with a pilot phase involving the most vulnerable households, especially in rural areas and schools with high dropout rates. Its extension in 2010 marks the satisfactory results noted in school attendance of targeted students and lower dropout rates in schools concerned.

Najah Program: Another reform, however, gave a new lease on life to that advocated by the Charter. The emergency plan or Najah program (2009-2012) was designed, among other things, around the linguistic issue. Several measures have been taken to succeed in this project, including more hours assigned to French in university courses. However, no satisfactory result was attained.

The Strategic Vision for the Reform of the Moroccan School 2015-2030 of King Mohamed VI: As mentioned before, one preoccupation of his Majesty King Mohammed VI was to reform Morocco’s system education and ensure restoration of confidence in the school. In addition, the Sovereign pointed out that Moroccans wanted an education system that was based on open-mindedness, critical analysis and foreign language acquisition which will enable their children to access the job market and start their professional life. The King described a new reform based on fairness and equal opportunity, a quality education for all that will encourage individual and social progress; this educational system will combat poverty and isolation. This Strategic Vision for the Reform of the Moroccan education sector is set to take place 2015-2030.

Integration of ICT (Information communication Technology): National teacher preparation and education programs such as Genie, ICT, and others are thriving, but a bundle of challenges and important questions remain for research to explore. The effective integration of ICT into education and the teaching of mathematics fundamentally transforms mathematical activity and improves student achievement on mathematics tests.
Teacher Training and professional development: Teacher training and professional development and reinforcing basic training and organizing continuous training sessions to make teachers capable of handling the learning requirements as well as the pedagogical and communicative skills required by all of the new initiatives.

A series of other programs has been launched to improve the quality of education, and reform the way the education sector has been administered. Among these initiatives were the establishment of Regional Assessment and monitoring student progress involving international organizations such as TIMSS, PIRLS, UNESCO, the World Bank and other organizations.

**Recommendations**

The issues affecting education addressed by this study might be central to any mathematics reform effort and might serve as a catalyst for today’s various societies that are experiencing emerging multilingualism and cultural diversity. This study attempted to explore how cultural identity and multilingualism affected mathematics education in Morocco post the French Protectorate and aimed to establish and extend the scholarly bases for the study of mathematics and cultural diversity in Morocco. Several recommendations arose from this study to those interested in similar research. I discuss in turn three types of recommendations. First, I discuss recommendations to prospective researchers about what have I learned by conducting this study. Second, I discuss recommendations to policy makers. Third, I discuss what my study has to offer professional educators and teachers. Finally, I close by discussing recommendations for further research.

**Recommendations to Prospective Researchers**

This study may provide prospective researchers who are interested in historical topics some insights into the state of how to employ a historical research methodology and make their
own interpretations about results based on prior research. My advice to other researchers about
the kind of research I did is when dealing with historical studies, one must consult a great many
libraries, books, and documents. Expect that deciphering the information may be time-
consuming, and sometimes one may come up with ephemeral information only. Be aware that
this type of study requires consulting works in other languages and their translation to English.
Thus, schedule ample time to undertake such translations by oneself. In addition, when dealing
with historical studies, one may experience difficulties finding appropriate references as required
by APA style for events or old transcripts, whereas use of indirect citation may be necessary.
Also, be mindful that it takes much longer than one might think to arrange for library and writing
center privileges, so allot extra time for using these services.

**Recommendations to Policymakers and Reformers**

Arabisation of mathematics in Morocco has many shortcomings. Its consequences have
handicapped both teachers and students and caused major financial hardships for poor families
and tremendous social fractures between classes. The adequate decision at this time is to go back
to teaching mathematics in the French language as it was in the 1960s and 1970s. The Arabic
language at the time was used for literary subjects and that was acceptable. As long as there was
no plan to extend Arabisation to the tertiary level and Arabic was not equipped with complete
mathematical terminology, French was here to stay. In this age of globalization, it is obvious that
language barriers will only separate one civilization from the other and close the door to
priceless opportunities for education and employment, especially at time when the flow of
information is governed by knowledge, not by the language of the ruling power. Most
importantly, adopting the French colonial language in Morocco will avoid potential ethnic
conflicts and bring back a generation of Moroccan intellectuals who were educated in the French language to contribute to the Moroccan educational system.

The use of the national language in our primary schools should be encouraged: this will help to preserve our national culture and heritage. However, authorities appear not to have considered the fact that Arabic needs to coin a thoroughly new terminology for the teaching of science and technology before proceeding to the implementation of the Arabisation policy.

To use the mother tongue in the teaching of mathematics, the following need to be achieved simultaneously:

1. Complete terminology and mathematical symbols in Arabic (same for the Amazigh language) need to be accomplished. The indigenous language must not be only taught and used but taught properly at all levels of the educational ladder. An Arabisation policy affecting scientific topics can only apply to the Moroccan educational system when Arabic is equipped with complete mathematical terminology and symbols that are free of French language, symbol borrowing, and code switching, whether verbally or in print.

2. Enough research is needed in the Arabic language to cope with all levels of education, including the tertiary level. For this to be achieved, we should learn from the Golden Islamic Middle Age era when Greek mathematics was translated into Arabic. Thus, at this time the focus should shift to translating Western scientific research into Arabic. The Arabisation policy will not succeed without enough availability of Western research translated into Arabic.

3. Enough faculty members are needed to teach scientific topics in Arabic for all levels of education, ensuring adequate and suitable training for the teachers concerned.
Specialists in the mother tongue in this lexical committee should be involved. The use of the mother tongue and mathematical language should be prioritized / improve the nation’s technological basis. Textbooks writers, publishers, and curriculum planners should work together with experts in mathematics to produce standard texts in mathematics for the pupils’ mother tongues in order to gain their pride of place in schools for better understanding of the subject. Society and groups should be educated on the need to support mother tongue initiatives in the teaching of mathematics while relying heavily on teachers’, students’, and parents’ opinions to deal with all involved issues.

Among the foreign languages present in Morocco, English enjoys a special status. It is not a colonial heritage, unlike French or even Spanish. This gives it the status of a “neutral” foreign language, far from being seen as a cultural threat and free of any negative allegation. Indeed, English is associated with modernity, science, technology, and globalization. It is competing more and more with French, particularly in the education and tourism sectors. Today, this language is taught by various English-speaking institutions, such as Akhawayn University in Ifrane, the American Language Centers, and the British Council.

Moreover, English is the most popular language in the world. Akhawayn University in Morocco has become a very successful school by adopting the American educational system. Moroccan schools should follow the model of Akhawayn University and English should be considered the future language for Morocco for the following reasons that policymakers and education professionals may find of interest.
First, traditionalists will not have to worry about restoring cultural identity by using Arabisation (which has not been successful anyway) since Morocco was not a colony of any English-speaking country.

Second, English has a rich scientific terminology while Arabic lacks scientific terminology and symbols that have constantly been borrowed from the French language, whether verbally, in speeches, or in print. More research can be done about whether the adoption of English in parts of Morocco represents a real threat to the future of the French colonial language in Morocco.

**Recommendations to Professional Educators and Teachers**

Language ideologies should be an integral component of teacher education programs and language policy discussions to create equitable multilingual education. More importantly, teacher education programs should focus on engaging teachers in collaborative ethnographies of language socialization and translingual practices and ideological analyses of those language practices in relation to multilingual education.

Teachers should ensure that appropriate curriculum, textbooks, technology, instructional materials, and professional development initiatives are available to students. In addition, teachers need to apply formative and summative assessments and make sure they are aligned with the curriculum frameworks. This will increase students’ scores and give them feedback about their own progress. Furthermore, a teacher should involve students in tangible life projects and tasks that must be interesting. Teachers are diverse and each one has different needs, brings different perspectives, and works with different intensities towards a collective goal of student learning. As a result, teachers’ effectiveness and students’ achievements vary from classroom to classroom. To overcome these differences, teachers from different disciplines and administrative
staff should participate in more meetings to discuss ways to enhance student learning, improve instructional practices, and create a collegial learning culture within the school. Teachers should exchange ideas and implement strategies with their colleagues to help their students. They should make deliberate attempts to allow for multiple ways of learning and assessing and decide about formal and informal assessments, both formative and summative, which drive the instruction in the classroom. However, extensive and appropriate research on the movements embodied in the nature of curriculum, teacher training, assessment, and policymaking is critical in shaping the future of high school mathematics education. Yet, the far greater extent to which research can inform how these changes play out and what future directions are taken in mathematics education depends on the research community’s response.

**Recommendations for Further Research**

Suggestions for further research and other equally important issues related to this topic could be further investigated. The goal of linguists is to advocate for strong forms of bilingual education to continue fulfilling the responsibility of language learning policy as a resource. Key questions that emerge from the language as resource orientation are many. These include questions such as finding out how language maintenance among linguistic minority communities is facilitated. More branching of frames as resource orientations may be needed to clarify how linguistic diversity is framed in relation to national unity and what differences might there be between how the dominant national language and minority languages are considered as resources. What “ideological and implementation spaces” are present in policies that allow for the development of educational programs that expand students’ bi-/multilingual repertoires? In addition, how do educational programs and curricula facilitate the development of intercultural understanding and lifelong bi-/multilingualism?
New ways of understanding the dynamics of bilingualism and multilingualism, particularly within the classroom context, are creating alternative opportunities for language learning and teaching. For instance, translanguaging is increasingly used to sustain the dynamic linguaging of students. Given that French is read from left to right and Arabic is read from right to left creates a question for future research to find out how translanguaging will affect students’ cognition in learning mathematics when dealing with two languages that are written or read in the opposite direction.

Considering the situation of language conflict between Moroccan ethnic groups, further research can be done about whether the re-adoption of the French colonial language in Morocco will avoid these potential ethnic conflicts and help restore the educational Moroccan system. Also, since the Tamazight language was recognized as an official language in Morocco as recently as 2011 and its future is still unknown, a good question for researchers is to find out if teaching mathematics in the Tamazight language will suffer the same consequences at the tertiary level as Arabisation did. Another question that can be further investigated by researchers is to find out if mathematics was purposely taught in Arabic/French in Morocco to appease both generations of teachers who learned mathematics in French and traditionalists seeking the preservation of cultural identity through Arabisation.

Given that the English language is free of any Moroccan colonial connotation, exploring English research versus French research in the scientific field may be of interest for future researchers to investigate if English poses a threat to the French language and becomes a future potential language in the Moroccan educational system and how traditionalists will react to the expansion of English as a future language in Morocco.
A next major step for researchers is to produce the next generation of bilingual education researchers who will conduct program evaluation research and refine what forms of dual language programs are most effective. As more and more dual language schools develop, many variations in implementation are evolving. Evolution of the model may lead to even higher achievement, but researchers may also identify fewer effective forms of implementation.

This knowledge may help practitioners understand how multilingualism and cultural identity affect mathematics education and may provide additional avenues of investigation for mathematics education researchers and calls for meaningful school reforms and changes that reflect concerns about rigor, relevance, reasoning, and sense making in high school mathematics education.
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Appendix A

Students’ Attitudes Toward Standard Arabic

Question 1: Please rate your proficiency level in Standard Arabic.

<table>
<thead>
<tr>
<th>Students</th>
<th>Very good</th>
<th>Good</th>
<th>Average</th>
<th>Weak</th>
<th>Very weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>0 % (n = 0)</td>
<td>28.12 % (n = 27)</td>
<td>48.95 % (n = 47)</td>
<td>22.91 % (n = 22)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private schools</td>
<td>10 % (n = 4)</td>
<td>17.50 % (n = 7)</td>
<td>45 % (n = 18)</td>
<td>27.5 % (n = 11)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 2: Are you satisfied with your level of competence in Standard Arabic?

<table>
<thead>
<tr>
<th>Students</th>
<th>Satisfied</th>
<th>Unsatisfied</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>25 % (n = 24)</td>
<td>69.79 % (n = 67)</td>
<td>5.20 % (n = 5)</td>
</tr>
<tr>
<td>Private schools</td>
<td>20 % (n = 8)</td>
<td>72.50 % (n = 29)</td>
<td>7.50 % (n = 3)</td>
</tr>
</tbody>
</table>

Question 3: What does Standard Arabic represent for you?

<table>
<thead>
<tr>
<th>Students</th>
<th>Language of religion and identity</th>
<th>Language of the past and decline</th>
<th>Language of progress and modernity</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>81.25 % (n = 78)</td>
<td>4.16 % (n = 4)</td>
<td>14.58 % (n = 14)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private schools</td>
<td>80 % (n = 32)</td>
<td>7.5 % (n = 3)</td>
<td>10 % (n = 4)</td>
<td>2.5 % (n = 1)</td>
</tr>
</tbody>
</table>
Question 4: Do you prefer Standard Arabic as a language of science, literature or both?

<table>
<thead>
<tr>
<th>Students</th>
<th>Language of literature</th>
<th>Language of science</th>
<th>Both</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>61.45 % (n = 61)</td>
<td>9.37 % (n = 9)</td>
<td>23.95 %  (n = 23)</td>
<td>3.12 % (n = 3)</td>
</tr>
<tr>
<td>Private schools</td>
<td>80 % (n = 32)</td>
<td>7.5 % (n = 3)</td>
<td>12.5 % (n = 5)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 5: How do you find the project of Arabising science disciplines?

<table>
<thead>
<tr>
<th>Students</th>
<th>Positive</th>
<th>Negative</th>
<th>Has advantages and disadvantages</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public students</td>
<td>23.95 %  (n = 23)</td>
<td>28.12 % (n = 27)</td>
<td>47.91 % (n = 46)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private students</td>
<td>12.50 % (n = 5)</td>
<td>47.50 % (n = 19)</td>
<td>40 % (n = 16)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 6: Do you prefer partial or complete Arabisation project?

<table>
<thead>
<tr>
<th>Students</th>
<th>Partial Arabisation</th>
<th>Complete Arabisation</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>68.75 % (n = 66)</td>
<td>28.12 % (n = 27)</td>
<td>3.12 % (n = 3)</td>
</tr>
<tr>
<td>Private schools</td>
<td>75 % (n = 30)</td>
<td>17.5 % (n = 7)</td>
<td>7.5 % (n = 3)</td>
</tr>
</tbody>
</table>

Question 7: Does Standard Arabic pose any problem in your learning of sciences?

<table>
<thead>
<tr>
<th>Students</th>
<th>Yes</th>
<th>No</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>17.70 % (n = 17)</td>
<td>82.29 % (n = 79)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private schools</td>
<td>22.50 % (n = 9)</td>
<td>72.50 % (n = 29)</td>
<td>5 % (n = 2)</td>
</tr>
</tbody>
</table>
Question 8: In what language do you prefer to study science at university?

<table>
<thead>
<tr>
<th>Students</th>
<th>SA</th>
<th>French</th>
<th>English</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>30.20 %</td>
<td>58.33 %</td>
<td>9.37 %</td>
<td>2.08 %</td>
</tr>
<tr>
<td></td>
<td>(n = 56)</td>
<td>(n = 9)</td>
<td>(n = 9)</td>
<td>(n = 2)</td>
</tr>
<tr>
<td>Private schools</td>
<td>10 %</td>
<td>65 %</td>
<td>22.50 %</td>
<td>2.50 %</td>
</tr>
<tr>
<td></td>
<td>(n = 4)</td>
<td>(n = 26)</td>
<td>(n = 9)</td>
<td>(n = 1)</td>
</tr>
</tbody>
</table>

Question 9: When I use Standard Arabic, I feel a sort of social promotion

<table>
<thead>
<tr>
<th>Students</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>48.95 %</td>
<td>25 %</td>
<td>23.95 %</td>
<td>2.08 %</td>
</tr>
<tr>
<td></td>
<td>(n = 47)</td>
<td>(n = 24)</td>
<td>(n = 23)</td>
<td>(n = 2)</td>
</tr>
<tr>
<td>Private schools</td>
<td>30 %</td>
<td>30 %</td>
<td>27.50 %</td>
<td>12.50 %</td>
</tr>
<tr>
<td></td>
<td>(n = 12)</td>
<td>(n = 12)</td>
<td>(n = 11)</td>
<td>(n = 5)</td>
</tr>
</tbody>
</table>

Question 10: If I weren’t obliged to learn Standard Arabic, I wouldn’t care about it

<table>
<thead>
<tr>
<th>Students</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>0 %</td>
<td>21.87 %</td>
<td>45.83 %</td>
<td>32.29 %</td>
</tr>
<tr>
<td></td>
<td>(n = 0)</td>
<td>(n = 21)</td>
<td>(n = 44)</td>
<td>(n = 31)</td>
</tr>
<tr>
<td>Private schools</td>
<td>37.5 %</td>
<td>25 %</td>
<td>30 %</td>
<td>7.5 %</td>
</tr>
<tr>
<td></td>
<td>(n = 15)</td>
<td>(n = 10)</td>
<td>(n = 12)</td>
<td>(n = 3)</td>
</tr>
</tbody>
</table>

Question 11: I would learn sciences effectively if the language of instruction were not Standard Arabic

<table>
<thead>
<tr>
<th>Students</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.08 %</td>
<td>33.33 %</td>
<td>17.70 %</td>
<td>21.87 %</td>
</tr>
<tr>
<td></td>
<td>(n = 26)</td>
<td>(n = 32)</td>
<td>(n = 17)</td>
<td>(n = 21)</td>
</tr>
<tr>
<td>Private schools</td>
<td>37.5 %</td>
<td>35 %</td>
<td>22.5 %</td>
<td>5 %</td>
</tr>
<tr>
<td></td>
<td>(n = 15)</td>
<td>(n = 14)</td>
<td>(n = 9)</td>
<td>(n = 2)</td>
</tr>
</tbody>
</table>
Question 12: My ability to use Standard Arabic is an impetus for my future success

<table>
<thead>
<tr>
<th>Students</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>41.66 % (n = 40)</td>
<td>19.79 % (n = 19)</td>
<td>21.87 % (n = 21)</td>
<td>16.66 % (n = 16)</td>
</tr>
<tr>
<td>Private schools</td>
<td>7.50 % (n = 3)</td>
<td>5 % (n = 2)</td>
<td>32.50 % (n = 13)</td>
<td>55 % (n = 22)</td>
</tr>
</tbody>
</table>
Appendix B

Science Teachers’ Attitudes Toward Standard Arabic

Question 1: Rate your level of competence in Standard Arabic.

<table>
<thead>
<tr>
<th>Science teachers</th>
<th>Very good</th>
<th>Good</th>
<th>Average</th>
<th>Weak</th>
<th>Very weak</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.27 % (n = 6)</td>
<td>45.45 % (n = 10)</td>
<td>9.09 % (n = 2)</td>
<td>18.18 % (n = 4)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private schools</td>
<td>60 % (n = 12)</td>
<td>40 % (n = 8)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 2: How do you find the Arabisation of science education?

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Positive</th>
<th>It has advantages and disadvantages</th>
<th>Negative</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.27 % (n = 6)</td>
<td>9.09 % (n = 2)</td>
<td>63.63 % (n = 14)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private schools</td>
<td>30 % (n = 6)</td>
<td>20 % (n = 4)</td>
<td>50 % (n = 10)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 3: Do you prefer partial or complete Arabisation

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Partial Arabisation</th>
<th>Complete Arabisation</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.27 % (n = 6)</td>
<td>54.54 % (n = 12)</td>
<td>18.18 % (n = 4)</td>
</tr>
<tr>
<td>Private schools</td>
<td>100 % (n = 20)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>
Question 4: Specify the difficulty you face in using Standard Arabic as a medium of teaching

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Reading and explaining</th>
<th>Writing</th>
<th>No difficulty at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.27 % (n = 6)</td>
<td>18.18 % (n = 4)</td>
<td>54.54 % (n = 12)</td>
</tr>
<tr>
<td>Private schools</td>
<td>20 % (n = 4)</td>
<td>20 % (n = 4)</td>
<td>60 % (n = 12)</td>
</tr>
</tbody>
</table>

Question 5: How often do you experience difficulties using scientific terminology in Standard Arabic?

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Very often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>13.63 % (n = 3)</td>
<td>50 % (n = 11)</td>
<td>22.72 % (n = 5)</td>
<td>4.54 % (n = 1)</td>
<td>9.09 % (n = 2)</td>
<td>0 % (n = 0)</td>
</tr>
<tr>
<td>Private schools</td>
<td>5 % (n = 1)</td>
<td>70 % (n = 14)</td>
<td>10 % (n = 2)</td>
<td>5 % (n = 1)</td>
<td>10 % (n = 2)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 6: I think that French should supplant Standard Arabic in scientific disciplines

<table>
<thead>
<tr>
<th>Teachers</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>9.09 % (n = 2)</td>
<td>18.18 % (n = 4)</td>
<td>22.72 % (n = 5)</td>
<td>50 % (n = 11)</td>
</tr>
<tr>
<td>Private schools</td>
<td>0 % (n = 0)</td>
<td>25 % (n = 5)</td>
<td>0 % (n = 0)</td>
<td>75 % (n = 15)</td>
</tr>
</tbody>
</table>

Question 7: I think scientific books should be published in French rather than in Standard Arabic

<table>
<thead>
<tr>
<th>Teachers</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>9.09 % (n = 2)</td>
<td>22.72 % (n = 5)</td>
<td>27.27 % (n = 6)</td>
<td>40.90 % (n = 9)</td>
</tr>
<tr>
<td>Private schools</td>
<td>0 % (n = 0)</td>
<td>25 % (n = 5)</td>
<td>0 % (n = 0)</td>
<td>75 % (n = 15)</td>
</tr>
</tbody>
</table>
Question 8: I think that students’ acquisition of sciences depends on their mastery of Standard Arabic

<table>
<thead>
<tr>
<th>Teachers</th>
<th>I totally agree</th>
<th>I agree</th>
<th>I disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>45.45 % (n = 10)</td>
<td>31.81 % (n = 7)</td>
<td>18.18 % (n = 4)</td>
<td>4.54 % (n = 1)</td>
</tr>
<tr>
<td>Private schools</td>
<td>85 % (n = 17)</td>
<td>15 % (n = 3)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 9: What are your predictions about the future status of Standard Arabic in education?

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Developing</th>
<th>Declining</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>31.81 % (n = 7)</td>
<td>63.63 % (n = 14)</td>
<td>4.54 % (n = 1)</td>
</tr>
<tr>
<td>Private schools</td>
<td>15 % (n = 3)</td>
<td>85 % (n = 17)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>
Appendix C

Arabic Teachers’ Attitudes Toward Standard Arabic

Question 1: Rate your science students’ level of competence in Standard Arabic.

<table>
<thead>
<tr>
<th>SA teachers</th>
<th>Very good</th>
<th>Good</th>
<th>Average</th>
<th>Weak</th>
<th>Very weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>0 % (n = 0)</td>
<td>18.18 % (n = 2)</td>
<td>54.54 % (n = 6)</td>
<td>18.18 % (n = 2)</td>
<td>9.09 % (n = 1)</td>
</tr>
<tr>
<td>Private schools</td>
<td>0 % (n = 0)</td>
<td>50 % (n = 5)</td>
<td>50 % (n = 5)</td>
<td>0 % (n = 0)</td>
<td>0 % (n = 0)</td>
</tr>
</tbody>
</table>

Question 2: In your opinion, are students interested or uninterested in learning Standard Arabic?

<table>
<thead>
<tr>
<th>SA teachers</th>
<th>Interested</th>
<th>Uninterested</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.27 % (n = 3)</td>
<td>54.54 % (n = 6)</td>
<td>18.18 % (n = 2)</td>
</tr>
<tr>
<td>Private schools</td>
<td>0 % (n = 0)</td>
<td>100 % (n = 10)</td>
<td>0 %</td>
</tr>
</tbody>
</table>

Question 3: Do you prefer partial or complete Arabisation?

<table>
<thead>
<tr>
<th>SA teachers</th>
<th>Partial</th>
<th>Complete</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>18.18 % (n = 2)</td>
<td>72.72 % (n = 8)</td>
<td>9.09 % (n = 1)</td>
</tr>
<tr>
<td>Private schools</td>
<td>0 % (n = 0)</td>
<td>90 % (n = 9)</td>
<td>10 % (n = 1)</td>
</tr>
</tbody>
</table>
Question 4: Is Standard Arabic helpful or impeding for students’ integration into the job market?

<table>
<thead>
<tr>
<th>SA teachers</th>
<th>Helpful</th>
<th>Impeding</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>18.18%</td>
<td>81.81%</td>
<td>0%</td>
</tr>
<tr>
<td>(n = 2)</td>
<td>(n = 9)</td>
<td>(n = 0)</td>
<td></td>
</tr>
<tr>
<td>Private schools</td>
<td>20%</td>
<td>80%</td>
<td>0%</td>
</tr>
<tr>
<td>(n = 2)</td>
<td>(n = 8)</td>
<td>(n = 0)</td>
<td></td>
</tr>
</tbody>
</table>

Question 5: What is your prediction about the future status of Standard Arabic in education?

<table>
<thead>
<tr>
<th>SA teachers</th>
<th>Developing</th>
<th>Declining</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools</td>
<td>27.27%</td>
<td>63.63%</td>
<td>9.09%</td>
</tr>
<tr>
<td>(n = 3)</td>
<td>(n = 7)</td>
<td>(n = 1)</td>
<td></td>
</tr>
<tr>
<td>Private schools</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>(n = 0)</td>
<td>(n = 10)</td>
<td>(n = 0)</td>
<td></td>
</tr>
</tbody>
</table>

Appendix D

Table of Causes of Dropout from School and Possible Policy Options

<table>
<thead>
<tr>
<th>Cause</th>
<th>Contributing factors</th>
<th>Comment</th>
<th>Policy options</th>
<th>Level</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of schooling</td>
<td>Direct costs</td>
<td>Direct costs include admission fees, tuition fees, and any other essential payments required for attendance.</td>
<td>Legislate for fee primary education; prohibit the charging of additional fees and in public schools; regulate fees in private schools. Consider conditional cash credit transfers linked to school attendance and advancement but only with tuition fee abolition.</td>
<td>N,D,C,H</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>Indirect costs</td>
<td>Indirect costs include the cost of travel, school feeding and other discretionary inputs to schooling e.g. private tuition.</td>
<td>Use school mapping to reduce average distance to school and plan free school buses where appropriate; provide school feeding schemes free to those in the lowest two quintiles of household income; regulate private tuition and undermine demand with free access to revision services and school-based additional lessons.</td>
<td>N,D,H</td>
<td>E</td>
</tr>
<tr>
<td>Opportunity costs</td>
<td>Household demands on children</td>
<td>Children may contribute to domestic chores and to household economic activity at the expense of school attendance.</td>
<td>Promote community-based good parenting classes designed to encourage regular school attendance and limit domestic responsibilities of children.</td>
<td>C,D,H</td>
<td>D</td>
</tr>
<tr>
<td>Legitimate child labour</td>
<td></td>
<td>Children may work for payment of income in kind outside the household under conditions judged legal and safe. This may affect school attendance.</td>
<td>Use OSDs and social protection systems and schools to identify legitimate child labour, monitor its impact on attendance and learning, and discourage households from making demands on children to earn money.</td>
<td>N,D,C,H</td>
<td>D</td>
</tr>
<tr>
<td>Illegal child labour</td>
<td></td>
<td>Children In the working age may be involved in work that is not decent or appropriate. This may affect school attendance and is illegal.</td>
<td>Identify and prosecute those commissioning illegal child labour and confiscate assets.</td>
<td>N,D,C,H</td>
<td>D</td>
</tr>
<tr>
<td>Perceived relevance</td>
<td>Lack of curriculum relevance</td>
<td>Knowledge and skills in national curricula taught in schools may not be seen as valuable for employment, livelihoods, and well-being.</td>
<td>Review and revise curricula and pedagogy in the light of well-considered school-based evaluation studies of learners’ and teachers’ practices, needs, and wants. Identify knowledge and skills critical to jobs, livelihoods and well-being broadly defined and incorporate into national curricula. Include flexibility in national curricula to respond to the specificities of local needs, cultural differences, gendered preferences and other opportunities to increase relevance.</td>
<td>N,D,S,</td>
<td>S,C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of support from caregivers</td>
<td>Caregivers may not see the benefits of schooling as sufficient to compensate for the costs in relation to particular children.</td>
<td>Promote community-based good parenting classes. Develop and promote information on the income, health, and well-being benefits of becoming more educated. Share information about reducing direct and indirect costs and sources of subsidy for low quintile of households.</td>
<td>C,D,</td>
<td>D</td>
</tr>
<tr>
<td>Cause</td>
<td>Contributing factors</td>
<td>Comment</td>
<td>Policy options</td>
<td>Level</td>
<td>Theme</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Lack of special needs facilities</td>
<td>Children with special needs including disabilities and unusual talents may need different forms of provision to remain motivated.</td>
<td>Ensure that special needs are identified and accommodated in the design and operation of educational institutions. Allocate resources to give every teacher basic understanding of common forms of disability and nominate at least one teacher in every school with special responsibility for assessing needs.</td>
<td>N,D,S</td>
<td>S,O</td>
<td></td>
</tr>
<tr>
<td>Low achievement</td>
<td>Low achievement</td>
<td>Children with low levels of achievement both absolutely and relatively may suffer from reduced motivation and self-esteem and see the little value in repeatedly falling assessments.</td>
<td>Low achievement has many causes that do not have one policy response. All education systems should tax in the effective management of learning within a structured curriculum that provides clear goals and objectives for achievement. In different domains of knowledge and skill. All teachers should be supported to develop skills in formative assessment that can diagnose learning problems and suggest pedagogic interventions. High-stakes assessment should be fit for purpose and reflect the full range of goals set for education systems, not simply the narrow demands of robust discrimination in performance for selection.</td>
<td>N,D,S</td>
<td>S,O</td>
</tr>
<tr>
<td>Poor and Irregular attendance</td>
<td>Irregular attendance reduces time on task and continuity of learning experience and may do so to the point where children lose engagement with the curriculum.</td>
<td>Irregular attendance has many causes and no single policy response. Monitoring and diagnosis prior to intervention requires the systematic record keeping of patterns of attendance linked to unique child identity numbers. This can allow the tracking of children through the school system so that none disappear from support and intervention systems designed to ensure no child is left behind or can leave school silently. There should be a prohibition on punishing children whose attendance is poor. It should always be clear who is responsible to follow up a child's non-attendance whether it is a school teacher, a staff member with pastoral responsibilities, a social protection officer, or some other named individual.</td>
<td>D,C,H,S</td>
<td>D,S</td>
<td></td>
</tr>
<tr>
<td>Overage entry</td>
<td>Overage children are often at risk of dropping out than those in the appropriate age for their grade. Being substantially overage is associated with drop out and low achievement.</td>
<td>Legislation should be in place to ensure that every child enters school at an appropriate age and that parents are legally responsible to ensure this happens. In most countries this is likely to be no later than the age of 6. Children without birth certificates should be issued with identity documents by schools, or through school based services, if they are legal residents of the country and have no birth certificate.</td>
<td>D,S,C,H</td>
<td>E,D</td>
<td></td>
</tr>
</tbody>
</table>
### Table of causes of dropout from school and possible policy options (continued)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Contributing factors</th>
<th>Comment</th>
<th>Policy options</th>
<th>Level</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetition</td>
<td>There is no systematic evidence that repetition improves achievement if it occurs more than once in a school career. High rates of repetition may demoralize students and lead to drop out.</td>
<td>Repetition increases the number of overage students and may demoralize those who repeat especially if they are simply invited to follow the same curriculum that they have failed. Norms should be set for acceptable rates of repetition (e.g., less than 1%) since repetition is a curriculum and pedagogic problem. High rates of repetition in a school indicate some combination of inappropriate curriculum and ineffective teaching. CPD should be used to ensure teachers’ adopt strategies that minimize repetition. Automatic promotion should be the norm.</td>
<td>N,O,S,H</td>
<td>S,O</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Distance and time to school</td>
<td>School attendance in most countries is highly correlated with distance from school.</td>
<td>School mapping should be used to minimize distance to school consistent with efficient operating costs since small schools are likely to be more expensive per student than larger schools. Costs of travel may discourage attendance and should therefore be subsidized for those in the lowest two quintiles of household income. Where boarding schools are deemed necessary by population density, costs need to be carefully considered. Elective boarding by children in the top three quintiles of household income should be discouraged unless operated at full cost to parents.</td>
<td>D,C,S</td>
<td>E,S</td>
</tr>
<tr>
<td>Safety in travelling to school</td>
<td>Parents and caregivers often indicate safety and travelling to school as a high-level concern especially in relation to girls.</td>
<td>Every school and local authority should undertake a risk analysis of safety issues in and around schools and adopt appropriate measures with a zero tolerance policy of antisocial and illegal behaviour.</td>
<td></td>
<td>D,C,S</td>
<td>S</td>
</tr>
<tr>
<td>Safety in school</td>
<td>Violence in school</td>
<td>Violence in school is given in some countries as a reason for dropping out and for not returning to school because of the fear of corporal punishment.</td>
<td>Legislation should be enacted to ensure that the boundaries of the appropriate action in relation to school discipline are well known and enforced. Children should have access to independent channels through which they can draw attention to inappropriate behaviour.</td>
<td>D,C,S,</td>
<td>E,S</td>
</tr>
<tr>
<td>Bullying</td>
<td>Bullying is cited by both boys and girls as a reason for ceasing to attend school.</td>
<td>National and local guidelines are needed to discourage physical and mental bullying, which causes distress and loss of self-esteem. Guidelines need to be public, transparent, and it must be clear who is responsible for enforcing their implementation.</td>
<td></td>
<td>C,S</td>
<td>S</td>
</tr>
<tr>
<td>Health</td>
<td>Infectious and parasitic childhood disease</td>
<td>The epidemiology associated with dropping out can identify common treatable causes of becoming out-of-school children.</td>
<td>Children in school should undergo regular health checks and be within circles of support that monitor their health status during their school career and provide access to treatment.</td>
<td>D,C,S,H</td>
<td>E,S</td>
</tr>
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<tr>
<td>Undernutrition and malnutrition</td>
<td></td>
<td>Undernutrition leads to stunting which is often associated with late enrolment and a subsequent high risk of dropout. Malnutrition can lead to micronutrient deficiencies which have implications for cognition.</td>
<td>Health monitoring should establish the extent of undernutrition and malnutrition and identify strategies to ameliorate this in both school and preschool populations of children.</td>
<td>D.C.S.H</td>
<td>E.S</td>
</tr>
<tr>
<td>Physical and mental disabilities</td>
<td></td>
<td>Different forms of disability are associated with exclusion from school.</td>
<td>Child health systems should assess and monitor all children in school and out of school periodically to identify physical and mental disabilities and make provision for their amelioration.</td>
<td>D.C.S.H</td>
<td>E.S</td>
</tr>
<tr>
<td>Health of family members</td>
<td></td>
<td>Demands placed on children to become carers can affect their school attendance.</td>
<td>Social protection systems and schools should monitor whether or not children are acting as caregivers to other household members on a scale likely to affect their education. CSOs should be encouraged to provide support wherever possible.</td>
<td>D.C.S.H</td>
<td>E.S</td>
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<tr>
<td>Sexual and reproductive health</td>
<td></td>
<td>Poor decision-making based on ignorance of good sexual and reproductive health practice can result in underage pregnancy, sexually transmitted diseases, and emotional dislocation.</td>
<td>Appropriate curricula and training for teachers are needed to promote sexual and reproductive health good practice as part of life skills. Those with HIV/AIDS and other sexually transmitted diseases should have the same legal rights to education as all other citizens.</td>
<td>D.C.S.H</td>
<td>E.S</td>
</tr>
<tr>
<td>Household status</td>
<td>Single parent households and orphanhood</td>
<td>Single parent households may result in reduced probabilities of attending school. In some surveys orphans have a reduced probability of attending school but not in all cases.</td>
<td>Single parent families are more likely to have specific needs in relation to the support of children's education. Schools and social protection agencies should be aware of children's household status and whether or not particular support is needed. Orphans also have many different circumstances that may need to be addressed to ensure children are protected and supported by caregivers or those acting in their place.</td>
<td>H.C.S</td>
<td>D</td>
</tr>
<tr>
<td>Fostered children</td>
<td></td>
<td>Fostered children may be discriminated against in terms of opportunities for schooling and payment of costs.</td>
<td>Legal obligations around fostering children should be regularized to ensure fostered children have the same rights as children of biological parents. The schooling status and progress of fostered children should be monitored by schools and social protection agencies.</td>
<td>H.C.S</td>
<td>D</td>
</tr>
<tr>
<td>Migrant status</td>
<td></td>
<td>The civil status of migrants may inhibit enrolment in local schools; local authorities may be reluctant to provide schools for recent migrants; migrant children may have very different language capabilities and need to be able to communicate in the host communities.</td>
<td>The specificities of internal or cross-border migration are very complex. The educational status of the children should be reviewed by the responsible agencies where children are located, to ensure that their right to education is realized and that their probability of completing a full cycle of education is no less than it would have been before migration.</td>
<td>N.D.C.S</td>
<td>D</td>
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<tr>
<td>Displaced household</td>
<td></td>
<td>Displaced households may or may not have rights of access to school for their children.</td>
<td>Households displaced by conflict may include children and adults; children may also be displaced without adult members of their families. In either case responsible authorities have an obligation to ensure that rights to access to education are realized.</td>
<td>N,D,C,S</td>
<td>D</td>
</tr>
<tr>
<td>Membership of excluded social group</td>
<td></td>
<td>In some countries particular social groups suffer discrimination in terms of access to schooling.</td>
<td>Dropout resulting from membership of excluded social groups has many different forms. Participation and dropout in different communities should be monitored, and if some forms of participation are evidently inequitable the causes should be explored. Clear responsibilities should exist and force legislation that commits states to provide equality of opportunity.</td>
<td>D,S</td>
<td>E,S</td>
</tr>
<tr>
<td>Nomadic household</td>
<td></td>
<td>Some communities have livelihood and lifestyle choices which create barriers to access to normal schooling for children.</td>
<td>Nomadic and other groups with livelihoods which mean that conventional secondary schooling is unlikely to deliver the right to basic education may need special provisions suited to circumstance which often includes seasonality, cultural specificities, and sensitive management of transitions between the past and the future.</td>
<td>D,C,H</td>
<td>E,S</td>
</tr>
<tr>
<td>Young families</td>
<td>Pregnancy</td>
<td>Some schools exclude girls who become pregnant.</td>
<td>No young girls or women should be excluded from school as a result of pregnancy. Special arrangements may need to be made in different cultural contexts to ensure this is the case.</td>
<td>D,C,S,H</td>
<td>S</td>
</tr>
<tr>
<td>Young motherhood</td>
<td></td>
<td>Young mothers below the age of 15 may or may not be allowed to return to school.</td>
<td>Young mothers below the age of 15 should have a right to opportunities to continue their education in an appropriate way. This will benefit them and their young families.</td>
<td>D,C,S,H</td>
<td>S</td>
</tr>
<tr>
<td>Young fatherhood</td>
<td></td>
<td>Young fathers may be required to become economically active.</td>
<td>Young fathers below the age of 15 should have a right to opportunities to continue their education in an appropriate way. This will benefit them and their young families.</td>
<td>D,C,S,H</td>
<td>S</td>
</tr>
<tr>
<td>School practices</td>
<td>Unfriendly schools</td>
<td>Child friendly schools should be inclusive and have pastoral systems that are designed to minimize dropout. They should also be child seeking schools where the locus of responsibility for children who may drop out is clear.</td>
<td>Child friendly school policy should be promoted throughout school systems to ensure that children are safe, secure, happy, motivated, and free of unfriendly and hostile school environments. Guidelines are widely available and should be adopted with clear responsibilities for generating and sustaining school environments that attract children rather than discourage them from attending.</td>
<td>D,S</td>
<td>S</td>
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</tbody>
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<table>
<thead>
<tr>
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<th>Policy options</th>
<th>Level</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Language of instruction</td>
<td>Language of instruction is often a factor in dropping out in countries where the mother tongue is not the language of instruction.</td>
<td>Many languages are used in the countries in the MENA region. Where the medium of instruction is not the mother tongue of children there will be issues of transition. Where an international language from outside the region becomes the language of instruction there will also be transition issues. Language policy must be clear and developed with an awareness of the consequences for dropping out and becoming out of school of poorly managed transitions.</td>
<td>N,S</td>
<td>S,D</td>
<td></td>
</tr>
<tr>
<td>Poor management of transitions between levels</td>
<td>Transitions between school levels e.g. primary to lower secondary are often associated with higher rates of dropout than within each cycle.</td>
<td>Where transition rates between levels are much less than 100 per cent dropout is likely to be disproportionately concentrated at particular levels. Selection to the next level may favour those from higher income households, those from particular areas, and may also be favourable to one or the other gender. School management systems need to address transition issues and devise strategies that remove any association with involuntary dropout. This may involve research on the curriculum and pedagogic practice.</td>
<td>D,S</td>
<td>E,S</td>
<td></td>
</tr>
<tr>
<td>Underqualified teachers</td>
<td>Teachers without appropriate levels of capability and skill may directly or indirectly encourage dropping out.</td>
<td>All children have a right to be taught by qualified teacher who have been trained to understand how children of different ages from different backgrounds learn most effectively. This is an obligation of states and the responsibility of Ministries of Education.</td>
<td>N,D</td>
<td>E,S</td>
<td></td>
</tr>
<tr>
<td>Teacher absenteeism</td>
<td>Significant teacher absenteeism undermines learning continuity and may be associated with falling motivation to attend school.</td>
<td>Where teacher absenteeism is significant its causes need to be identified and addressed. This may require changes in school management, employment contracts, sanctions for teachers whose absenteeism is excessive, and incentives for those who ensure continuity of learning.</td>
<td>N,D,S</td>
<td>E,S</td>
<td></td>
</tr>
<tr>
<td>Lack of remedial support</td>
<td>Schools which fail to address the needs of the less capable may have lower retention rates.</td>
<td>Dropout relating to low achievement may arise if little provision is made for the specific learning needs of the less capable. Where this is true systematic attention needs to be given to systems of enrichment and retrieval which can lessen the difference in achievement between the highest and lowest scoring children.</td>
<td>D,S</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Large class sizes</td>
<td>Over large class sizes can result in children underperforming.</td>
<td>Large classes may contribute to unfriendly schools where vulnerable children may be more likely to drop out and be less likely to attract attention. Over large class sizes are unlikely to encourage high achievement amongst less capable learners and are more likely to generate classroom management problems.</td>
<td>N,D,S</td>
<td>S</td>
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</tbody>
</table>
### Table of causes of dropout from school and possible policy options (continued)

<table>
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</thead>
<tbody>
<tr>
<td>Poor assessment practice</td>
<td></td>
<td>Poor management of learning may result in low achievement, leading to dropout.</td>
<td>School-based assessment should be focussed strongly on formative assessment that diagnoses learning needs and learning capabilities. This will not be the case if it simply mimics high-stakes external exams designed to discriminate between candidates rather than illuminates learning difficulties. Investment may be needed in developing assessment practice linked directly to managing learning more effectively, especially for the less capable most at risk of dropping out.</td>
<td>N,D,S</td>
<td>S</td>
</tr>
<tr>
<td>Uneven preschool supply</td>
<td></td>
<td>Preschool participation is associated with entry to primary school at the appropriate age and higher levels of subsequent achievement.</td>
<td>National legislation to phase in access to preschool to all children with subsidies to ensure that provision is free to those in the lowest two quintiles of household income. Take steps to encourage CSO’s to develop local preschool provision on existing school sites and community spaces making use of opportunities to engage parents and project good parenting messages.</td>
<td>N,D,C</td>
<td>S</td>
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</table>

### Key to classifications

<table>
<thead>
<tr>
<th>Level</th>
<th>OOSCI theme</th>
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<tbody>
<tr>
<td>Individual</td>
<td>Enabling environment E</td>
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<tr>
<td>Household</td>
<td>Supply S</td>
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<tr>
<td>Community</td>
<td>Demand D</td>
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<tr>
<td>District</td>
<td>Quality Q</td>
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<tr>
<td>School</td>
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<tr>
<td>National</td>
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- Individual characteristics of children are not used in the classification in the chart II since policy issues at system level are not generally mediated by the characteristics of individual children.
- A national level has been added to the classification.
- The OOSCI theme categories have some overlap since supply-side interventions are likely to be enabling and quality improvement, though mostly on the supply side, and will affect demand.

Appendix E

List of Analyzed Secondary Mathematics Textbooks