WORLD OF SCIENCE EDUCATION
Arab States

Saouma BouJaoude
American University of Beirut
and
Zoubeida R. Dagher (Eds.)
University of Delaware

Each volume in the 7-volume series The World of Science Education reviews research in a key region of the world. These regions include North America, South and Latin America, Asia, Australia and New Zealand, Europe and Israel, Arab States, and Sub-Saharan Africa.

The focus of this Handbook is on science education in Arab states and the scholarship that most closely supports this program. The reviews of the research situate what has been accomplished within a given field in an Arab rather than an international context. The purpose therefore is to articulate and exhibit regional networks and trends that produced specific forms of science education. The thrust lies in identifying the roots of research programs and sketching trajectories—focusing the changing façade of problems and solutions within regional contexts. The approach allows readers to review what has been done and accomplished, what is missing and what might be done next.

ISBN 978-94-6091-045-6

SensePublishers  CHPS 03
The World of Science Education
CULTURAL AND HISTORICAL PERSPECTIVES ON SCIENCE EDUCATION: HANDBOOKS

Volume 3

Series Editors
Kenneth Tobin
The Graduate Center, City University of New York, USA
Wolff-Michael Roth
University of Victoria, Canada

Each volume in the 7-volume series The World of Science Education reviews research in a key region of the world. These regions include North America, South and Latin America, Asia, Australia and New Zealand, Europe and Israel, Arab States, and Sub-Saharan Africa.

The focus of this Handbook is on science education in Arab states and the scholarship that most closely supports this program. The reviews of the research situate what has been accomplished within a given field in an Arab rather than an international context. The purpose therefore is to articulate and exhibit regional networks and trends that produced specific forms of science education. The thrust lies in identifying the roots of research programs and sketching trajectories—focusing the changing façade of problems and solutions within regional contexts. The approach allows readers to review what has been done and accomplished, what is missing and what might be done next.
The World of Science Education

*Arab States*

Saouma BouJaoude
_American University of Beirut_

Zoubeida R. Dagher
_University of Delaware_
# TABLE OF CONTENTS

Introduction: Science Education in Arab States .......................................................1  
Saouma BouJaoude and Zoubeida R. Dagher

SECTION I: ISSUES OF SIGNIFICANCE AND CONCERN TO ARAB SCIENCE EDUCATORS

1. Curriculum in Arab States: Historical and Contemporary Perspectives........11  
   Munir Bashshur

2. The Impact of Contextual Variables on Science Achievement in Arab  
   Countries: Results from TIMSS 2003...............................................................27  
   Murad Jurdak

3. Epistemology of Science in Curriculum Standards of Four Arab Countries....41  
   Zoubeida R. Dagher

4. Language of Instruction and Science Education in the Arab Region:  
   Toward a Situated Research Agenda ...............................................................61  
   Tamer G. Amin

5. Professional Development through Applied Engagement: Egyptian Teacher  
   Opportunities for Professional Growth Grants .................................................83  
   Fouad Abd-El-Khalick

6. Religion and Science Education: An Egyptian Perspective.................107  
   Nasser Mansour

7. Role of UNESCO and its Regional Partners in Promoting Science  
   Education in Arab States.................................................................................133  
   Ghada Gholam

SECTION II: STATUS OF SCIENCE EDUCATION RESEARCH IN A NUMBER  
OF ARAB STATES

8. Science Education in Jordan .................................................................153  
   Sumaya Al-Muhtaseb and Mahmoud Al-Weher

9. Outcomes of a Half-Century of Science Education in Maghreb Countries....183  
   Fouad Chafiqi and Andrée Tiberghien
TABLE OF CONTENTS

10. Science Education Development in the Sultanate of Oman .........................205  
   *Abdullah Ambusaidi and Ali Al-Shuaili*

   *Saouma BouJaoude, Fouad Abd-El-Khalick and Fadi El-Hage*

12. Meta-Issues Involved in Research in Arab States: Reflections of a Social  
    Scientist ...........................................................................................................257  
    *Adnan El-Amine*

13. Challenges and Opportunities for Science Education in the Arab Region.....265  
    *Zoubeida R. Dagher and Saouma BouJaoude*

Contributors............................................................................................................279
SAOUMA BOUJAOUDE AND ZOUBEIDA R. DAGHER

INTRODUCTION: SCIENCE EDUCATION IN ARAB STATES

Apart from a number of UNESCO reports and relatively few published journal articles on miscellaneous research topics in international journals, little is known about the status of science education in Arab countries outside their geographic boundaries. What is available for interested researchers is a modest array of research studies published on contemporary miscellaneous topics over the past few years. This observation, based on studies published in international venues, under- represents the level of research activity that takes place at the region’s private and public universities since most of the research produced is published in local or regional Arabic research journals. For the sake of clarity, this book is concerned with members of the League of Arab States that include the following 22 countries: Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen.

Comprehensive accounts of science education in the region are difficult to locate, and when found tend to provide limited and dated information. Yet, given the tremendous rate of change and the ongoing reforms that are taking place in various countries, there is a critical need for current accounts on science education that systematically address issues in curriculum, teacher development, and interaction between science and society. Thus the idea of this edited book which aims to shed light on science education issues within the Arab region around matters that seldom get discussed in international circles.

Arab states occupy a vast area in South West Asia and North Africa from the Arabian Gulf in the east to the Atlantic Ocean in the west. These countries that share some social and cultural values, religious beliefs, historical events and declare Arabic as the official language differ considerably from one another in substantial ways. Even though Arabic is the official language, the colloquial Arabic is different from country to country. Also, there exist major differences among these countries that are influenced by their current and aspiring economies that are outcomes of policy decisions that in turn shape educational goals and priorities.

A number of Gulf countries have developed and instituted policies that support gradual transition from oil and gas to knowledge-based economies. These policies have had a major impact on systemic education reforms [pre-K-12]. Perhaps a case in point is the state of Qatar, in which sweeping reforms have drastically changed the educational landscape by shifting from public to independent schools, from Arabic to English as the language of instruction in science and mathematics, and from traditional teaching methods to inquiry-oriented ones promoting research and
critical thinking skills among students at all levels. Such quick and rapid changes pose challenges especially at the early stages of implementation when students have to suddenly learn science and mathematics in English even when they are not competent speakers of English quite yet, and when teachers struggle with the language themselves while trying to shift teaching towards more inquiry and integration of new technologies. While the challenges to implementation are plentiful, so are the human and financial resources provided to align policy decisions with instructional practices.

Other Arab countries that have seen educational reform initiatives recently include the United Arab Emirates (UAE), and Saudi Arabia. In Abu Dhabi, the Abu Dhabi Education Council has initiated projects that aim “to build an education system that provides young people with the knowledge and skills needed to participate more fully in the Emirate’s economic and social life, and compete in the global marketplace”. Similarly, the Dubai Education Council was established to “enhance the education sector in Dubai at all levels to bring it up to international standards while maintaining cultural & social values and further develop the educational institutions in order to create a knowledge based society”. Finally, in Saudi Arabia the “King Abdullah Bin Abdul Aziz Project for Developing Public Education (Tatweer)” aims to develop teachers’ skills, develop curricula, enhance school activities, and improve school environment.

These cases demonstrate two points: 1) educational change is recognized as central to bringing about the desired economic and cultural goals. The scope of educational reforms undertaken as well as the resources committed to them, tend to be proportional (in the case of some but not all countries) to the perceived gap between the current competencies and skills of high school and college graduates and the competencies and skills they need to lead, compete, and excel in a global economy. 2) Reforms in science education take place in the context of broader educational reforms, but they invariably carry special political force and significance due to the anticipated gains in scientific and technological literacy, considered a sure ticket for attaining global advantage.

This book provides a survey of science education issues in Arab states as seen from the perspective of the contributing authors based on their experiences and insights. Consequently, the purpose of the book is not to provide a thorough or exhaustive account of all the issues facing science education in Arab countries, but rather to offer the reader a privileged vantage point for understanding the presented issues.

What is the current state of science education in the Arab region? Briefly stated, the problems faced by science education in Arab states can be described in terms of access to and quality of science education. Problems of access are manifested in the high levels of illiteracy, especially among females, in some Arab countries. Many Arab states are attempting to increase access to education through a variety of programs and strategies. This has resulted in an increase in student enrollment at all educational levels in the past decades and a decrease in illiteracy rates among the population in general and among women more specifically. However, the illiteracy rates are still relatively high and there is a serious problem in relation to scientific and technological literacy (United Nations Development Program,
Basic literacy is no more sufficient especially when considering the need for scientifically and technologically literate individuals who can function in a world where competition is extremely high and knowledge is being produced at such a high rate that catching up is rather difficult even for people who are highly educated and trained.

Even when the problems of access are addressed, a serious problem in Arab states is the low quality of education experienced by students at all levels. The problem of quality is manifested in outdated curricula and teaching methods, emphasis on theoretical science content and neglect of hands-on and practical activities, lack of or limited access to appropriate technologies and the Internet, low quality science and technology education programs, lack of teacher support, and most importantly, lack of sufficient budgets for improving the quality of science education.

Over the last three decades, there have been attempts to reform science education in Arab states. The Arab League Educational Cultural and Scientific Organization (ALECSO) has been active in promoting science and technology education reforms. As early as 1989, ALECSO published documents on the Arab strategy for science and technology followed by the Arab Strategy for Information in the Internet Age in 1999. In addition, it published the strategy of biotechnology in the Arab countries in 1994 followed by a reference book on the integrated subjects for the basic level of education in 1996. In 2007, that organization also published a book that included background papers on the strategy for disseminating scientific and technological literacy in Arab nations. More recently, ALECSO has published model audio-visual educational packages for teaching and learning in the field of renewable energies along with a number of dictionaries whose aim was to standardize usage of science and technology terminology in Arab states.

Recent reform efforts are perhaps most visible in terms of scope in gulf countries like United Arab Emirates, Qatar, and Saudi Arabia. In some countries like Egypt, Jordan, and Qatar, new curriculum standards or goals have been developed, leading to new professional development opportunities and in some cases to reorganizing school structures (e.g., Qatar). Other states where reform has been undertaken recently include Lebanon, Saudi Arabia, and the United Arab Emirates. Whether modest or extreme in scope, there seems to be a lack of documentation of the effectiveness of these reforms in achieving their goals. Most countries continue to depend on monitoring their student achievements on the TIMSS or PISA tests or on locally developed monitoring systems such as those in Saudi Arabia (General Directorate of Measurement and Evaluation) and Egypt (National Center for Examinations and Educational Evaluation) to get a sense of the effectiveness of their education systems.

It is impossible to provide a comprehensive coverage of all the issues and concerns that face Arab science education in one volume. What we provide however, is a survey of issues depicted from the particularity of practices arising in specific countries and expressed in a variety of descriptive, statistical or analytical accounts. By taking a closer look at these issues, it becomes clear that despite the presence of linguistic, religious, and cultural values that unite the region there is tremendous
diversity in the types of challenges faced by individual countries. We hope that the discussion of educational challenges and opportunities will provide readers with an international perspective that will expand and enrich their understanding of the Arab region relative to their own local contexts.

This book is organized into two major sections. The first section addresses a number of issues of significance and concern to Arab science educators such as factors influencing science achievement, nature of science in the curriculum, language of instruction, professional development, religion and science education, and the role of international organizations in supporting science education. The second section surveys and analyzes the science education terrain in a number of Arab countries such as Jordan, Maghreb region, Oman, and Lebanon. This is followed by reflections on research in the social sciences in Arab states. By focusing on these major areas, we hope to engage readers with the particularities of the cases and then derive from them a set of current challenges and opportunities for science education research and development in the Arab region.

SECTION I: ISSUES OF SIGNIFICANCE AND CONCERN TO ARAB SCIENCE EDUCATORS

The first chapter in this section entitled “Curriculum in Arab states: historical and contemporary perspectives” provides a historical background for education in the Arab region. Bashshur anchors his approach in a socio-cultural classification of the countries of the region in terms of their exposure to Western influences, and adoption of Western modes and patterns. He uses this classification to highlight present educational features which cover three main areas: a) structural: governance and organization (with special attention to public/private control), and school ladder (with special attention to teacher and higher education), b) access and distribution: statistics on population, students and teachers by sex and level/type of education (and qualifications of teachers whenever possible), and c) procedural: curriculum and examination, with special attention to language(s) of instruction and the place of science/mathematics in the curriculum. Using observational and numerical data, the author makes a compelling case for Arab curriculum studies.

Subsequently, six chapters address educational issues that preoccupy Arab educators in general and science educators more specifically. In a chapter entitled “The impact of contextual variables on science achievement in Arab countries: results from TIMSS 2003”, Jurdak goes beyond the poor achievement scores to explore the impact of contextual factors on science achievement in eight Arab countries. Using the TIMSS 2003 database, he identifies several contextual factors that impact science achievement within each of the eight countries and explains them in terms of developmental indicators. Moreover, Jurdak contrasts these factors across countries to identify common contextual variables which impact science achievement. The author discusses the impact of student perceptions, classroom context, teacher perceptions, school context, and the national context on science achievement.

In a chapter entitled “Epistemology of science in curriculum standards of four Arab countries”, Dagher addresses the question of what nature of science goals are
included in the curriculum documents of Egypt, Jordan, Lebanon, and Qatar. In this comparative analysis, she identifies the range of nature of science goals expressed in the curriculum documents and classifies them along the historical, psychological, sociological and philosophical dimensions of science. She concludes that at least one dimension is found to be totally missing from each of the reviewed curriculum documents. She also notes some unique goals and discusses the implications of these findings for the enacted and learned science curriculum.

The limited research base with the potential to inform public debates regarding the optimal language of science instruction is addressed by Amin in a chapter entitled “Language of instruction and science education in the Arab region: toward a situated research agenda”. The author outlines necessary directions for future research based on a description of the distinct linguistic context of Arab countries and on a selective review of two relevant literatures pertaining to teaching science through the medium of students’ native language when it is not a dominant international language like English and French and students’ second or third language when this is an international language of science. Amin selects and discusses the literature with particular reference to the linguistic context of Arab countries. The author concludes the chapter with recommendations for interpreting the relevance of existing research in an Arab context and offers suggestions for prioritizing research that need to be conducted with Arab student populations.

Concerns regarding professional development are addressed by Abd-El-Khalick in an Egyptian context. In a contribution entitled “Professional development through applied engagement: Egyptian teacher opportunities for professional growth grants”, Abd-El-Khalick suggests that the Egyptian Ministry of Education which works within the framework of a centralized, top-down model for professional development, has well established entities, with formal structures and specialized personnel, for designing and delivering professional development activities for teachers. Much of these entities, however, could be characterized as “dormant,” with minimal, if any, meaningful professional development occurring in schools. He describes and discusses different stages in a “Professional growth through engagement” model that aims to have teachers take responsibility for their own development. The author presents evidence supporting the effectiveness of this model in terms of participant teachers’ adoption of more student-centered instructional behaviors and students’ improved attitudes toward school and their own learning.

The controversial issue of religion and science is tackled by Mansour in a chapter entitled “Religion and science education in Egypt: an Egyptian perspective”. The author highlights some of the challenges to science education faced in Egypt, where the dominant religion is Islam. In most cases, Muslim science educators as well as ordinary Muslims are torn between their professional commitments and their value system as believers. Students are expected to attain a good understanding of the nature and processes of science and to develop the values, morals, and ethics that enable them to use scientific knowledge to achieve personal and societal goals. However, many topics included in science curriculum, such as evolution, cloning, abortion, and genetic engineering, are acknowledged as controversial because of their potential conflict with religious beliefs. Teachers’
interpretation of the religious view regarding these controversial topics can create a false contradiction. The author presents a model that describes teachers’ personal religious beliefs and discusses the model’s relevance for meeting the challenges of teaching controversial science issues.

The role of international organizations in prompting and supporting science education in the Arab states is discussed by Gholam in a chapter entitled “Role of UNESCO and its regional partners in promoting science education in Arab states”. Gholam describes the history of UNESCO support of science education with a detailed background on its different sectors especially education and science. Then, she describes the programs and projects implemented by UNESCO in various Arab states at both pre-university and university levels and presents work plans to improve science education in the future. This is followed by lessons gained from implementing the programs to evade previous mistakes and build on success stories region-wide. Finally, the author highlights the role of UNESCO in providing technical expertise to support member states in policy making for improving their science education and discusses the importance of cooperation and pooling of resources among international organizations, universities and private sectors highlighting the role of UNESCO Chairs and the University Education Twinning and Networking Scheme (UNITWIN).

SECTION II: STATUS OF SCIENCE EDUCATION RESEARCH IN A NUMBER OF ARAB STATES

Science education research mainly takes places in higher education institutions in the Arab states. This research, however, is not readily available to interested individuals because of the absence of publicly accessible databases. This section of the book highlights types of science education research studies that are taking place in Jordan, Al-Maghreb countries, Oman, Lebanon and ends with a reflection on issues affecting the quality of research in the social sciences.

In a chapter entitled “Science education in Jordan”, Al-Muhtaseb and Al-Weher provide a comprehensive view of the status of science education in Jordan, with a focus on the history of science education, science curriculum reform, science curriculum, instruction, and assessment, teacher preparation, science education research conducted by science educators and graduate students, and issues and problems of science education.

Similarly, Chafiqi and Tiberghien provide a general view of science education in a chapter entitled “Outcomes of a half-century of science education in Maghreb countries (1956–2006)”. In this chapter, Chafiqi and Tiberghien focus on four countries: Morocco, Algeria, Tunisia and Mauritania and address matters related to science curricula, training of science and technology teachers, non formal scientific and out of school activities, history and current status of science education research, and future developments in science education in relation to geopolitical and economic concerns.

In a chapter entitled “Science education development in the Sultanate of Oman”, Ambusaidi and Al-Shuaili provide an overview of the development of education in general and science education more specifically in the Sultanate of Oman in response to
recent changes in the global environment. In this context, they focus on reform efforts in various aspects of science education such as goals of science education, curriculum, assessment processes, supervision, instruction, and science teacher preparation. Additionally, they describe the context in which science education research takes place, survey research that has taken place in the past few decades, and discuss future directions for this research.

Focusing on Lebanon, BouJaoude, Abd-El-Khalick, and El-Hage attempt to construct a roadmap and a summary of the body of science education research conducted between 1992 and 2007 in a chapter entitled “Science education research in Lebanon: trends and issues”. Specifically, the authors review empirical studies conducted by students and researchers situated inside Lebanon between 2003 and 2008, identify major trends and issues that characterize this research, characterize theoretical perspectives underlying science education research conducted in Lebanon, summarize major findings of this research, and discuss implications of this research as well possible future directions.

In the last chapter of this section entitled “Meta-issues involved in research in Arab states: reflections of a social scientist”, El-Amine takes a hard look at the social science research terrain in Arab states. The author delineates some of the differences between the social and hard sciences and analyzes them from two vantage points, objectivity and availability of research funds. El-Amine then focuses on the role of scientific community and government in social science research, the similarities and differences between the roles of the social science researcher, the foreign expert, and the social actor in the context of Arab societies. In closing, Al-Amine discusses the nature of social science research and the bureaucratic use of research in Arab states.

In the final chapter of the book, we take stock of the issues discussed by colleagues in the previous chapters, and present a synopsis of the insights, recommendations, and new questions arising from their studies for the purpose of synthesizing current understandings and formulating a productive research agenda. We hope that this book will spark the readers’ interest in further studying the issues presented or missed by the authors, and lead to new conversations and fruitful research practices that serve to improve science learning and teaching in the Arab world.

NOTES

1 In response to the difficulty in locating research resources, the Lebanese Association for Educational Studies launched a project entitled Shama which is an “Arab Educational Information Network, established through an initiative by the Lebanese Association for Educational Studies (LAES). Shamaa is a database of the educational sources that have appeared in the Arab Countries since 1/1/2007. Shamaa covers books, articles, MA theses and Ph.D. dissertations, written in Arabic, French, and English. During the first stage (2 years), the information in Shamaa is limited to bibliographical data (without abstracts), such as author name, title, place and date of publication, number of pages, etc. Also, Shamaa provides the contact information of the publisher. The user of Shamaa may access it by descriptor, title, author name or any keyword (http://www.shamaanet.org/index-en.htm).
4 http://www.moe.gov.sa/openshare/EnglishCon/e27_10_2008_094255.html
It is important to mention that conducting a review of science education reform efforts, research, or projects across Arab states is very hard currently because of the absence of a pan-Arab database that keeps track of publications in these areas. Any effort to review this research presently is by necessity limited and lacking breadth.

Refer to Godwin (2006) for an overview of educational reforms in the U.A.E. and to Grant et al. (2007) for political and economic analysis.

Refer to Brewer, Augustine, Zellman, Ryan, Goldman, Stasz, & Constant, 2007 report for details on reform efforts in Qatar.

Refer to Fatany (2007) for a brief description of educational reforms in Saudi Arabia.
SECTION I: ISSUES OF SIGNIFICANCE AND CONCERN TO ARAB SCIENCE EDUCATORS
1. CURRICULUM IN ARAB STATES: 
HISTORICAL AND CONTEMPORARY PERSPECTIVES

INTRODUCTION

What do scholars in the field of science education like to know about education in the Arab region, so that their own observations or conclusions on science education in this region may become more meaningful? To answer this question we need first to define the term Arab region, and explain what Arab is about it, and in what sense can one talk about Arab education.

Common and Disparate Features

To start with, the term Arab region is a very complex one. The same region is sometimes called the Arab World, and the countries that are included in it are referred to as Arab countries or Arab states, and the people who inhabit them are sometimes called Arabs, but more often identified as Egyptians or Algerians or Syrians or Lebanese or citizens of any of the other Arab states that belong to the Arab League which includes 22 states at present. Geographically, these states fall in two continents: Asia and Africa spreading over an area of 12.9 million sq km, larger than Europe (10.4 million sq km), Canada (9.6 million sq km), or the USA (9.2 million sq km). The largest of these states, the Sudan, has an area of 2.5 million sq km, and the smallest, Bahrain, an area of a mere 665 sq km, i.e., 1/4000th that of the Sudan. In terms of population, the region has close to 320 million (2005), almost one fourth of them (80 million), in Egypt, while less than one percent of that size in Bahrain (727 thousand). Size in area or population is belied in other equally important statistics that relate to socioeconomic conditions: per capita income ranges from more than US$80 thousand in Qatar, to 1/120th of this in Yemen ($600), or 1/16th of this in Egypt ($5000), the country that has the largest population. In terms closer to our concerns: literacy rates for adults (over 15 years) is about 70% for the whole region, against a world average of 82% (1995–2004); for females it is 60% in the Arab region compared to 77% as a world average. Literacy rates are highest in the small rich states of the Gulf (Kuwait 93%, Qatar and UAE 89%, and Bahrain 87%), but then they are high also in some not so rich countries (Jordan 91%), or not so politically stable (Palestine 92%). In the most populous country, Egypt, it stands at 71%.
The contrasts are many and striking, covering all aspects that come to mind. Yet all these countries are called Arab, and the people who inhabit them are called Arabs. This means that these countries and their inhabitants share some common traits that others do not, or at least do not share them to the same extent or in the same way. These traits, in our judgment, find their best expression in the meeting of two strands that have been intertwined through the long history of this region that stretches for close to 1400 years: language and religion. The language is clearly the Arabic, and the religion is Islam. It is in the singular (and tortuous) combination of these two that the essence, or weltanschaung, of whatever is “Arab” resides. Both the Prophet and the Holy Book of Islam are Arabs, or delivered in Arabic. Nowhere else is this combination more significant or more laden with meaning than in the Arab world. It is on this double axis of religion and language or double helix that the whole panorama of Arab history revolves. Yet in its march, this history has taken different twists and given rise to different manifestations in different parts of the Arab region. A detailed account of these variations is the proper domain of historians, but for this introduction, it should be sufficient to point out briefly the main historical periods, and the main features that characterize each.

First period: from beginning of Islam (622) to the Ottoman conquest of Syria, Egypt and Western Arabia (1517), a total of almost 900 years. This is a vast stretch of time which has seen the rise of Islam and its expansion from Spain to India, the effervescence of Arab/Islamic culture in the 9th–12th centuries, and its great contributions in religion, philosophy and science. For the Arabs, this is their Golden Age, which still lives in their memories as a source of pride and inspiration.

Second period: from the Ottoman Conquest to the breakup of the Ottoman Empire after the First World War (1922); a total of some 400 years. This is a period associated in the minds of most Arabs as their Dark Age. It has, however, injected into their lives some laws and regulations that continue in effect to this day (in a manner similar perhaps to what the Roman Empire has done in Europe). It has also brought the region face to face with the West, with the Napoleonic invasion of Egypt (1798), and the subsequent rule of Mohammad Ali (1805–1848), bringing Arab/Islamic culture into direct contact with Western power and values. It was during this period that Europe came to the region as a colonizer: France in Algeria (1830) and Tunisia (1881); Britain in the Persian/Arab Gulf coast (1820), Aden (in present day Yemen) (1839), Egypt (1882), and Sudan (1898), and the process accelerated with the collapse of the Ottoman Empire after World War I.

Third period: from the collapse of the Ottoman Empire until the early 1950’s. The process of European colonialism continues: the French mandate over Syria and Lebanon (1920) and the British mandate over Palestine, Transjordan (Corresponding geographically to today’s Hashemite Kingdom of Jordan) and Iraq (1920). But this period is also the same period when independence was granted or received by individual states: Egypt (1922), Iraq (1932), Lebanon (1943), Syria (1946), Transjordan (1946), and the process continued, interrupted by the defeat of the Arabs in 1948, and the establishment of the state of Israel, an event that had
cataclysmic effects on the Arab states, ushering a series of coups d’états: Syria (1949), Egypt (1952), and Iraq (1958), followed by a period of turbulent military/one man/one party/one family-dynasty rule.

Fourth period: from the 1950’s until the present. This is the period of exuberant hopes and painful convulsions and frustrations: Algerian war of liberation (1954); unity between Egypt and Syria (1958) and subsequent dissolution (1961); Arab/Israeli wars, defeats and loss of territories (1956, 1967 and 1973); rise of Palestinian Liberation Organization (1964); withdrawal of Britain East of Suez (1968) and formation of United Arab Emirates (UAE) (1971); formation of Gulf Cooperation Council including UAE and Saudi Arabia (1981); 15 years civil war in Lebanon (1975–1990); peace accord between Egypt and Israel (1979); Islamic revolution in Iran (1979) and its subsequent impact in the region; Israeli invasion of Lebanon (1982) and its subsequent withdrawal (2000); rise of Islamic resistance in Lebanon and Palestine (1988–1990); Iraqi invasion of Kuwait (1990) and the first Gulf war (1991); first Palestinian Intifada (2000) and the protracted wars between Israelis and Palestinians; terrorist attacks in the USA (2001) and subsequent fallout in the region; the second invasion and US occupation of Iraq (2003); assassination of PM Hariri in Lebanon (2005), Israeli war on Lebanon (2006), Israeli war in Gaza (2006), and the continued popularity, influence, and controversy of militant Islam.

Markers for the Future

The march goes on, and what shape will the Arab region take in the future is anybody’s guess. The centrality of the double helix (language and religion) in influencing future trends remains paramount, but through time, this combination has itself been impacted by the march of events summarized above. The outcome of this is reflected in all aspects of Arab life, but can best be summarized in three points of relevance to our concern with Arab education and the curriculum:

– While “Arabism” and unity of Arabs was the dominant ideology in the early part of the 20th century, the individual “state” has become of a much greater importance both as a sphere of identification for the average person and also as a mechanism for directing and controlling his daily life. In most states (Lebanon being an important exception), the educational system was rendered into a tool to serve the needs of the state, and the school into a growing field for reliable and compliant citizens. Education emerged as an important avenue of control from the top down, and an elevator from the bottom up for the average person.

– Side by side with the rise of the “state”, Islam forged ahead sidetracking or distracting “Arabism” as a focus of identification, and like Arabism, cutting across state boundaries or rising above them. In the meantime, the state found itself under increasing pressures to offer services of all kinds, including educational, to an ever-increasing number of people.

– In due time, the pressure that the “state” found itself subjected to went beyond numbers, to issues of a practical nature that had to do with running the schools,
such as qualifications of teachers, subject matter to be taught, language of instruction, examination procedures, textbooks and school equipments and other similar issues. To find answers to these issues, it drew upon three sources:

a. The general Arab/Islamic culture and tradition which, though short on providing specific solutions, was still very powerful as a source of inspiration and pride, particularly in matters that had to do with teaching history and language,

b. Relationships with other Arab states, on account of proximity or association, or in accordance with agreements between two or more states or other agreements of a general Arab regional nature, and,

c. Western states that included but were not limited to old colonial powers, also international organizations modeled after or controlled by the West, such as the UNESCO or the World Bank.

Solutions or answers to specific educational problems coming from these three sources were not always in agreement with each other, and indeed, they were received and acted upon differently in different Arab states. To elaborate, it will be best to think of the Arab states in terms of groups or categories, each having some common background or experience that conditioned the kind of educational problems they faced, and the solutions they sought. The classification that we find most appropriate for our purposes here consists of four categories: a) Al-Mashrek states, on the eastern board of the Mediterranean: Egypt, Iraq, Jordan, Lebanon, Palestinian territories, and Syria; these possess the oldest tradition and experience in education, b) Al-Maghreb states in north Africa: Algeria, Libya, Morocco, and Tunisia, which were subjected to direct influence from Europe and continue to revolve in its shadow, c) The Gulf states: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and UAE, rich in oil resources, embarked on mass educational expansion recently, and d) The least economically developed: Comore, Djibouti, Mauritania, Somalia, Sudan, and Yemen.

*Curriculum Borrowing, Imitation and Adaptation*

The above gives us the contours or the dimensions into which educational institutions and the curriculum of the Arabs evolved. We should hasten to note from the start, that there is very little link between what stands now for curriculum in the Arab states and the curriculum that existed prior to the 19th century, when Western influence swept into the region. Not that cultural life was dormant before then, or that there were no schools or teachers or a subject matter to teach, but the influence of the West put on track a new direction in education that caused an interruption or a hiatus between the education that existed before and the one which emerged gradually as a result. The new one which is prevalent today is different from that which existed before in three main ways: a) it gave rise to a “system” of education, with a specific content and a specific set of rules and regulations controlled and directed from the center, in the form of a ministry, b) it revised or transformed the content, moving it more in the direction of this world rather than those of the afterworld, or religion, and c) it opened the education system up to a larger number of students than ever before.
As far as content is concerned, we see a curriculum pattern in Egypt developing early in the 19th century soon after the establishment of Diwan Al-Madaress (the forerunner of the present day Ministry of Education) in 1837 by Mohammad Ali. A simple but an official government educational ladder was put in place in preparation for “higher studies”, composed of six years, three for “elementary” and another three for “secondary”. The content was divided into two broad subject matter areas, reflective of what stands for the essence of Arab history and culture: religion (Qur’an), and language, with some rudimentary arithmetic included in the latter. In 1863, the educational ladder was extended by two more years adding one year to each of the elementary and the secondary, making the total 8 years instead of 6. Also, the number of teaching periods for each subject in each of the 8 grades was given in specific, producing a total of 28 periods per week for the elementary and 33 for the secondary. The content remained divided in the same two areas of religion (Qur’an) on the one hand, and language (with arithmetic) on the other, but the pattern of subject distribution in each was more clearly staggered upward, the higher the grade the more detailed and parcelled the subjects become. For example, Arabic language which was given 14 weekly periods in the first two grades of the elementary level was broken down in the last two grades of the elementary into Arabic proper for 9 periods, and penmanship or calligraphy for 5. In the four grades of the secondary, the breakdown was more detailed: geometry was introduced in the first two grades, reducing the number of periods given to Arithmetic; also in the last two grades, biology and chemistry were introduced for 2 periods each. In addition, French language was introduced for 6 periods, and history and geography for 3 periods taught in French (this was in 1863). Then in 1905, branching off into two streams in the last two grades of the secondary appeared for the first time: one stream for sciences and another for arts, in preparation for “higher studies”; also English was introduced along with, or as a substitute for French (Britain occupied Egypt in 1882)\(^2\).

The kind of thinking that guided the framing of the curricula in the 19th century, and the distribution of subjects or topics over a number of years, each with a specific weight or a number of periods per week, remains unchanged as a framework for curriculum making in Egypt today. In fact, the same thinking guides curriculum making in all other Arab states, with variations. These variations are found between one Arab country and another, and within the same country over time, but the approach remains the same. Looking at Egypt once more, we find that in 1957, some 95 years after the first “modern curriculum” in 1863, important changes have been introduced. The most important of these changes is that the number of years of study was extended in 1957 to a total of 12, instead of 8 years in 1863, and the 12 years broken down into three cycles, instead of two: a) elementary for 6 years, b) intermediate (or preparatory) for 3 years, and c) secondary for 3 years. The streaming that was introduced in 1905 in the upper secondary for the first time was kept unchanged: one for arts and the other for sciences, but this time in the last 2 grades of a 3 instead of a 4-year secondary stage (Al-Husari, 1963). Of more importance is that the middle stage, called intermediate or preparatory, which did not exist in 1863, was redefined in terms of function, making it more an extension of the elementary stage rather than one preparing for
the secondary, opening the door for a time when compulsory education will begin to expand upward in the 1990’s in most Arab states to cover the whole 9 years, relabeled now as “basic education”, making general secondary education a stage with one exclusive function, i.e., to prepare for university admission.

There were other changes that could be seen in Egypt in the curriculum of the mid-1950’s, one of them is that periods given before to the teaching of a foreign language were removed from the elementary cycle, and in their place more periods were given to civic education and “practical activities”; teaching of a foreign language was now to be delayed until the intermediate level and will continue throughout the secondary. At the secondary level, a second “European” language was to be introduced in the “literary” but not in the “scientific” stream where more periods were to be given to the sciences and mathematics. It is to be remembered that those changes came at the crust of a military take over that gripped the country in 1952, and put it on a new course of development. Removing foreign language from the elementary cycle was an example of the manner in which the new political order wished to assert its independence and determination that the new Arab generation be rooted in its own Arab culture and shielded from foreign influences.

In addition, Egypt in the late 1950’s introduced other types of “secondary” education programs which were vocational or technical in nature, or organized some existing scattered programs of this kind into more uniform patterns, making them either terminal, or leading to short post secondary programs, but not to the university. These were classified into three main categories: a) industrial, b) agricultural and c) commercial. Compared with the “academic” programs, the pattern of subject/period distribution in these showed more periods given to more practical or vocational subjects, and fewer ones given to a smaller number of academic subjects than in the pre-university “academic” track (Al-Husari, 1963).

The above pattern of streaming and subject distribution in Egypt went through a number of adjustments and modifications in the early part of the 20th century, before it stabilized in the late-fifties along the lines described above. Because of its size and influence, this Egyptian pattern was emulated in most other Arab states, in some cases instantaneously and in others in a more gradual and selective manner. The main features in this pattern remain a list of discrete subjects spread over a number of years, where each subject is allotted a number of weekly periods, which are raised or lowered depending on the intended field of “specialization” in preparation for university studies. In the case of vocational or technical programs, the balance between subjects and weights given to them is determined by what is perceived as appropriate for work after graduation.

There are two reasons why Egypt deserves this special attention that we are giving it in this discussion: size and age. The first is indisputable; Egypt has the largest population as well as the largest number of children in schools than any other Arab state. The second reason is not as indisputable, for there are other countries, particularly Lebanon in the East and Morocco and Tunisia in the West that can compete with Egypt in terms of age or experience in education. But none has the combination of size and age that Egypt has, nor, for that matter, the authority of a concentrated political center that could more easily highlight and
propagate achievements. Other countries share with Egypt early exposure to the West, some even earlier than those made possible by Mohammad Ali’s projects in Egypt, but the impact of these on other Arab countries was limited to the contributions of some individuals who worked in these countries in comparison to that of the more pervasive Egyptian government. The pattern of curricular distribution that was ultimately adopted and stabilized in Egypt, which we may describe as discrete subjects, was the one which gradually spread from Egypt (and Syria) to other Arab countries or was copied by these countries, particularly by those in the Gulf, when these became ready to move into mass education.

Main Type with Some Variations

The type which we have been elaborating above remains the dominant one in all Arab states at the present time, with some variations here and there, and exposed to some novelties from time to time, but these do not last very long, or influence the character of this type in any substantial way. We have used above the terms ‘discrete subjects’ to describe the main features of this type, but additional details will bring it more to life: irrespective of what Arab state one is thinking of, we can imagine the majority of the children brought into schools at the compulsory school age, usually at 6, see the inside of classrooms for the first time in their lives, sit 40 or 50 or 60 in one classroom face to face with one teacher struggling to teach them something about a subject in the syllabus, often by shouting over their heads, or picking on one among them to answer a question, or to read from the book, or more often shouting to bring calm to the room and end chaos, and within a few minutes afterwards shifts to another subject in the syllabus, or leaves the room to be replaced by another teacher who comes in, in the higher grades, to teach another subject in the syllabus. Information of this kind has been reported recently by an observer who visited schools in Cairo: “Like so many schools in Egypt, this particular school operated in two shifts. In Cairo, 54 percent of government primary schools and 64 percent of government preparatory schools are shift schools. The facility under study served as the Zahra School for Girls from 6:45 am to 12:00 pm and as the Amira School for Girls from 1:00 pm to 6:00 pm. Approximately fifteen hundred students attended each school, or shift, making for a total of three thousand students who utilized the school facility each day. The class size was up to eighty pupils per class, far exceeding the national average of forty-one pupils per class. Three, and sometimes four, girls shared bench desks intended for two students…” (Herrera, 2006, pp. 156–157). Another observer of the same conditions commented that, “Teachers are faced with the daunting task every day, of having to control, punish, rear, and transmit knowledge during a forty-five minute class period … A well controlled class they explain, is in the best interest of the student, for his/her main objective is to retain the maximum amount of information and earn high grades on the exam….To maintain control, teachers often organize their classes according to a fixed formula” (Farag, 2006, p. 121). The author goes on to say, “when it comes to the curriculum, teachers have little flexibility and are obliged to teach the official textbook” (Farag, 2006, p. 124).
M. BASHSHUR

What are the subjects in the curriculum that punctuate the work that teachers do in their classrooms? First, we will examine those subjects taught in the first 9 grades that are now considered by most as basic and compulsory. Next, we will examine school subjects taught at the upper secondary level.

Subjects in the First Nine Grades

A quick look at the subject distribution in a number of Arab states reveals a long list of subjects that ranges in number from 14 to 20 (not all given in all grades) and call for a total meeting sessions of 40–45 minutes each, which range in number from 339 per week in Egypt to 253 in Sudan for all subjects in all 9 grades. Religion takes the highest percentage of the total in Saudi Arabia (27.6%), followed by the total in Yemen (23.0%), Sudan (19.1%), Qatar (14.9%), Oman (12.5%), Libya and Kuwait (11.9%), followed by a chain of states where it receives less than 10.0% of the total: Morocco (9.8%), Jordan (9.6%), UAE (8.8%), Bahrain (8.3%), Syria (7.4%), Egypt (7.1%), Tunisia (5.5%), Algeria (4.7%), and finally Lebanon, where it receives zero, i.e., it is not included as a teaching subject in the official curriculum. Lebanon and Saudi Arabia represent extremities in this case, where in the first religion receives the maximum, and in the other it receives nothing in the official curriculum. However, we should be aware that most students in Lebanon are enrolled in private schools many of which are owned or controlled by religious groups where the religion to which the school belongs is taught in addition to the official curriculum. Hence the context and the delivery mode of teaching religion in Lebanon are much more complex than the percentages disclose (Bashshur, 2003).

Arabic is the one single subject that receives more periods than any other subject in all Arab states, except in Saudi Arabia. The highest numbers assigned for Arabic are in Egypt, Algeria, Tunisia, Sudan, Saudi Arabia, Syria, Iraq… in a descending order, but combined with religion, the other pillar subject, this order changes, where Saudi Arabia comes on top (54.1% of the total), followed by Yemen and Sudan (48.3%), Qatar (39.5%), Iraq (37.8%), Egypt (37.2%), Kuwait and Iraq (36.8%), then Algeria (35.4%), Libya (34.7%), Morocco (34.4%), Bahrain (33.9%), Tunisia (33.7%), Oman (33.6%), Syria (33.1%), UAE (29.4%), and finally Lebanon (20.0%). The percentage given for Lebanon relates to Arabic language only, for, as we said before, Lebanon does not include religion as a subject in its official curriculum.

There is another feature that constitutes a peculiarity in the case of Lebanon, namely that it is the only Arab country where a foreign language has always been included in its official curriculum starting from the first elementary grade. Until recently, no other country, except those in North Africa which were colonized by France, included a foreign language in any of its elementary grades. This began to change in the early 1990’s, when a number of other Arab countries began to introduce a foreign language (usually English) into their elementary curriculum, starting from the upper grades and going down. At present, all Arab countries include a foreign language in one or more of their elementary grades. Some of them, particularly those in the Gulf (Kuwait, Bahrain, UAE, Qatar and Oman) have already covered all grades in the elementary, and others are approaching that goal.
Science and mathematics represent an intriguing area in Arab curricula. In a sense, these are the new subjects, compared to religion and Arabic. Not that they were not taught before; they were as early as the 19th century, but in a rudimentary form mathematics, or rather arithmetic, was included as part of Arabic language in the elementary schools of Egypt in 1837 as we mentioned before. There is no doubt that some sort of science was also included, but even less formal or organized, as part of Arabic or maybe as part of religion, particularly in relation to body care, cleanliness, and hygiene. This has changed considerably over time, and the two subjects, particularly mathematics, occupies now a sizable place in the curricula of all Arab states. Table 1 gives the percent of time that each of the two subjects receives out of the total in all the 9 grades of basic education.9

<table>
<thead>
<tr>
<th></th>
<th>Math</th>
<th>Science</th>
<th></th>
<th>Math</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>13.3</td>
<td>2.7</td>
<td>Bahrain</td>
<td>17.7</td>
<td>10.6</td>
</tr>
<tr>
<td>Sudan</td>
<td>17.5</td>
<td>3.2</td>
<td>UAE</td>
<td>16.7</td>
<td>8.8</td>
</tr>
<tr>
<td>Syria</td>
<td>14.5</td>
<td>9.1</td>
<td>Oman</td>
<td>18.3</td>
<td>11.7</td>
</tr>
<tr>
<td>Lebanon</td>
<td>15.8</td>
<td>13.3</td>
<td>Qatar</td>
<td>15.0</td>
<td>9.8</td>
</tr>
<tr>
<td>Jordan</td>
<td>5.2</td>
<td>13.1</td>
<td>Algeria</td>
<td>19.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Iraq</td>
<td>19.9</td>
<td>12.5</td>
<td>Tunisia</td>
<td>14.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>13.4</td>
<td>8.8</td>
<td>Morocco</td>
<td>18.2</td>
<td>7.9</td>
</tr>
<tr>
<td>Kuwait</td>
<td>14.1</td>
<td>9.0</td>
<td>Libya</td>
<td>19.6</td>
<td>12.3</td>
</tr>
<tr>
<td>Yemen</td>
<td>17.0</td>
<td>9.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A couple of remarks may be added to the above:

- Mathematics is taught starting with grade one in all grades; in this it belongs to the core in the curriculum just like Arabic and religion, and its share out of the total is clearly substantial.

- Unlike mathematics, the sciences are not included starting from the first grade in all states. This is especially true in Egypt and Sudan where the sciences receive very low coverage. With more scrutiny, we find that there is in Egypt a subject on the list in the first 3 elementary grades, with the unusual title of “educational activities and practical skills” with a substantial weight of 10 periods given to it in each grade, then we find that this subject disappears in the second 3 grades of the elementary and its place is taken by the “sciences” for 3 periods, then these also disappear in the third 3 grades, and their place is taken by “practical areas”. In the case of Sudan, something more unusual is observed, where in the first 6 grades no sciences are included, but a subject appears with a title that can hardly relate to the sciences: “applied and expressive arts”; in the second 3 grades, a more tantalizing title appears: “man and the universe”, defined as an “integrated area of learning from science, history, geography, applied arts and music”. This title is given 4 periods in each of the second 3 grades. In the third 3 grades the subject of “sciences” does appear with a substantial weight, and in addition another subject: “health & nutrition” appears on the list for the first time.
There is another matter that impinges on the teaching of the sciences (and mathematics) that has far-reaching implications, i.e., the language(s) used in teaching them. Traditionally, the language used in most Arab states in teaching all subjects at the elementary level, including mathematics and science, has been Arabic, but this is changing in many Gulf states, such as the UAE and Qatar. In Lebanon, when the new curricula were issued in 1997, the language stipulated for public schools was Arabic, but in 2001 an official permission was granted allowing public schools to use languages other than Arabic in teaching the sciences or mathematics. Private schools in Lebanon have always had freedom to choose whatever language they wished in teaching, and they invariably chose either French or English in teaching mathematics and sciences at all levels. In other Arab states using a foreign language, particularly at the secondary level, is becoming the norm rather than the exception in an increasing number of Arab states.

Subjects in the Upper Secondary

In almost all Arab states, the first 9 grades are crucial in the life of all students. They are all subjected to some type of a central examination that determines their direction afterwards in the upper secondary. This direction can be either towards the general or academic fields that are desired by almost everyone or towards the vocational or technical fields. The first leads to the university and the second does not, except in very rare cases. In terms of numbers, the proportion of those who go into the academic fields is generally twice as many as those who go into the vocational fields; sometimes the ratio of the first to the second reaches 3 or 4 to 1. The duration of study in the upper secondary academic is generally 3 years (2 in Jordan and Oman and 4 in Tunisia), the first is usually common to all, followed by two choices in the remaining 2 grades: “scientific” and “literary”. In some few cases (Lebanon, Tunisia) the second year splits into 2 more in the third (terminal) year: the scientific splits into mathematics or sciences, and the literary into humanities or social sciences. This bifurcation is a definite marker of the fields of study or specialization that those who continue their studies at the university level will enter. With this characterization in mind, it will not be a surprise to find a heavily polarized course distribution in the last two grades of the secondary cycle.

The first year is common to all in most states; its function seems to be defined as preparation for the bifurcation that will come later in the 2nd and 3rd years, except when the first year itself is bifurcated, like in Jordan (where the secondary stage is for 2 years only), and in Bahrain (where it is for 3 years). When it is common, the distribution of subjects/periods illustrates the preparatory nature of this first year; as examples, the total number of weekly periods in Egypt is 38, in Saudi Arabia it is 35 and in Lebanon it is also 35; religion and Arabic take a total of 8 periods in Egypt, 11 periods in Saudi Arabia and only 5 in Lebanon (where religion is again not included). Foreign language(s) take 6 for the first and 3 for the 2nd foreign language in Egypt, the numbers for Lebanon are 5 and 2, and for Saudi Arabia 4, with no second foreign language. When it comes to mathematics and the sciences, the distribution is by single subject and is very close in the 3 cases: in Egypt mathematics takes 4 periods,
and each of the three sciences physics, chemistry and biology take 2; the distribution in Saudi Arabia is the same except that mathematics takes 5 periods. Mathematics takes 5 periods also in Lebanon, and in addition, physics takes 3 periods while each of the other two sciences takes 2 periods each.

In none of the three countries we are reviewing does the concept of “elective” or optional courses appear. Such a concept does appear in some other countries such as in Jordan and Bahrain but in a limited way. In Jordan, the program is laid out in 3 categories of courses: a) Common general education, b) Electives and c) Optional. In the elective part, students in the literary stream may choose an additional subject from among a list that includes religion, geography and mathematics; those in the scientific stream may choose from among courses in biology, geology or a literary subject.

In the last two grades, concentration becomes heavier in favor of the stream or line of specialization. An example from Lebanon is that while literary and social science subjects are given 18 periods in the first common year, mathematics 5 and the sciences 7, the numbers shift in the second year where in the Humanities section the numbers for the literary and social sciences rise to 24, while those for mathematics drop to 4, and the sciences disappear totally as single subjects and in their stead a new course called “scientific culture” appears with a mere 3 periods per week. The trend continues upwards and further concentration appears in the 3rd and last year, where the share of the literary and social sciences rises to 27 periods, while that of mathematics drops even further to 2 periods, and the general course called “scientific culture” remains with the same 3 periods per week. The pattern for the other three streams of specialization is the same, but in reverse.

An examination of textbooks assigned for these various subjects reveals a more peculiar and disturbing situation. Quite often a textbook for a subject which receives a major number of hours, is simply shrunk by cutting off a number of chapters in it in a procrustean fashion to make it suitable as a textbook for the same subject in another stream of specialization that is assigned a fewer number of hours. The principle that lies behind is the same that beguiles the whole approach in curriculum design in Arab states, i.e., conceiving of it in terms of discrete parts or units that can be increased or decreased, or rearranged at will in different combinations like in a Lego game to produce different results.

The above image is further reinforced by what central examinations do to students struggling to pass the exams at the end of the secondary school stage with grades high enough to earn them a place at the university level. Individual courses are assigned different weights in different streams or lines of specialization not only in terms of periods or meeting sessions per week, but also in terms of weights or coefficients that each receives in the government exam. A subject like mathematics, for example, that receives 10 periods in the curriculum of the “General Science” stream, is given a coefficient of 100 out of 300 on the exam, while the same subject is given 4 periods in the curriculum and a coefficient of 40 in the exam in the “Sociology and Economics” stream, and even less in the “Humanities and Literature” stream. The end result is that students, as well as their teachers, give much less attention to the secondary subjects. Subjects which are lower than that on the list, like a second foreign language, or technology, or arts and activities,
which were originally put in the curriculum to provide breadth or enrichment, end up being cut off totally by both students and teachers. In reality many schools do not even include them on their daily schedules, and the few hours assigned to them are either dropped, or added up to augment those given to major subjects.

**The Curriculum: An Alibi for Poor Product?**

A definition of the curriculum as “a structured series of intended learning outcomes” (Johnson, 1967, p. 130) is as plausible as any as a stepping-stone to the basic questions that lay behind this discussion of curricula in the Arab states: How good are they? Are they helping to move the new generations of the Arabs towards some “intended learning outcomes?”

We have restricted ourselves in this discussion to providing a historical background, and then to collecting and sorting out information that relates to the “structure” of the “series” of subject matter units, generally known as “courses” with specific hours or teaching periods assigned to them, at different levels and in different fields of study. The implication has been that these series should lead to some “intended learning outcomes”.

But surely we know that achieving these “outcomes”, assuming that they are known, will have to depend on so many other and more important factors that we did not even touch upon in this discussion, such as the availability and dedication of qualified teachers who will be able to “teach” this curriculum, and the effective management of the educational system as a whole, in its various components, those related directly or indirectly to teaching.

Since we did not touch upon such factors, we feel that our discussion of the curriculum in the Arab states falls short of the target, and maybe even frustrating, as it does not connect with the “learning outcomes” that these curricula are intended to serve.

To reduce this deficiency, we will call to our aid at the end of this discussion two kinds of material related to the “outcomes”: the first of it is available in abundance, and the second is rare. The first is a sample of the mountains of complaints and criticisms directed at the performance of the educational system in the Arab world by almost everybody, and the second is some data on how well do children in some Arab states perform on international comparative studies of student achievement in mathematics and sciences in comparison to their peers in other countries.

Of the first kind we take samples from recent publications by experienced educators in the largest two Arab states, Egypt and Saudi Arabia, the first with a per capita income among the lowest in the region, and the second among the highest at the other end of the scale.

The educator from Egypt, a professor of education in Al-Mansura University states in a recent book on the reform of education in Egypt, “attempts at reform should start from regaining confidence and respect to the school, after so many students and parents have turned their back to it as evidenced in the very high rates of absenteeism from classes, and spread of private tutoring….In a recent public
survey on family expenditure, it was shown that 55% of the families spend money on private tutoring... (which) has become a chronic disease in the country, where emphasis is placed not on learning and culture but on memorization and passing the exam... the majority of students have turned their back to the school... particularly those in the last year of the secondary stage, where the private tutor has replaced the school teacher...”. (Al-Buhairy, 2008, pp. 22, 47, 79 & 84, translated from Arabic).

The second writer is President of Yamama University in Riyadh, Saudi Arabia, who concludes in a book published in 2009, that “the educational system in the Kingdom... should adopt a new philosophy of education based on a balance between deep religious, moral and psychological upbringing on the one hand, and possession of mental and behavioral skills that enable (our youth) to become productive and competitive in the future... on the other. Despite the fact that our students take a very large number of subjects in religion in their study, the influence of religious and moral values on their public behavior is weak; in fact it can be said that one of the things that characterize the behavior of our new generation is their disregard of everything, of religion and customs, of people, life and ethics.” (Al-Isa, 2009, p. 104).

Before he arrived at his scathing conclusion, Al-Isa had already done his own calculations of the amount of time given to religion in the curriculum, and reported that students in the two largest branches of specialization at the secondary level (out of four), Theological Sciences and Natural Sciences, take 60% in the case of the first, and 51% in the case of the second of all their program, from grade 1 elementary to grade 12 secondary, in the two subjects of religion and Arabic, while the corresponding ratios for mathematics is 13% in the first and 16% in the second, and that of sciences is 9% in the first and 16.5% in the second (2009, p. 23).

The second kind of material related to “outcome” is the standing of Arab students on the TIMSS. These were given in 2003 and 2007, in mathematics and sciences and in 2 grades 4th and 8th. More Arab states participated in 2007 than in 2003 as shown in Table 2.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>495</td>
<td>500</td>
<td>489</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hong Kong</td>
<td>607</td>
<td>554</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>599</td>
<td>587</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>378</td>
<td>354</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>347</td>
<td>341</td>
<td>304</td>
<td>297</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>339</td>
<td>327</td>
<td>314</td>
<td>318</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>316</td>
<td>348</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>296</td>
<td>294</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yemen</td>
<td>224</td>
<td>197</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Continued)
Table 2. (Cont.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMSS Scale Average</td>
<td>466</td>
<td>500</td>
<td>473</td>
<td>500</td>
</tr>
<tr>
<td>Singapore</td>
<td>605</td>
<td>593</td>
<td>578</td>
<td>567</td>
</tr>
<tr>
<td>Korea</td>
<td>589</td>
<td>597</td>
<td>558</td>
<td>553</td>
</tr>
<tr>
<td>Lebanon</td>
<td>433</td>
<td>449</td>
<td>393</td>
<td>414</td>
</tr>
<tr>
<td>Jordan</td>
<td>424</td>
<td>427</td>
<td>475</td>
<td>482</td>
</tr>
<tr>
<td>Tunisia</td>
<td>410</td>
<td>420</td>
<td>404</td>
<td>445</td>
</tr>
<tr>
<td>Bahrain</td>
<td>401</td>
<td>398</td>
<td>438</td>
<td>467</td>
</tr>
<tr>
<td>Syria</td>
<td>–</td>
<td>395</td>
<td>–</td>
<td>452</td>
</tr>
<tr>
<td>Egypt</td>
<td>406</td>
<td>391</td>
<td>421</td>
<td>408</td>
</tr>
<tr>
<td>Algeria</td>
<td>–</td>
<td>387</td>
<td>–</td>
<td>408</td>
</tr>
<tr>
<td>Oman</td>
<td>–</td>
<td>372</td>
<td>–</td>
<td>423</td>
</tr>
<tr>
<td>Palestine (Authority)</td>
<td>390</td>
<td>367</td>
<td>435</td>
<td>404</td>
</tr>
<tr>
<td>Kuwait</td>
<td>–</td>
<td>354</td>
<td>–</td>
<td>418</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>332</td>
<td>329</td>
<td>398</td>
<td>403</td>
</tr>
<tr>
<td>Qatar</td>
<td>307</td>
<td>–</td>
<td>319</td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>387</td>
<td>381</td>
<td>396</td>
<td>402</td>
</tr>
</tbody>
</table>

Source: http://timss.bc.edu/isc/publications.html

The above scores speak for themselves. None of the Arab states scored higher than the TIMSS scale average in either of the two subjects in either of the two years or in either of the two classes, except one country, Jordan, which in 2003 scored 2 points above the average in the 8th grade sciences. Given the observational and anecdotal data discussed earlier, considerable work lies ahead for curriculum workers and educators in all fields in the Arab world.

NOTES
1. It is to note that not all Arabs are Moslems since there are sizable religious minorities, especially Christian minorities, in many Arab countries.
2. Syllabi are given in detail for both elementary and secondary stages starting with 1837, when Diwan A-Madarees was established, and until 1913, one year before WWI. (See Pasha, 1917, pp. 2–14).
3. The mid-fifties was a time of political restructuring and alignments in the Arab world giving rise to new political arrangements, the most noteworthy of which was the union of Egypt and Syria into one United Arab Republic (1958–1961) causing the educational system in the two states to become united. Their combined system soon became the model to emulate in most Arab states, encouraged by a series of Arab regional conferences and agreements in the 1950’s and 1960’s, all pointing towards the need for more Arab harmonization and unity in education.
4. The total at all levels in 2006 was close to 22 million, which was 27% out of the total of 81 million students in the Arab region as a whole. See UNESCO: Global Education Digest, 2008.
5. See footnote no. 2 above.
6. This can be inferred from the latest data on enrolment where the number of children in primary schools in the Arab world was close to 40 million, while the number of those in the preprimary was
less than 3 million, mostly in private schools (see UNESCO, Institute for Statistics, Global Education Digest 2008).

7 Two countries, Jordan and Oman have extended this period into a total of 10 grades.
8 Figures on number of hours are taken from World Data on Education, 6th edition, 2006/07, accessed through www.ibe.unesco.org

REFERENCES


MURAD JURDAK

2. THE IMPACT OF CONTEXTUAL VARIABLES ON SCIENCE ACHIEVEMENT IN ARAB COUNTRIES: RESULTS FROM TIMSS 2003

INTRODUCTION

Research on the impact of school contextual variables – variables related to context such as teacher characteristics, school characteristics, and class processes – on achievement is abundant but mostly inconclusive. Many experimental studies (e.g., Akey, 2006; Archibald, 2006; Klinger, Rogers, Anderson, Poth & Calman, 2006; Leff, Power, Costigan, & Manz, 2003; Vermunt, 2005; Watkins, 2004) addressed this issue; however, the great majority of these were small-scale studies which focused on one or two contextual factors in order to conform to quantitative research design. Other qualitative studies (e.g., Collins, 2002; Zuberi, 2008) provided some understanding of the relationships between few contextual variables and achievement. However, these studies were limited by difficulties in generalizing the results to other socio-cultural contexts.

The recent international comparative achievement studies, such as TIMSS 2003, have provided data that enable researchers to study and compare the impact of contextual variables on achievement within and across countries. These studies (e.g., Gorard & Smith, 2004; Hanushek & Luque, 2003; OECD, 2005) generally did not address specifically the impact of contextual variables on science achievement. Conversely, this chapter reports part of a larger study conducted to investigate the impact of contextual variables on mathematics and science achievement using data from TIMSS 2003 (Jurdak, 2006). The purpose of the present chapter is to identify and compare the effect of student variables, teacher variables and school variables on the overall science achievement of Grade 8 students in the eight Arab countries that participated in TIMSS 2003.

TIMSS 2003

IEA, the International Association for the Evaluation of Educational Achievement, has conducted so far four international comparative studies of student achievement in mathematics and sciences. In 1994–95, TIMSS (known then as the Third International Mathematics and Science Study) assessed student achievement in both mathematics and science at third, fourth, seventh and eighth grades, and the final year of secondary school. In 1999, TIMSS (by now renamed the Trends in International Mathematics and Science Study) again assessed eighth-grade students...
in both mathematics and science to measure trends in student achievement since 1995. TIMSS 2003, the third data collection in the TIMSS cycle of studies, was administered at the eighth and fourth grade levels. TIMSS 2007 is the most recent of these studies. However, its results have been released in December 2008 (see http://www.iea.nl/timss2007.html)

At the heart of the TIMSS 2003 International Database are the student achievement scores in mathematics and science, together with responses of students, teachers, and principals to the background questionnaires. Student achievement scores and student questionnaire responses have been merged to facilitate secondary analyses. More specifically, the database includes the following for each country for which internationally comparable data are available: 1) students’ responses to each of the mathematics and science items administered in the study, 2) student achievement scores in mathematics and science, 3) students’ responses to the student questionnaires, 4) teachers’ responses to the teacher questionnaires, 5) principals’ responses to the school questionnaires, and 6) National Research Coordinators’ responses to the curriculum questionnaires.

Forty-eight countries participated in TIMSS 2003 of which eight were Arab countries. Table 1 lists all the Arab countries that have participated in TIMSS in 1995, 1999, or 2003 at fourth or eighth grade as well as their national science score in 2003. It is to be noted that all the Arab countries scored below the international average score of 500.

Table 1. Arab Countries Participating in TIMSS by Year and Their Scores in 2003

<table>
<thead>
<tr>
<th>Country</th>
<th>Grade 4</th>
<th>Grade 8</th>
<th>TIMSS 2003 National Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95</td>
<td>03</td>
<td>95</td>
</tr>
<tr>
<td>Jordan</td>
<td>475</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bahrain</td>
<td>438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palestinian authority</td>
<td>435</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>421</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>404</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>398</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>396</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>393</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>393</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The TIMSS 2003 assessment of student achievement in mathematics and science was designed to measure trends in student achievement in mathematics and science at the fourth and eighth grade levels. The assessment had ambitious coverage goals, reporting not only overall mathematics and science achievement scores, but also scores in important content areas in these subjects. The mathematics and science assessment frameworks for TIMSS 2003 were framed by two organizing dimensions or aspects, a content domain and a cognitive domain. There were five content domains in mathematics (number, algebra, measurement, geometry, and data) and five in science (life science, chemistry, physics, earth science, and environmental science) that defined the specific mathematics and science subject matter covered by the assessment. The cognitive domains, four in mathematics (knowing facts and
procedures, using concepts, solving routine problems, and reasoning) and three in science (factual knowledge, conceptual understanding, and reasoning and analysis) defined the sets of behaviors expected of students as they engaged with the mathematics and science content. Student achievement was reported in terms of performance in each content area as well as in mathematics and science overall.

Mathematics and Science Assessments

The TIMSS 2003 eighth-grade assessment contained 383 items, 194 in mathematics and 189 in science. Between one-third and two-fifths of the items at each grade level were in constructed-response format, requiring students to generate and write their own answers. The remaining questions used a multiple-choice format. In scoring the items, correct answers to most questions were worth one point. However, responses to some constructed-response questions (particularly those requiring extended responses) were evaluated for partial credit, with a fully correct answer being awarded two points. The total number of score points available for analysis thus somewhat exceeds the number of items.

TIMSS Background Questionnaires

Three questionnaires were used by TIMSS 2003 to gather information about students’ educational experiences together with their mathematics and science achievement on the TIMSS assessment in order to identify factors or combinations of factors related to high achievement. The three types of background questionnaires included the following:

- The school questionnaire asked school principals or headmasters to provide information about the school contexts for the teaching and learning of mathematics and science.
- The teacher questionnaire, completed by the mathematics and science teachers of sampled students, collected information about the teachers’ preparation and professional development, their pedagogical activities, and the implemented curriculum. At the eighth grade level there were separate versions for mathematics teachers and science teachers.
- The student questionnaire, completed by eighth-grade students who were tested, sought information about the students’ home backgrounds and their experiences in learning mathematics and science.

There were different versions for countries where eighth-grade science is taught as a single subject and countries where it is taught as separate subjects (i.e., biology, chemistry, physics, and earth science). Details about TIMSS questionnaires are found in Martin (2005).

Summary Indices and Derived Variables from Questionnaire Data

TIMSS 2003 collected data on many hundreds of variables from the students, teachers, and principals who participated in the study. The purpose of these data was to help policymakers, curriculum specialists, researchers, and others better
understand the performance of their educational systems. In addition to the data on the original questions asked in the various questionnaires, TIMSS created a range of indices and derived variables that summarized the data in ways that highlighted the relationship with mathematics and science achievement. For example, a three-level index of “Good School and Class Attendance” was constructed from principals’ ratings of the extent to which three student behaviors – arriving late at school, absenteeism, and skipping classes – were a problem in the school. Students were assigned to the high level of the index if their principal reported that all three behaviors were not a problem. Students were assigned the low level of the index if their principal indicated that two or more of the behaviors were a serious problem or two behaviors were a minor problem and a third a serious problem. Students whose principals reported other combinations of responses were assigned to the medium category.

Plausible Value Variables

TIMSS estimates each student’s achievement on the entire assessment conditional on the student’s responses to the items that they took and the student’s background characteristics. Because there is some error inherent in this imputation process, TIMSS draws five such estimates, or “plausible values”, for each student on each of the scales. Each student, therefore, has five estimates of his or her achievement on the TIMSS mathematics and science scales.

Sample and Population

In each country, representative samples of students were selected using a two stage sampling design. Although countries could, with prior approval, adapt the sampling design to local circumstances, in general countries selected at least 150 schools in the first stage using probability-proportional-to-size sampling. In the second stage, one or two classes were randomly sampled in each school. Generally, this resulted in a sample size of at least 4,000 students per country. Some countries opted to include more schools and classes, enabling additional analyses, which resulted in larger sample sizes.

METHODOLOGY

Data

Upon the request of the UNESCO Regional Office for Arab States, which sponsored this study, the IEA provided TIMSS data on a DVD. In this study three data files were used for each of the eight Arab countries which participated in TIMSS 2003. These files are:

− Student background file, a student-level file that includes data on the student questionnaire with the plausible scores for each student in Grade 8.
THE IMPACT OF CONTEXTUAL VARIABLES

- Science teacher background file, a teacher-level file that includes data on science teacher background questionnaires. This file did not include plausible scores associated with the teacher.
- School background file, a school-level file that includes data on the school background questionnaire filled by the school principal. This file did not include plausible scores associated with the school.

Dependent Variables

The Average Science Plausible Score (ASPS) defined as the average of the five plausible values for overall science achievement was used in this study as a measure of overall science achievement. The Average Plausible Score for the Science Teacher (APSST) was computed to be the mean of the average of the science plausible score for the students in the sample taught by that science teacher. The Average Plausible Score for the School (APSS) was computed as the mean average plausible score of the students in the sample in that school.

Statistical Analyses

Three statistical analyses were used in this study: stepwise multiple regression and variance component. For each of the eight countries three runs of stepwise regression were used as follows:

- Stepwise regression with the student background variables as predictors and the Average Science Plausible Score (ASPS) as dependent variable.
- Stepwise regression with the science teacher background variable as predictors and the Average Plausible Score for the Science Teacher (APSST) as dependent variable.
- Stepwise regression with the school background variables as predictors and the Average Plausible Score for the School (APSS) as dependent variable.

For each stepwise regression analysis the order in which the significant variables were entered by the stepwise regression with the proportion of variance associated with each variable was identified and the results of all regression analyses were aggregated in the form of tables and graphs which provided the basis for comparisons among the eight Arab countries. The variance component analysis was done to compare the variance accounted for by the school as a random variable. The results of this analysis were used to compare the eight Arab countries on the extent to which variance across students and schools account for variance in achievement.

RESULTS

Comparison of Between-Student Variance in Science Achievement

Figure 1 shows the total between-student variation in science achievement by country. The total between-student variation varies considerably across countries. Four Arab countries (Egypt, Lebanon, Palestine and Jordan) had higher between-student
variation than the average Arab countries (between-student variance = 6000, see Figure 1), whereas four countries (Bahrain, Saudi Arabia, Morocco and Tunis) had lower between-student variation than the Arab countries average.

If there is a more or less homogeneous set of educational provisions across countries, the largest part of the variation in educational performance of students would depend on the students’ aptitude and background. This means that the relatively higher between-student variation in one country reflects differences in either students’ attitudes or backgrounds or in educational provisions compared to a country that has lower between-student variations. The results in Figure 1 show that the Arab countries vary in their educational provisions in science education or in students’ aptitudes and background-factors. Consequently, this chapter will try to shed light on the impact of students’ background factors, teacher factors, and school factors on the overall science achievement of grade 8 students in the eight Arab countries that participated in TIMSS 2003.

Comparison of Between-School Variance in Science Achievement

The between-school variance indicates how much variation lies among schools. The larger the between-school variance, the more schools contribute to overall performance differences within each country. One way to analyze the role of schools within each country is to simply look at the proportion of variance that can be attributed to schools. The percentage of between-school variation to total
variance in science achievement by country is shown in Figure 2. This figure shows that Lebanon and Egypt have higher percentage in science achievement than the average of Arab countries whereas the remaining six countries have lower percentages than the average of Arab countries.

**Figure 2. Between-school variance in science achievement by country.**

**COMPARISON OF VARIANCE IN SCIENCE ACHIEVEMENT ACCOUNTED FOR BY INDIVIDUAL STUDENT-LEVEL VARIABLES**

In this section we compare the variance in science achievement accounted for by each student-level variable across the Arab countries. For each country, the first three student-level variables which entered in the stepwise regression and the proportion of variance each contributed were selected. Table 2 shows the order of entry of student level variables in the regression equation by country. Figure 3 shows the proportion of between-school variance in science achievement accounted for by student-level variables. Table 2 shows that the first variable to enter the regression equation was either “Index of Self-Confidence in Learning Science” (four countries) or one of the two related variables “Parents Highest Education Level” or “Students’ Educational Aspirations Relative to Parents Educational Level” (three countries). The order was reversed for the variable that entered second where the variable “Parents Highest Education Level” or “Students’ Educational Aspirations Relative to Parents Educational Level” entered second in four countries and the variable “Index of Self-Confidence in Learning Science” entered second in three countries. The third variable to enter the regression equation was the “Index of Students’ Perception of Being Safe in School”. The variable “Index of Self-Confidence in Learning Science” is defined by TIMSS...
2003 as “student perceives that he/she usually does well in science, science is easier for him/her than for many of classmates, science is one of his/her strengths, and perceives that he/she learns things quickly in science”. The variable “Index of Students’ Perception of Being Safe in School” entered first in Lebanon and three other countries. This last variable was defined by TIMSS 2003 as “to have a feeling of being safe in school (not subject to stealing, bullying, intimidation, ridicule, or neglect by other students)”. The “Availability of Computer” entered third in only two countries.

Table 2. Order of Entry of Student-level Variables in the Regression Equation by Country

<table>
<thead>
<tr>
<th>Variable</th>
<th>Countries in which the variable entered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index of Self-Confidence in Learning Science</td>
<td>-Jordan, -Palestine, -Saudi Arabia, -Morocco</td>
</tr>
<tr>
<td>Parents Highest Education Level</td>
<td>-Egypt, -Saudi Arabia, -Tunisia, -Morocco</td>
</tr>
<tr>
<td>Students’ Educational Aspirations Relative to Parents Educational Level</td>
<td>-Bahrain, -Jordan, -Saudi Arabia, -Palestine</td>
</tr>
<tr>
<td>Index of Students’ Perception of Being Safe in School</td>
<td>-Lebanon, -Palestine, -Egypt, -Bahrain</td>
</tr>
<tr>
<td>Availability of Computer</td>
<td>-Morocco</td>
</tr>
</tbody>
</table>

Figure 3. Proportion of total variance in science achievement accounted for by student-level variables by country.
Figure 4 shows that in the seven countries in which one or more teacher-level variable entered the regression equation (no variable entered for Palestine), three such variables seem to compete for the first place in the order of entry of the variables: “Index of Science Teachers’ Perception of School Climate” (in Bahrain and Jordan), “Index of Science Teachers’ Perception of Safety in the Schools” (in Lebanon, Morocco, and Tunisia), and “Index of Teachers’ Reports on Teaching Science Classes with Few or No Limitations on Instruction due to Student Factors” (in Egypt and Saudi Arabia). In TIMSS 2003, the “Index of Science Teachers’ Perception of School Climate” variable is defined as the extent to which the teacher perceives favorably “the school climate (teachers’ job satisfaction, teachers’ understanding of the school’s curricular goals, teachers’ degree of success in implementing the school’s curriculum, teachers’ expectations for student achievement, parental support for student achievement, parental involvement in school activities, students’ regard for school property, students’ desire to do well in school)”. The more favorable the perception of the science teacher of the school climate, the higher the science achievement is. The “Index of Science Teachers’ Perception of Safety” in the Schools is defined as the extent to which the teacher perceives that
the school is located in a safe neighborhood, feeling that the teacher is safe at school, and perception of the sufficiency of school security policies and practices. The more favorable the perception of the science teacher of school safety, the higher the science achievement is. The “Index of Teachers’ Reports on Teaching Science Classes with Few or No Limitations on Instruction due to Student Factors” is defined as the extent to which the science teacher reported that no or few limitations were due to student factors. The fewer the limitations due to student factors reported by the teacher, the higher the student achievement in science. The other variables that entered the regression equation are “Class Size for Science Instruction” (Bahrain and Lebanon) and “Mathematics Teacher Has Full License or Certification” (Egypt).

COMPARISONS OF VARIANCE IN SCIENCE ACHIEVEMENT ACCOUNTED FOR BY INDIVIDUAL SCHOOL-LEVEL VARIABLES

Figure 5 shows the proportion of variance in science achievement accounted for by each of the school-level variables in each of the eight Arab countries. In the six countries in which one or more school-level variable entered the regression equation, the variable “Index of Principals’ Perception of School Climate” entered first in the regression equation in all countries except Morocco. The variable “Index of Principals’ Perception of School Climate” is defined by TIMSS 2003 as the extent to which the school principal has a favorable perception of the school climate which includes “the school teachers’ job satisfaction, teachers’ understanding of the school’s curricular goals, teachers’ degree of success in implementing the school’s curriculum, teachers’ expectations for student achievement, parental support for student achievement, parental involvement in school activities, students’ regard for school property, students’ desire to do well in school”. The more favorable the principal’s perception of school climate the higher is the science achievement of the students in the school.

Only in Jordan and Bahrain, a second variable entered the regression equation and in both of them, this variable was “Trends in Index of Availability of School Resources for Science Instruction”. This variable is defined as the extent to which the principal of the school perceives “science resources for instruction are more available”. Science resources include the following categories: instructional materials (e.g., textbook), budget for supplies (e.g., paper, pencils), school buildings and grounds, heating/cooling and lighting systems, instructional space (e.g., classrooms), computers for science instruction, computer software for science instruction, calculators for science instruction, library materials relevant to science instruction and audio-visual resources for science instruction. The more available the resources for science instruction are, the higher the science achievement of the students in the school. The variable “Trends in Index of Good School and Class Attendance” entered third only in Jordan.
CONCLUDING ASSERTIONS AND NOTES

Based on the results, we present a series of assertions that we feel are warranted by the data. The first assertion is that the Arab countries vary in equity in provisions for science education as reflected in the variation of the proportion of between-school variance to total variance. Lebanon and Egypt have the highest proportions (lower equity), while the other remaining five countries have lower proportions (higher equity).

Second, the combined overall impact of student-, teacher-, and school-variables on science achievement varies among the Arab countries, the highest impact being in Lebanon and Egypt and the lowest in Morocco. The impact of the student aptitude and background on science achievement was higher than the impact of the teacher variables in all eight Arab countries except Bahrain. However, there was no consistency regarding the comparison of the impact of teacher and school variables on mathematics achievement.

Third, the student-level variables that impact mathematics and science achievement are listed below in descending order of their contribution to the prediction of science achievement:
- Index of self-confidence in learning science.
- Parents’ highest education level.
Students’ educational aspirations relative to parents’ educational level.

Index of students’ perception of being safe in school.

Some of the above variables are amenable to change by policy, some by practice, and some are neither. The variable “Index of Self-Confidence in Learning Science” is an affective student-level variable. According to the definition presented in TIMSS 2003, it involves self-perception by the student regarding doing well in science, ease of the subject, strength in the subject, and pace of learning the subject. Obviously, this index is not amenable to change through policy but rather through practice by considering changes in classroom teaching and learning practices such as sensitizing science teachers to adopt practices that have the potential to enhance self-confidence in learning science. Teaching skills that target enhancement of self-confidence in learning science ought to become a component of teacher education programs as well as professional development in-service programs and activities. The two variables “Parents Highest Education Level” and “Students’ Educational Aspirations Relative to Parents Educational Level” are not amenable to change through policy or practice. These two variables are linked to macro-level long-term complex social and economic changes. Since these two variables are closely related to the variable “Index of Self-Confidence in Learning Science”, one could speculate that a positive change in the latter, which is somewhat under the possible control of the school, may minimize the negative effect of low parental educational level.

Though the variable “Index of Students’ Perception of Being Safe in School” is a student-level variable, it is closely related to the school environment and hence is amenable to change by changing policy as well as practice. This variable relates to self-perception by students regarding stealing, bullying, intimidation, ridicule, or neglect by other students in school. It seems that these activities, particularly bullying and intimidation, are relatively prevalent in school in the eight Arab countries and affect negatively the academic achievement in both mathematics and science. Increasing students’ perception of safety in school by controlling and reducing bullying and intimidation ought to be targeted by ministries of education policies as well as by school discipline practices.

Fourth, though there are some discrepancies in the impact of teacher-level variables on science achievement among the eight Arab countries, there is a general trend that the teacher-level variables which impact science achievement are:

Index of science teachers’ perception of school climate.

Index of science teachers’ perception of safety in the schools.

Index of teachers’ reports on teaching science classes with few or no limitations on instruction due to student factors.

All three variables are policy-amenable. In TIMSS 2003, the “Index of Science Teachers’ Perception of School Climate” variable is defined as the extent to which the teacher perceives favorably the school climate (see definition above). The more favorable the perception of the science teacher of the school climate, the higher is the science achievement. The “Index of Science Teachers’ Perception of Safety in the Schools” is defined as the extent to which the teacher perceives that the school is located in a safe neighborhood, feels safe at school, and perceives the school security policies and practices to be sufficient. The more favorable the perception
of the science teacher of school safety, the higher is the science achievement. The “Index of Teachers’ Reports on Teaching Science Classes with Few or No Limitations on Instruction due to Student Factors” is defined as the extent to which the science teacher perceives that there are no or few limitations on instruction due to student factors (students with different academic abilities, students who come from a wide range of backgrounds, students with special needs, uninterested students, low morale among students, disruptive students). The fewer the limitations due to student factors reported by the teacher, the higher the student achievement in science.

In the seven countries in which one or more school-level variables entered the regression equation for predicting science achievement, the variable “Index of Principals’ Perception of School Climate” entered first in the regression equation in these countries except Bahrain and Morocco and it entered second in Bahrain. The variable “Trends in Index of Availability of School Resources for Science Instruction” entered first in Morocco and Bahrain.

In sum, there seems to be more commonalities than difference among the Arab countries that participated in TIMSS 2003 in terms of factors that impact science education. At the student level, an affective science-related factor, confidence in learning science, comes first followed by a socio-economic factor, namely parental education or the students’ aspiration relative to parents education. At the teacher and the school levels, school climate plays a major role. It is fortunate that these variables (with the exception of parental education) and all variables that seem to contribute to science achievement are amenable to modification by planned changes in policies and/or practices.

NOTES

1 This paper was supported by a grant from the UNESCO Regional Office for Education in the Arab States, Beirut, Lebanon.
2 Refer to http://www.pisa.oecd.org/dataoecd/15/20/34668095.pdf for definition of contextual variables and their effect on achievement.
3 The questionnaires are available at http://timssandpirls.bc.edu/timss2003i/context.html.
4 In statistics, imputation is the substitution of some value for a missing data point or a missing component of a data point.

REFERENCES


