Educational Issues in the Middle East North Africa Region

Outcomes of the IEA Arab Region Training Seminar Series 2006/2007

Edited by Petra Lietz, Hans Wagemaker, Oliver Neuschmidt, and Juliane Hencke

The International Association
for the Evaluation of
Educational Achievement

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Table of Contents

CHAPTER 1

Introduction

Hans Wagemaker, Petra Lietz, Oliver Neuschmidt, and Eugenio Gonzalez

1.1 BACKGROUND AND AIMS OF THE REPORT *(Hans Wagemaker)*

Among the goals of the International Association for the Evaluation of Educational Achievement (IEA)[1] is a commitment to contribute to the development of a worldwide community of researchers in educational evaluation and assessment. In part, the responsibility to achieve this goal is discharged through the regular training that is provided during the course of preparation and participation in IEA studies. However, in some instances, training needs are identified that go beyond the training provided as part of the ongoing project activities. These needs range from the compilation of national or regional reports and the production of bivariate statistics to the analysis of multivariate and multilevel models aimed at examining relationships between various variables thought to be linked to student achievement. Furthermore, the need for researchers in participating countries continues to move beyond the role of providing basic quality data on educational outcomes to that of providing policy advice based on in-depth analyses of educational outcomes and their antecedents, mediators, and moderators.

These developments are raising new challenges relative to IEA's commitment to fostering research capability. To further and more fully reflect its interest in this area, IEA is continuing to develop and offer training seminars for researchers interested in furthering the analytical skills required to analyze the extensive and complex datasets that are a product of IEA studies. In 2005, IEA, with support from the World Bank (through a Global Program and Partnership, or GPP, initiative), initiated a training seminar series that targeted the low- to middle-income countries of the Middle East/North Africa region (MENA) that had already participated in the Trends in Mathematics and Science (TIMSS) assessments in 1999 and/or 2003 or that were intending to take part in 2007. The Global Program for the Assessment of Student Achievement (PASA) was developed in response to a perceived global demand for the assessment of educational outcomes, which is a central goal of Education for All (EFA), initiated in 1990 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). Moreover, a perceived regional need existed to develop the skills and capabilities of researchers and institutions as they sought to respond to the changing needs of educational policymakers and new expectations in terms of public accountability (United Nations Development Programme, 2003).

Global Program for the Assessment of Student Achievement-MENA Training

Under the terms of the Development Grant Facility, IEA received funding for a period of three years to support not only the participation of up to 20 countries in the TIMSS and Progress in Reading Literacy Studies (PIRLS), but also the provision of training activities specifically focused on the Arabic countries of the MENA region. The funding from the World Bank was augmented by IEA's own resources and some additional support from the United Nations Development Program (UNDP).[2] Through its Data Processing and Research Center (DPC) in Hamburg, Germany, IEA used the funding to develop a training seminar series designed to enhance the statistical and analytical skills of the researchers of the

1 IEA is an independent international cooperative of national research institutions and government agencies, with its main secretariat located in Amsterdam, the Netherlands.

2 The UNDP supported the participation of several countries (Algeria, Egypt, Syria, Lebanon, Palestine, Yemen) in the TIMSS 2007 assessment and provided additional support to these countries for the training seminars.

national research teams that would participate in the TIMSS 2007 assessment. It was hoped that a context in which participants shared a common language as well as several other elements of cultural background would provide an environment that could maximize opportunities for collaboration and cooperation on a regional basis. In response to the invitation to participate in the seminar series, national centers responsible for the conduct of the TIMSS 2007 assessment in Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, the Palestinian National Authority, Qatar,[3] Saudi Arabia, Syria, Tunisia, and Yemen each sent two or more representatives.

The objective of the seminar series, which is described more fully in this report, was to provide the participants with the training and skills necessary to permit them to conduct secondary analysis of their national datasets. In preparation for these seminars, participants were encouraged to identify a policy issue that they considered to be particularly salient for their policymakers and which it was felt the TIMSS 2003 data could be used to provide some policy insights. The training was also designed as a means of preparing the analysts for the work they would have to do when preparing national reports based on the TIMSS 2007 assessment. Because several countries had not participated in the previous assessment, they were encouraged to work with the datasets of other countries in the region and to examine issues that might be of common interest or that might inform the analysis they would conduct for their TIMSS 2007 national reports.

This report offered the participants not only a platform from which they could report on the analyses they conducted, but also a means of discussing their analyses in a way that would contribute to local policy analysis debates. However, we acknowledge that analyses which go beyond the reported bivariate analyses will be required in order to do the complexities of teaching and learning mathematics and science justice.

1.2 THE TRAINING SEMINAR SERIES *(Petra Lietz)*

The seminar series consisted of three workshops, each of four to five days' duration. The first took place in Amman, Jordan, in February 2006, the second in Muscat, Oman, in August 2006, and the third in Tunis, Tunisia, in February 2007. Thus, the seminars were held in one location from each of the three major areas of the Arab region, namely the Middle East Arabic countries, the Gulf Arabic countries, and the Maghreb countries. The host countries generously supported the seminar series by providing the infrastructure, organizing accommodation and conference support, and funding the social program for the seminars, including an opening ceremony, a group dinner, and an excursion.

In terms of content, the first seminar provided an opportunity for participants to familiarize themselves with the TIMSS international database and some aspects of the study design, such as the sampling design and plausible values, and their implications for analyses. In addition, the DPC seminar team presented examples of how to calculate means, percentages, and standard errors of science or mathematics achievement at the student level relative to different subgroups, such as gender or school authorities. Other presentations focused on how to undertake calculations at the teacher and school levels using the IEA IDB Analyzer© (see Chapter 1.4) and how to generate graphical displays of results using international Excel templates. Each presentation was followed by extensive opportunity for participants to gain hands-on practice with TIMSS data.

The second seminar started with presentations highlighting the progress participants had made in conducting analyses since the first seminar and a plenary discussion of the results. This was followed by a presentation from the DPC seminar team on the interplay between educational research and policy as well as on the aims and objectives of writing reports for policymakers. The main focus of this second seminar, however, was on continuing the analyses being conducted by the individual countries, with support from the DPC seminar team where desired.

3 Qatar participated only in the first training seminar.

In line with a request from participants at the end of the second seminar, one input during the third seminar consisted of a presentation of how to compute multiple-item indicators when using TIMSS data. The other input was provided in the form of an example chapter that participants could use as a template for their contribution to this report. In this way, a framework was given that detailed the structure, content, and editorial conventions for writing policy-relevant research. The seminar concluded in the same fashion as the preceding ones, with an evaluation of the seminar followed by a plenary session in which the current status of the analyses, required next steps, and participants' suggestions for possible further training were summarized.

1.3 THE IEA TIMSS TESTING PROGRAM *(Oliver Neuschmidt)*

TIMSS 2003 is the third cycle of assessment in the framework of the Trends in International Mathematics and Science Study (TIMSS), conducted by IEA. As occurred with previous cycles of the study in 1995 and 1999, the international study coordination for TIMSS 2003 was a collective enterprise consisting of several organizations. In addition to the IEA headquarters based in Amsterdam, these were the TIMSS and PIRLS International Study Center at Boston College in the United States, the IEA Data Processing and Research Center in Hamburg, Germany, Statistics Canada in Ottawa, and the Educational Testing Service in Princeton, New Jersey. The member organizations in this partnership reflect the variety of expertise that is required when conducting studies in education that aim to provide genuinely comparable and valid data of high quality across a large number of countries.

In each participating country, a national research coordinator (NRC), together with a research team, was responsible for implementing the TIMSS study in his or her country. The NRCs conducted this work in accordance with the TIMSS guidelines and procedures that govern, among other things, matters of sampling, translation, fieldwork, and data entry and cleaning.

In total, 49 countries participated in TIMSS 2003. Among them were the following 10 Arabic countries: Bahrain, Egypt, Jordan, Lebanon, Morocco, Palestinian National Authority, Saudi Arabia, Syrian Arab Republic, Tunisia, and Yemen. In 2003, nine of the 10 countries conducted the study at the Population 2 level, which translated into Grade 8, while Yemen conducted testing at the Population 1 level, which translated into Grade 4. As Syria and Yemen did not meet the criteria of the TIMSS sampling design, data from these countries were not included in the analyses conducted for this report.

As was the case in the first two testing cycles, two sets of instruments were used in TIMSS 2003. These were the achievement tests, aimed at collecting student performance data in mathematics and science, and the background questionnaires, aimed at collecting information on the context in which education occurs from students, teachers, and schools.

The achievement tests included constructed response as well as multiple-choice items that had been prepared by an international item development taskforce, with input from NRCs. To ensure a broad coverage of test items without overburdening single students, a rotated booklet design was used, which meant that each participating student received one of the 12 different test booklets available. In the test design, every effort was made to ensure that the tests reflected the curricula of the participating countries and that no bias was introduced due to non-coverage of specific content areas in a particular country. In addition, countries had the opportunity to identify items that were not covered in their respective national curriculums.

The development of the background questionnaires was also an international effort that allowed countries to have input on questions and response options. Questions were designed around the framework put forward originally by Keeves (1974). This framework specified the intended curriculum as mandated at the system level, the implemented curriculum as taught by teachers in classrooms, and the attained curriculum in terms of the curriculum as learnt by students. Thus, data collected from the achievement tests and background questionnaires were aimed at providing policymakers, curriculum specialists, and educators with evidence on which to base decisions regarding educational policies and teaching practices around the world. To maintain the currency of the available information, the data collection of the next cycle of TIMSS—the 2007 assessment—has been completed, the TIMSS 2007 international reports have been published, and the international database (IDB) will be released at the beginning of 2009.

1.4 THE IEA IDB ANALYZER©
(Eugenio Gonzalez)

The International Database Analyzer—or IEA IDB Analyzer©—is a plug-in for the Statistical Package for the Social Sciences (SPSS) developed by the IEA Data Processing and Research Center and used to generate SPSS syntax that is required to combine files and analyze data from large-scale assessments. An analysis performed with the SPSS code generated by the IEA IDB Analyzer© takes into account information from the sampling design when computing the sampling variance. In addition, the SPSS code can handle multiple plausible values and calculate the variance of estimates due to imputation. The IEA IDB Analyzer© enables users to conduct statistical hypothesis testing between groups in the population without having to write programming syntax.

The IEA IDB Analyzer© consists of two modules. The first module is used to pre-process the international datasets released at the end of an IEA testing cycle. Specifically, it is used to generate SPSS code for merging school-, teacher-, and student-level files while simultaneously allowing the user to choose a subset or all of the variables in the selected files. While IEA studies collect data from different levels, such as schools, teachers, and students, the results of any analyses should nonetheless be reported in reference to the student level, as it is only this form of reporting that appropriately reflects the study's design (see Martin, Mullis, & Chrostowski, 2004). The IEA IDB Analyzer© generates a syntax file that ultimately creates a student-level file with the teacher and/or school data merged into it.

Data from IEA studies are generally distributed separately by country. The first module of the IEA IDB Analyzer© also facilitates the combining of data from different countries into one dataset that can subsequently be used for analyses either with the IEA IDB Analyzer© itself or with other software packages chosen by the user. Joining files from different countries permits the conduct of cross-country analyses.

The second module of the IEA IDB Analyzer© is used to analyze the data, whether or not these have been pre-processed with the first module. The second module contains a number of procedures for analysis. One of them, called "PV means," generates SPSS code for the computation of estimates of means and percentages of any variable of interest overall for a country, and for specific subgroups within a population. These point estimates are always calculated with their corresponding standard errors. Another procedure, called "achievement regression," allows significance testing of the effect of student-, teacher-, and/or school-level background variables on student achievement. All procedures, regardless of whether they focus on means, percentages, or regression coefficients, are computed by making use of appropriate sampling weights. Standard errors are computed using the jackknife repeated replicate method (JRR) as described in the TIMSS technical report (Martin et al., 2004).

In short, the advantage of using the IEA IDB Analyzer© is that it takes into account the complex sampling design of the TIMSS study, resulting in correct estimates of standard errors. In contrast, algorithms implemented in SPSS and many other frequently used statistics programs assume a simple random sample, an approach that leads to misleading results which, in turn, may lead to inappropriate conclusions.

Upon installation, the IEA IDB Analyzer© creates new menu options in SPSS. Its point-and-click user interface allows users to select countries, files, and variables for a specific analysis. The IEA IDB Analyzer© is available free of charge at http://www.iea.nl/iea_studies_datasets.html. Further details about the calculations performed by the IEA IDB Analyzer© can be found in the user guide for the TIMSS 2003 assessment (Martin, 2004).

1.5 THE STRUCTURE OF THE REPORT *(Petra Lietz)*

The current report consists of 11 chapters. This first chapter provides an introduction to the Arab region training seminar series and a brief overview of the IEA TIMSS testing program and tools. Chapter 2 presents country profiles for those Arabic countries for which data were used in the analyses. These profiles provide background information to aid the interpretation of results reported in the subsequent chapters. Chapters 3 to 10 report the actual analyses of the IEA TIMSS data undertaken by different countries from the Arab region. It should be noted that the list of countries described in the country profiles does not coincide with the names of the countries that reported analyses. The reason for this is that some countries for which data were available did not report any analyses while some countries for which no data were available used other countries' data for undertaking and writing up analyses. The final chapter (Chapter 11) consists of a summary of the findings, a reflection on the training seminar series, and an outlook in terms of needs for future training aimed at the further development of analyses and research skills.

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CHAPTER 2

Country profiles

Juliane Hencke and Marta Kostek (Eds.)[1]

This chapter consists of two parts. The first part, "General Information," provides selected summary statistics in figures and tables for the eight Arabic countries whose data are analyzed in the subsequent chapters. These summary statistics include GNP per capita, public expenditure on education, participation rates in education, and enrolment in private education. The second part of the chapter describes each country's education system.

The information presented in the first part is based on survey results reported to and processed by the UNESCO Institute for Statistics (UIS) and published in the *EFA Global Monitoring Report 2006* (UNESCO, 2005). Most of the data in the tables refers to school year 2002/2003, which coincided with the assessment year of TIMSS 2003, from which much of the data in the analyses reported in Chapter 3 originates.

The country-specific profiles in the second part were compiled by the countries themselves and, in some instances, complemented by information available from other sources. Thus, while the main elements in the country profiles—such as information on the organization of the education system, teacher training, and examinations and assessment—coincide, some additional information, for example, emphasis on mathematics and science, is provided only for some countries.

Together, the contextual information from these two parts serves as the background for the results reported in the following chapters.

2.1 GENERAL INFORMATION

Figure 2.1 provides a map of the eight education systems that provided the data analyzed in this publication. All countries form part of the Middle East and North Africa (MENA) region which, on the one hand, shares a number of cultural elements, such as the Arabic language and the Islamic religion. On the other hand, these countries comprise an economically diverse region that includes the oil-rich economies in the Gulf as well as countries around the Mediterranean Sea that have few natural resources.

The indicators of the financing of education in Table 2.1 reflect this economic diversity. The Gulf countries, Bahrain and Saudi Arabia, have three to four times the GNP per capita of Egypt, Jordan, and Lebanon. One of the two Maghreb countries, Morocco, is similar in terms of this indicator. Tunisia, the second Maghreb country, occupies a middle position among the eight countries in terms of GNP per capita.

Tables 2.2 and 2.3 provide information on participation in primary and secondary education in the eight countries. Whereas the starting age of compulsory education is six years in all countries, the end of compulsory education ranges from 11 years in Saudi Arabia to 16 years in Jordan and Tunisia. Lebanon, Morocco, and Tunisia have gross enrolment ratios greater than 100%, which points to the fact that students either younger or older than the primary school age are enrolled at this level. All countries have a net enrolment ratio in primary education of around 90%, with the exception of Saudi Arabia, where only 54% of students of primary school age are enrolled in primary education. The gender parity indices are around one for all countries, illustrating that female and male students of primary-school age have the same access to education.

1 We acknowledge the contributions to the country sections of this chapter from the following authors: Huda Al Awadhi (Bahrain); Mohammed Saad El Orabi (Egypt); Khattab Abulibdeh and Manal Abdelsamad (Jordan); Said Bouderga (Morocco); Mohammed Matar Mustafa and Khaled Bisharat (Palestinian National Authority); Abdulkhalig Salah Khalaf and Fahad Al-Muhaiza (Saudi Arabia); and Imène Ghedamsi, Samira Helanoui, Leila Kamoun, and Hikma Smida (Tunisia).

Participation in secondary education (Table 2.3) is relatively high, with a net enrolment rate of between 80 and 90% in Bahrain, Egypt, Jordan, and the Palestinian National Authority. While about two thirds of students of secondary school age are enrolled in secondary education in Tunisia and half in Saudi Arabia, this proportion drops to slightly over one third in Morocco. The gender parity index shows that a slightly higher percentage of girls than boys participate in secondary schooling in Bahrain, Jordan, the Palestinian National Authority, and Tunisia, but that a higher percentage of male students are enrolled in Egypt, Morocco, and Saudi Arabia.

Finally, Table 2.4 gives the percentage of students attending private primary and secondary schools. Across nearly all of the eight countries, the provision of private education is higher at the primary than at the secondary school level. However, the countries differ remarkably with respect to the extent of private education provided—from a low 0.9% at the primary school level in Tunisia to a high 64% at the same level of schooling in Lebanon. Lebanon also has a very high proportion of students enrolled in private schools at the secondary school level, which indicates that more than half of all students in this country between the ages 6 and 14 years are educated in private rather than government schools.

In summary, the information provided here suggests that while there are cultural commonalities among the eight countries for which data are analyzed in this report, especially with regard to language and religion, considerable differences exist between them in regard to GNP per capita, enrolment of students at the secondary school level, and the proportion of students enrolled in private rather than government education. These issues should be kept in mind when considering the results of the analyses of data from these eight countries.

Figure 2.1: The Arabic Countries that Provided the Data Used in the Analyses

Table 2.1: Financing of Education (2002)

Country or territory	GNP[1] per capita	Total public expenditure on education	Public current expenditure on primary education		Total public expenditure on primary education	Public current expenditure on primary education		
	PPP $US	*As % of GNP*	*As % of GNP*	*Per student as % of GNP*	*As % of total government expenditure*	*Per student (unit cost) in constant 2002 $US*	*Per student (unit cost) at PPP in constant 2002 $US*	*As % of public current expenditure on education*
Bahrain	16,190	…	2.1**	18.0**	…	1,731**	2,701**	…
Egypt	3,810	…	…	…	…	…	…	…
Jordan	4,180	…	2.0	13.5	…	239	561	…
Lebanon	4,600	2.7	…	…	12.3	…	…	…
Morocco	3,730	6.6	2.5	18.4	26.4	217	679	41.1
Palestinian National Authority	…	…	…	…	…	…	…	…
Saudi Arabia	12,660	…	…	…	…	…	…	…
Tunisia	6,440	6.7	2.2**	16.5**	18.2(z)	346**	1,088**	36.7**

Notes:

1 United Nations Population Division Statistics, 2002 revision, medium variant

PPP = Purchasing power parity

GNP = Gross national product

… = Missing data

** = UIS estimate

(z) Data are for 2001/2002

Source: UNESCO Institute for Statistics: *EFA Global Monitoring Report 2006*, statistical annex (column 1, p. 273; columns 2–4, p. 377; column 5–end, p. 376f)

Table 2.2: Participation in Primary Education (2002/2003)

Country or territory	Compulsory education	Primary education		Enrolment in primary education		Gross enrolment ratio (GER) in primary education (%)				Net enrolment ratio (NER) in primary education (%)			
	School age (000)	*School age (000)*	*School -age population (000)*	*Total (000)*	*Female (%)*	*Total*	*Male*	*Female*	*GPI (F/M)*	*Total*	*Male*	*Female*	*GPI (F/M)*
Bahrain	6–14[1]	6–11	84	82	49	97.1	97.2	97.0	1.00	89.9	89.2	90.6	1.02
Egypt	6–13	6–10	8,085	7,874**	48**	97.4**	100.0**	94.7**	0.95**	91.4**	93.1**	89.7**	0.96**
Jordan	6–16	6–11	794	786	49	99.1	98.7	99.5	1.01	92.0	91.3	92.7	1.02
Lebanon	6–12	6–11	435	449	48	103.4	105.0	101.7	0.97	90.6	90.8	90.4	0.99
Morocco	6–14	6–11	3,742	4,101	46	109.6	115.3	103.7	0.90	89.6	92.4	86.8	0.94
Palestinian National Authority	6–15	6–9	406	401	49	98.8	98.6	99.0	1.00	90.9	90.8	90.9	1.00
Saudi Arabia	6–11	6–11	3,514	2,342	48	66.6	67.8	65.4	0.96	54.4	54.7	54.2	0.99
Tunisia	6–16	6–11	1,154	1,277	48	110.7	112.6	108.6	0.96	97.3	97.3	97.3	1.00

Notes:

1 Source: Mullis, I. V. S., Martin, M. O., Olson, J. F., Berger, D. R., Milne, D., & Stancs, G. M. (Eds.). (2008). *TIMSS 2007 encyclopedia: A guide to mathematics and science education around the world* (Vol. 2). Chestnut Hill: TIMMS & PIRLS International Study Center, Boston College

GPI = Gender parity index

GER = Total enrolment in primary education as a proportion of the population of primary school-age according to national regulations. Values >100 are an indication of over- or under-age enrolment or grade repetition

NER = Proportion of the population of the official age for primary education according to national regulations who are enrolled in primary schools

** = UIS estimate

Source: UNESCO Institute for Statistics: *EFA Global Monitoring Report 2006*, statistical annex (column 1, p. 304; column 2–end, p. 312f)

Table 2.3: Participation in Secondary Education (2002/2003)

Country or territory	Secondary,[1] post-secondary, and non-tertiary[2] education		Enrolment in secondary education		Gross enrolment ratio (GER) in secondary education (%)				Net enrolment ratio (NER) in secondary education (%)			
	Age group	*School-age population (000)*	*Total (000)*	*Female (%) population*	*Total*	*Male*	*Female*	*GPI (F/M)*	*Total*	*Male*	*Female*	*GPI (F/M)*
Bahrain	12–17	70	67	50	95.5	92.7	98.8	1.07	87.0	83.9	90.3	1.08
Egypt	11–16	9,828	8,384**	47**	85.3**	88.1**	82.4**	0.94**	80.8**(z)	83.1**(z)	78.5**(z)	0.95**(z)
Jordan	12–17	4,713	613	49	86.0	85.1	86.9	1.02	79.9	78.9	81.1	1.03
Lebanon	12–14	441	350	51	79.4	76.1	82.8	1.09	…	…	…	…
Morocco	12–17	3,904	1,758	45	45.0	49.1	40.8	0.83	35.7**	38.5**	32.9**	0.86**
Palestinian National Authority	10–17	663	583	50	87.9	85.4	90.5	1.06	83.8	81.7	86.0	1.05
Saudi Arabia	12–17	2,981	1,995	46	66.9	70.3	63.4	0.90	52.7**	53.9**	51.6**	0.96**
Tunisia	12–18	1,481	1,149	51	77.6	74.6	80.7	1.08	64.5	61.3	67.8	1.11

Notes:

1 Refers to lower and upper secondary education (ISCED Levels 2 and 3)

2 Corresponds to ISCED level-like secondary education; it includes general as well as technical and vocational programs

GPI = Gender parity index

GER = Total enrolment in secondary education as a proportion of the population of secondary school-age according to national regulations

NER = Proportion of the population of the official age for secondary education according to national regulations who are enrolled in secondary schools

… = Missing data

** = UIS estimate

(z): Data are for 2001/2002

Source: UNESCO Institute for Statistics: *EFA Global Monitoring Report 2006,* statistical annex (p. 336f)

Table 2.4: Private Enrolment in Primary and Secondary Education (2002/2003)

Country or territory	Private enrolment as % of total enrolment	
	Primary education	*Secondary education*
Bahrain	22	15
Egypt	8**(y)	–
Jordan	29	16
Lebanon	64	51
Morocco	5	5
Palestinian National Authority	8	4
Saudi Arabia	7	8
Tunisia	0.9	4

Notes:
– = Missing data
** = UIS estimate
(y) Data are for 2000/2001
Source: UNESCO Institute for Statistics: *EFA Global Monitoring Report 2006*, statistical annex (p. 376)

In addition to the sources given in the tables, information for this section of the chapter was drawn from the following sources:

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2.2 COUNTRY PROFILE: BAHRAIN

Location:
Middle East, archipelago in the Persian Gulf, east of Saudi Arabia

Geographic coordinates:
26 00 N, 50 33 E

Area:

Land (in sq km):	665
Water (in sq km):	0

Population:
1,046,814

Major population
Bahraini 529,446, non-Bahraini 517,368.

Age structure:	(Jul 2007 est.)
0–14 years:	26.9%
15–64 years:	69.5%
65 years and over:	3.7%

Language(s):
Arabic, English, Farsi, Urdu

Language(s) of instruction:
Arabic, English

Sources:

- International Association of Universities. *World higher education database (WHED)*: Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
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Overview of the Bahraini education system

Educational provision in Bahrain includes a public and a private system. Because the provision within each is slightly different, the two systems are explained in turn below.

The public education system

Preschool or nursery education is not compulsory in Bahrain, which means parents can choose whether or not to enroll their children in a nursery school. A family's decision to place their child in nursery education generally depends on the family's education and socioeconomic background.

Children are required to enter *primary school* at six years of age and to attend it for six years. Children study all subjects within the primary school curriculum from their first year, and although some public schools are beginning to teach the English language from the first year, it is normally taught only from Grade 4 onwards. Students attend *intermediate school* from ages 12 to 15, and during this time are taught all standard subjects.

Secondary school, which is three years in duration, offers students a choice of three main tracks or streams: general, commercial, and technical. Each track focuses on subjects that relate to the specialization. The technical branch covers a core of general academic subjects and a number of workshop hours. The subjects include technology and practical work, mathematics, science, and technical drawing. The commercial branch also covers a core of academic subjects as well as specializations that include accountancy, pure and financial mathematics, economics, practical secretarial skills, and typewriting. Some subjects in the technical and commercial branches are taught in English. Students enrolling in the general track may additionally choose to specialize in science-based or literary-based subjects. Each of the three tracks leads to the *Tawjihi*, which is equivalent to the British GCSE.

Figure 2.2 presents, in summary form, the structure of the public education system from primary through to secondary level. Table 2.5 details the subjects taught from Grades 1 to 6 and the approximate number of sessions allocated to each subject per week during the school year.

Figure 2.2: Structure of the Bahraini Education System

Grade	Age						
12	17	Secondary Education	**General** Sciences Literary	**Commercial**	**Technical**	**Applied** Technical Advertisement	Religious Education Primary, Intermediate, Secondary
11	16						
10	15						
9	14	Third Cycle (Intermediate)					
8	13						
7	12						
6	11	Second Cycle (Primary)	**Basic Education**				
5	10						
4	9						
3	8	First Cycle (Primary)					
2	7						
1	6						

Table 2.5: Instructional Weekly Periods per Subject Taught at Grades 1 to 6

Subjects	Grades					
	1	**2**	**3**	**4**	**5**	**6**
Islamic Education (Religious Education)	3	3	3	2	2	2
Arabic Language	9	9	8	7	7	7
English Language	0	0	0	5	5	5
Mathematics	5	5	5	5	5	5
Science and Technology	2	2	2	3	3	3
Social Studies	1	1	2	2	2	2
Family Life Education	0	0	0	1	1	1
Art Education	2	2	2	2	2	2
Physical Education	2	2	2	2	2	2
Songs and Music	1	1	1	1	1	1
Total	**25**	**25**	**25**	**30**	**30**	**30**

The private education system

It is important to note that the majority of students in Bahrain's private education sector are Bahraini nationals. Within this sector, students must attend nursery school in order to gain entry to a private junior school. During the nursery stage, children learn English and, before gaining acceptance at a junior school, are required to take simple written and oral English tests and a mathematics test.

The majority of Bahraini private schools are recognized internationally, especially by institutions in the United Kingdom, the United States of America, and India, and also Italy and France. All subjects are taught in English, and the qualifications obtained are those of the English or American education systems, namely the General Certificates of Secondary Education (GCSEs), the SAT Reasoning Test, the International Baccalaureate (IB), and the A level English system.

Teachers and teacher education

Pre-primary and primary/basic school teachers must have a Bachelor's degree in education. The classroom teacher of the primary school teaches most of the subjects offered, except English language, design and technology, music education, and physical education. Teachers teaching from Grade 4 onwards are required to have a Bachelor's degree in a specific discipline, for example, Arabic, social studies, biology or mathematics, along with the postgraduate diploma in education. Each subject is taught by a teacher who has specialized in the specific discipline.

2.3 COUNTRY PROFILE: EGYPT

Location:
Northern Africa, bordering the Mediterranean Sea, between Libya and the Gaza Strip, and the Red Sea north of Sudan; includes the Asian Sinai Peninsula

Geographic coordinates:
27 00 N, 30 00 E

Area:

Land (in sq km):	995,450
Water (in sq km):	6,000

Population:
80,335,036 (Jul 2007 est.)

Major population subgroups:
Egyptian 98%, Berber, Nubian, Bedouin, and Beja 1%, Greek, Armenian, other European (primarily Italian and French) 1%; Muslim (mostly Sunni) 90%, Coptic 9%, other Christian 1%

Age structure:

0–14 years:	32.3%
15–64 years:	63.2%
65 years and over (Jul 2007 est.):	4.6%

Language(s):
Arabic (official); English and French widely understood by educated classes

Language(s) of Instruction:
Arabic, English, French

Sources:

- International Association of Universities. *World higher education database (WHED)*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
- *The world factbook*. Available online at https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html. Accessed July 18, 2007.
- *UNESCO*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/eg.rtf. Accessed July 18, 2007.

Overview of the Egyptian education system

The Egyptian education system consists of four stages (see Table 2.6):

- *Stage 1:* Kindergarten starts before formal education and comprises two years designated K–G1 and K–G2. These years are not compulsory.
- *Stage 2:* Basic education consists of primary schools, which students attend for six years, and preparatory schools, which comprise three years.
- *Stage 3:* Secondary education is provided by two types of school—general secondary schools (three years) and technical secondary schools (three or five years).
- *Stage 4:* University education includes colleges and institutes of higher education, with degree programs lasting between two and six years.

Each stage of the education system is offered by governmental (public) and private providers.

The compulsory sector of the Egyptian education system, which consists of nine grades, is known as “basic education.” It is split into two stages—primary school, which comprises Grades 1 to 6, and preparatory school, which comprises Grades 7 to 9. Basic education leads to the Basic Education Completion Certificate.

After these nine years of basic education, students can enter either a general secondary school, which offers an “academic option” or a “technical option.” The technical option includes three- and five-year technical schools as well as experimental schools that teach languages, education, and physical education. Usually, the only students admitted to university are those who are secondary school graduates from the academic option and who have obtained their General Secondary Education Certificate. Since 1991, however, some students graduating from technical schools with an Advanced Technical Diploma with scores above 75% have been allowed to enter higher education.

Table 2.6: The Egyptian Education System

Stage	Grades	Entrance age	Years of schooling		
Kindergarten	K–G 1	4–5	1		
	K–G 2	5–6	1		
Basic education	G 1–9	6	3	First cycle of basic education (primary schools)	First cycle of primary schools (G1–G3)
			3		Second cycle of primary schools (G4–G6)
		12 or above	3	Second cycle of basic education (preparatory schools)	
Secondary	G 13	15 or above	3–5	Two types of school	
				General	Technical
University	Colleges or higher education institutes	18 or above	2–6	Two years for some institutes Four years for all ordinary faculties and institutes Five years for engineering faculties Six years for clinical faculties	

The system of education is centralized. Accordingly, all students use the same textbooks in mathematics and science and attend the same number of periods per week (five for mathematics and five for science in Grade 8). In 2003, Egypt participated in TIMSS for the first time. About 7,200 Grade 8 students from 217 schools took part in the study.

In recent years, several policy initiatives in Egypt have sought to improve the mathematics and science achievement of students. In 2002, mathematics and science textbooks did not contain some topics taught elsewhere. Policymakers consequently decided to add these missing topics to the textbook for Grade 8 and to train all Egyptian teachers and supervisors in this new material. Teachers were also taught instructional strategies to increase the achievement of students of mathematics and science.

Teachers and teacher education

Pre-primary and primary/basic school teachers must hold a qualification from a university faculty of education. A distance learning program is also available. This allows primary school teachers who do not hold a degree to study in Arabic (as the language of instruction) toward a Bachelor of Education in Primary Education.

Secondary school teachers receive four years of training in university faculties of education, with courses comprising mathematics or science education and short-term practical training in schools. Teachers for preparatory and general secondary teachers follow the same course, which finishes with a Bachelor's degree. Graduates who have a four-year university degree in a discipline other than education can also teach at secondary level if they complete, at a faculty of education, a one-year postgraduate course, leading to a general diploma. Teachers of technical education are trained at special faculties. All teachers receive in-service training in different aspects of their work, such as strategies of instruction, new topics introduced into students' texts, and technology.

To prepare for Egypt's participation in TIMSS, general supervisors, regional principals, school headmasters, study supervisors, and senior teachers received professional development relating to the study. All were given guidance on the aims of TIMSS and were told that TIMSS is an international study designed to evaluate mathematics and science achievement, and that it should not be seen as a competition. The general supervisors, regional principals, and headmasters of schools were asked to consider and received guidance on these matters:

- Encouraging student achievement;
- Implications of conducting the study in a timely manner; and
- Developing a good learning environment in mathematics and science for students, especially through use of enrichment and remedial activities and programs.

Study supervisors and senior teachers received information and assistance on the following:

- The new topics included in the mathematics and science curricula;
- How to teach these new topics;
- Understanding, analyzing, and making use of the TIMSS test items, once released from the mathematics and science assessments; and
- Developing a good learning environment in mathematics and science for students, especially through use of enrichment and remedial activities and programs.

Examinations and assessments

In primary and preparatory schools, each school or *edara* (local area) is responsible for assessments from Grades 1 to 9. The examinations are prepared according to specifications provided by the National Center of Examinations and Educational Evaluation (NCEEE).

There is one textbook per curriculum subject for each grade, along with a teacher's guide, with both being prepared by the Center of Curricula and Instructional Materials. Student self-evaluation guides are also available for Grades 4 to 12, and these are prepared by the NCEEE. Schools can elect whether or not to give students these guides.

2.4 COUNTRY PROFILE: JORDAN

Location:
Middle East, northwest of Saudi Arabia

Geographic coordinates:
31 00 N, 36 00 E

Area:
Land (in sq km): 91,971
Water (in sq km): 329

Population:
6,053,193 (Jul 2007 est.)

Major population subgroups:
Arab 98%, Circassian 1%, Armenian 1%;
Sunni Muslim 92%, Christian 6% (majority Greek Orthodox, but Greek and Roman Catholics, Syrian Orthodox, Coptic Orthodox, Armenian Orthodox, and Protestant denominations), other 2% (several small Shi'a Muslim and Druze populations) (2001 est.)

Age structure:
0–14 years: 33%
15–64 years: 63%
65 years and over (Jul 2007 est.): 4%

Language(s):
Arabic (official), English widely understood among upper and middle classes

Language(s) of instruction:
Arabic, English

Sources:

- International Association of Universities. *World higher education database (WHED)*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
- *The world factbook*. Available online at https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html. Accessed July 18, 2007.

Overview of the Jordanian education system

Although Jordan has a scarcity of natural resources and wealth, the country is very keen to develop its education system, both qualitatively and quantitatively, so as to ensure Jordan's effective coexistence with 21st-century challenges.

Jordan's education system is therefore concerned with preparing Jordanian citizens for future challenges and aspirations. This approach includes several developmental aspects, the most important of which is extending the compulsory, free-of-charge basic education cycle from 9 to 10 years.

Degree of centralization/decentralization

A key principle of Jordan's educational policy is centralized general planning and follow-up in association with decentralized administration.

Curriculum and monitoring oversight

The Board of Education within the Ministry of Education determines curriculum content in Jordan. The ministry's monitoring, financial, and inspection divisions are responsible for administering audits of the school system and for assessing the outcomes of these audits.

As part of its developmental plans, the Ministry of Education has been providing Jordanian schools with curricula, textbooks, and teacher manuals that are of high quality and comply with global standards. The principles underlying this development include improving content and form, facilitating critical and creative thinking and problem-solving, linking content to life experience, and helping students employ information in their academic and practical lives. These measures all align with the economic and work-related imperatives of the present day, which are characterized by technical and scientific progress.

Structure of the education system

The education system consists of the following cycles:

- *The kindergarten cycle:* This cycle, which lasts for a maximum of two years, is open to children from four years of age. This preschool, non-compulsory stage is free of charge, and its schools are almost completely run by the private and voluntary sectors.
- *The basic education cycle:* Children enter this 10-year cycle at six years of age. During this

compulsory stage of the Jordanian education system, all students study the same content and are evaluated annually. In Grades 8 through 10, these assessments are used to determine which students will enter which of the various types of secondary education.

- *The secondary education cycle:* This stage lasts for two years. At the end of Grade 10, students are classified into two major streams: the comprehensive (academic and vocational) secondary educational stream, and the applied secondary educational stream. The program for the first-stream program ends with students sitting the General Secondary Education Certificate Examination in the following specializations:
  - The academic sub-stream, which includes scientific and literary specializations;
  - The vocational sub-stream, which includes industrial, commercial, agricultural, nursing, hotel management, and home economics.

  This cycle provides specialized cultural, scientific, and vocational experiences in order to provide the skills and knowledge necessary for students to meet the existing and anticipated needs of Jordanian society.

The role of pre-primary education

This role is evident in the Ministry of Education's plans to bring about a qualitative expansion and improvement of preschool education and to encourage the private sector to establish kindergartens. The Jordanian government and Ministry of Education are therefore giving high priority to the development of targeted approaches designed to improve the availability of early childhood education. Component 4 of Jordan's Education Reform for Knowledge Economy (ERfKE) promotes learning readiness through childhood education. ERfKE will directly assist the implementation of a comprehensive approach to improving the scope and quality of essential early childhood services.

Within its capabilities, the Ministry of Education has established a number of kindergartens, particularly in remote and needy areas, in order to achieve the following:

- Provide children with an adequate and secure educational environment necessary for promoting well-balanced educational growth;
- Help students acquire positive attitudes toward school, with a particular emphasis on effecting a smooth transition from home to school;
- Develop good health practices;
- Improve children's social relations; and
- Enhance children's skills and positive attitudes toward school life and instill a love of lifelong learning.

Emphasis on mathematics and science

The Ministry of Education is developing and updating mathematics and science curricula with the aim of achieving depth and excellence in science and mathematics teaching and learning. E-math projects receive funding from the Cisco Learning Institute and e-science projects are funded by the private sector, notably the Fastlink Corporation.

Jordan is also committed to taking part in educational monitoring activities. The country participated in the TIMSS program in order to assess Grade 8 students' achievement in mathematics and science. One hundred and forty Jordanian schools, involving 4,489 students, took part in the study in 2003. The results indicated that, in science, Jordan ranked first among the Arabic countries and 26th internationally. In mathematics, it ranked second among the Arabic countries and 33rd internationally.

Teachers and teacher education

Jordan's Ministry of Education recognizes that improving the quality of education is the nation's most pressing developmental goal. The ministry's policymakers and decisionmakers maintain that the Jordanian education system must prepare and qualify young people to be critical thinkers equipped with the life skills they need to operate effectively in a changing world. One of the most important steps in this direction is developing the quality of teacher education through progressive reform of educational policies and strategies. Jordan recognizes that if the Jordanian education system is to achieve its goals, it must have highly qualified, competent teachers, each of whom has specified competencies.

Jordan's participation in the various cycles of TIMSS has been motivated in part by this concern, given that TIMSS aims to help countries all over the world improve student learning in mathematics and science. In 1999, Jordan was one of 30 countries that took part in the TIMSS-Repeat (TIMSS-R) assessment. Information about Jordanian students' performance in this survey was thoroughly analyzed under the supervision of the National Center for Human Resources Development (NCHRD), and this work led to preparation of training guides for teachers.

Jordan's participation in TIMSS 2003 again saw the students' knowledge and skills analyzed. Teachers were made aware of which test items and areas of skill students commonly found difficult. The recommendations of those conducting the analyses were again used to prepare training guides for teachers.

The NCHRD not only oversees the TIMSS assessments conducted within Jordan but also acts as a liaison between IEA and educational organizations in the country. The practical training guides that the center develops allow teachers to help students avoid the errors they commonly commit in TIMSS. The content of the training guides include:

- Identification of errors, their types, and how they are committed;
- Suggested questions and tasks to help students understand how errors occur; and
- Suggested learning strategies to help students avoid errors (remedial tasks).

A recent initiative related to developing teachers' competencies is the Ministry of Education's development of the aforementioned ERfKE program. Component 2 of this program is designed to transform educational programs and practices so that they support the development of a knowledge economy within the country. Key emphases in the program are improved professional development and training for teachers and improved learning resources.

Some of the specific requirements relating to the teaching of mathematics and science are:

- A pre-service program designed to prepare potential teachers of science and of mathematics before they embark on their careers;
- An in-service training program that aligns with the requirements of teacher certification; and
- Closer coordination with the faculties of education in order to ensure that ministry requirements relating to preparation of competent science and mathematics teachers are met.

The implementation of ERfKE initiatives presents various opportunities to address some of these training issues. Teacher competencies are being developed, and a comprehensive teacher professional development plan is being prepared. The building of quality assurance mechanisms into the teacher competency requirements of the education system is an important component of ERfKE.

In essence, all teacher training initiatives, including all efforts by the Directorate of Training, Qualification, and Supervision, concentrate on helping students develop areas of strength and avoid areas of weakness so that they become innovative thinkers who can build their community and participate in the development of the international community.

Examinations and assessments

National and regional examinations

The Directorate of Examinations and Tests administers and conducts a number of assessments that fall under two main categories. The first category concerns the General Secondary Certificate Examination, which has nine different versions (categorized under academic and vocational) and is sat by those students who have completed 12 years of schooling. Each of the different versions has five common core subjects, along with some other specialist subjects. High stakes are attached to these examinations, as their results determine admission to higher education institutions.

The second assessment is the national testing program conducted for Grades 4, 8, and 10 in a variety of subject areas. The purposes of these tests are to monitor student performance in relation to the learning outcomes prescribed in the national curriculum. A particular aim of the national tests is to provide schools and regions with data that they can use to improve student performance. The national tests align with the goals and learning outcomes of the new national curriculum that was implemented in Grades 1, 4, 8, and 10 during the 2005/2006 school year.

National and regional assessments in mathematics and science

At the national level, the NCHRD conducts what is known as the National Assessment for Knowledge Economy Skills. TIMSS supplements this information by providing information at two levels. The first allows Jordan to gain perspectives on its students' achievement in comparison with the achievement of students from other Arabic countries. The second allows Jordan to examine the achievement of its students in an international context.

The main assessment administered by the Directorate of Examinations and Tests is the diagnostic assessment that is conducted annually for Grades 5 and 9 in science, mathematics, English, and Arabic. The purpose of this assessment is to improve instruction and learning through remedial activities. The assessment is applied to a sample of the student population. Other assessments involving nationwide samples of relevance here are PISA (literacy) and TIMSS (science and mathematics). The directorate is presently designing a new assessment, known as the Knowledge Economy Assessment. This will include three subject areas—science, mathematics, and reading—and its primary purpose is to monitor overall student progress in relation to those skills deemed critical for working within the knowledge economy.

Standardized tests

The Directorate of Examinations and Tests is presently preparing standardized tests, developed from item banks available to government schools. Assessment items from all subject areas are stored in these banks after undergoing regular scientific procedures designed to test their rigor and appropriateness. While private schools also have access to these tests, they are free to purchase commercial tests from third-party providers.

Monitoring individual student progress

Assessment policy is regularly updated to ensure that classroom assessment practices conform to Jordan's Educational Reform for the Knowledge Economy policy. This policy puts the student at the center of the learning process and focuses on each student's development as a responsible person and citizen of the knowledge economy. A specific set of assessment strategies and tools is used to monitor individual student progress. These items include performance-based assessment, observation, communication, reflection, checklists, rubrics, and learning logs. Together, these tools allow teachers to gather information about their students' progress and thus help teachers and students achieve the above-mentioned goals.

The assessments, along with everyday teacher-designed tests, generate grades for each student. New report cards have been designed to facilitate this reporting system, which focuses on basic skills and general learning competencies. Parents can use this information to help them plan the future of their children's education.

Grade promotion and retention policies

Regulations promulgated by the Directorate of Examinations and Tests permit students from Grades 1 to 3 to be promoted automatically from one grade to the next. Exceptions to this provision occur when a student achieves a score less than 40% in either mathematics or the Arabic language. Students from Grades 4 to 10 are also accorded automatic promotion as long as they do not fail in four subjects. If a student fails in three subjects, he or she must sit a "make-up" examination, and must attain a score of at least 50%. However, if students fail the make-up examination after being held back for two years during the basic stage (Grades 1 to 10), they are promoted.

Students can be accelerated through the grades, but only after careful assessment, special tests, and interviews to ensure they will cope with the advancement and that the acceleration does not extend beyond two grade levels. During secondary schooling, retention and promotion are course-based, and students can sit for any individual test more than once to fulfill the requirements of the General Secondary Certificate Examinations.

2.5 COUNTRY PROFILE: LEBANON

Location:
Middle East, bordering the Mediterranean Sea, between Israel and Syria

Geographic coordinates:
33 50 N, 35 50 E

Area:

Land (in sq km):	10,230
Water (in sq km):	170

Population:
3,925,502 (Jul 2007 est.)

Major population subgroups:
Arab 95%, Armenian 4%, other 1%; Muslim 59.7% (Shi'a, Sunni, Druze, Isma'ilite, Alawite or Nusayri), Christian 39% (Maronite Catholic, Greek Orthodox, Melkite Catholic, Armenian Orthodox, Syrian Catholic, Armenian Catholic, Syrian Orthodox, Roman Catholic, Chaldean, Assyrian, Copt, Protestant), other 1.3%

Age structure:

0–14 years:	26.2%
15–64 years:	66.7%
65 years and over (Jul 2007 est.):	7.1%

Language(s):
Arabic (official), French, English, Armenian

Language(s) of instruction:
Arabic, English, French

Sources:

- International Association of Universities. *World higher education database (WHED)*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
- *The world factbook*. Available online at https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html. Accessed July 18, 2007.

Overview of the Lebanese education system

Lebanese students enter school at the age of six. Children finish their period of compulsory education when they reach the age of 12. The Lebanese school system follows this structure:

- *Primary education:* Primary education is taught in primary schools in two cycles of three years each, and therefore lasts for six years. Lebanese students attend primary schools from age 6 to age 12.
- *Complementary education:* Complementary education is taught at intermediate schools and has a length of three years. Students of ages 12 to 15 attend these schools.
- *Secondary education:* Secondary education is taught at secondary schools and lasts for three years. Students in secondary schools are between 15 and 18 years of age.
- *Technical education:* Technical education is taught at technical secondary schools and also lasts for three years. Students attending these schools are also between 15 and 18 years of age.

As previously mentioned, secondary education in Lebanon lasts for three years and is divided into general education and technical education. While general education comprises subjects focusing on the humanities, economics, life sciences, and science, technical education offers approximately 55 different fields of study. School principals usually decide which secondary school track students will enter. Their decision is based on the results of the examination that students sit at the end of the period of complementary education.

Teachers and teacher education

Pre-primary and primary/basic school teachers in Lebanon are trained at faculties of education in public and private universities. A secondary education degree is required for admission. After three years of study, students graduate with a Bachelor's degree in elementary and primary education. Secondary school teachers receive their education at the Faculty of Education of the Lebanese University, which offers five-year courses leading to the *Certificat d'Aptitude pédagogique de l'Enseignement secondaire*. Colleges and universities also award teaching diplomas in various fields, such as mathematics, physics, and literature, among others.

2.6 COUNTRY PROFILE: MOROCCO

Location:
Northern Africa, bordering the North Atlantic Ocean and the Mediterranean Sea, between Algeria and Western Sahara

Geographic coordinates:
32 00 N, 5 00 W

Area:

Land (in sq km):	446,300
Water (in sq km):	250

Population:
33,757,175 (Jul 2007 est.)

Major population subgroups:
Arab-Berber 99.1%, other 0.7%, Jewish 0.2%; Muslim 98.7%, Christian 1.1%

Age structure:

0–14 years:	31%
15–64 years:	63.9%
65 years and over (Jul 2007 est.):	5.1%

Language(s):
Arabic (official), Berber dialects, French often the language of business, government, and diplomacy

Language(s) of instruction:
Arabic, French

Sources:

- International Association of Universities. *World higher education database (WHED)*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
- *The world factbook*. Available online at https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html. Accessed July 18, 2007.
- Maghreb Arabe Presse. (2007). *Morocco Intel launch USD127.7Mn ICT generalization program*. Available online at http://www.map.ma/eng/sections/social/morocco_intel_launc/view. Accessed March 31, 2008.

Overview of the Moroccan education system

The steps taken by the Moroccan government to reform Morocco's education system is clearly evident in the all-embracing decisions that have been taken concerning the system. These encompass re-organizing the administration of education, rationalizing expenditures, changing programs, endeavoring to minimize inequities in educational provision and achievement, advancing the schooling of girls in rural areas, and bringing educational evaluation under institutional control.

This commitment on the part of the government is reflected in the amount of money that it presently spends on education. Today, 25% of the country's general budget flows into the education system and associated training programs. According to state principles, the majority of the funding and responsibility for education remains the duty of the state. The state therefore guarantees *compulsory and fundamental* educational provision for all Moroccan children from age 6 to age 15. The state also maintains that no one should be excluded from post-compulsory education for financial reasons.

Structure of the education system

Morocco's National Education and Formation Charter defines the components of the Moroccan education system as follows:

- *Preschool education:* Two years in duration, preschool is open to all children between four and six years of age.
- *Primary school:* Lasting six years, primary school is open to children who have completed preschool as well as children six years of age who were unable to take part in preschool education and those who previously attended religious schools.
- *College (lower secondary school):* This stage of schooling lasts for three years and is open to children who have graduated from primary school with a primary school certificate.
- *Secondary education:* Also three years in duration and comprising general, technical, and professional streams, secondary education consolidates the skills students acquired during lower secondary education. Secondary education also offers diversification into apprenticeships and routes into professional

education associated with higher education. Secondary education consists of two cycles—the common cycle and the A-level cycle.
  – The common cycle is open to students with a lower secondary school certificate.
  – The A-level cycle lasts for two years and is open to students from the common cycle. It comprises two main lines. One covers technical and professional education and the second covers general education. Both lines are composed of multiple branches, and each branch consists of compulsory disciplines and optional disciplines.
- *Higher education:* This part of the education system contains the universities, the related colleges and specialized institutions, the engineering schools (preceded by preparatory classes), and schools for training teachers, specialized technicians, and equivalents.

Of the many programs that the Moroccan Ministry of Education currently undertakes, one program merits particular mention—the GENIE program. Launched in November 2007, the program is a joint initiative of the Moroccan Education Ministry and the American Intel Corporation. The aim of the program is the rapid and efficient introduction of information and communication technologies (ICT) in Morocco's public education institutions. The GENIE program has adopted a three-part strategy—equipping schools with multimedia rooms and internet-enabled computers, training teachers and raising their awareness of the use of ICT, and developing curricula pedagogical contents (Maghreb Arabe Presse, 2007).

2.7 COUNTRY PROFILE: PALESTINIAN NATIONAL AUTHORITY

Location:
Middle East
West Bank: west of Jordan
Gaza Strip: bordering the Mediterranean Sea, between Egypt and Israel

Geographic coordinates:
West Bank: 32 00 N, 35 15 E
Gaza Strip: 31 25 N, 34 20 E

Area:	*West Bank:*	*Gaza Strip:*
Land (in sq km):	5,640	360
Water (in sq km):	220	0

Population:
West Bank: 2,444,478 (2006 est.)*
Gaza Strip: 1,443,814 (2006 est.)*

Major population subgroups:
Muslim 97%, Christians and the Samarian Jewish community in Nablus 3%

Age structure:	*West Bank:*	*Gaza Strip:*
0–14 years:	42.4%	47.6%
15–64 years:	54.2%	49.9%
65 years and over:	3.4%	2.5%

Language(s):
Arabic, English (widely understood), Hebrew (spoken by some Palestinians)

Language(s) of instruction:
Arabic, English

Note:
*Without East Jerusalem

Sources:

- International Association of Universities. *World higher education database (WHED)*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
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General overview

Geographical location and size

The geographical location of the Palestinian National Authority (PNA) plays a major role in the country's climate and the diversity of climate between the southern and northern parts. The entire area historically encompassed by the Palestinian National Authority is about 27,000 km² and includes the Tabariya and El-Hoola lakes and half of the area of the Dead Sea.

The PNA took over management of Palestinian affairs in the West Bank and the Gaza Strip from Israel in July 1994. Since the time of the Oslo Accords, the PNA has had jurisdiction over these areas except where Israeli settlers and nationals are concerned. Israel retains responsibility for external defense and foreign affairs. The West Bank, which is about 5,640 km² in size, lies to the west of the Jordan River, and just over 60% of it is rural. The Gaza Strip, on the west coast of the Mediterranean, is a narrow strip of land comprising about 360 km². With a population of around 1.5 million people, it is one of the most crowded places on Earth.

Overall population

The number of Palestinians living in the West Bank and Gaza Strip at the beginning of 2007 was around four million. Approximately one and a half million people were living at that time in the Gaza Strip and 2.51 million people were living in the West Bank. In 1997, the population density was 467 people per square kilometer. By 2000, the density was 536 for each square kilometer. Another five years on (2005), there were 636 people living within each square kilometer.

Gross national income and income per capita

Table 2.7 provides the Palestinian gross national income and related indicators as of 2003.

Table 2.7: GDP, GNI, and GDI per Capita by Region, 2003, at Constant Prices in US$ (base year: 1997)

Region	GDP per capita	GNI per capita	GDI per capita
Remaining West Bank and Gaza Strip*	1,272.30	1,374.30	1,831.40
Remaining West Bank*	1,445.90	1,542.40	1,999.50
Gaza Strip	1,004.10	1,114.50	1,571.60

Note: *Without East Jerusalem
Source: The Palestinian Central Bureau of Statistics, national accounts, 2003

Infant mortality and life expectancy

The PNA has an infant mortality rate of 29 per 1,000 inhabitants. The average life expectancy for men is 71 years; for women, it is 73 years.

Overview of the Palestinian education system

Historical note

Palestinians took over responsibility for their education system in 1994, after the Oslo Accords.

Structure and levels of education

The education system in the PNA is composed of four stages: preschool education, basic education, secondary education, and university education.

- *Preschool:* This consists of one to two years and caters for four- to five-year-olds. The Ministry of Education and Higher Education (MoEHE) supervises and monitors preschool provision through supervisors in the field. Although most kindergartens are run by the private sector, the ministry provides kindergartens with technical and educational supervision, teacher training and licensing, and some funding.
- *Basic education:* This stage consists of 10 years of schooling, which is compulsory for all children. It extends from Grades 1 to 10, and is attended by 6- to 16-year-olds.
- *Secondary education:* This consists of two years of schooling encompassing Grades 11 and 12 and catering for 17- to 18-year-olds. This stage is divided into academic, technical, and vocational domains. The academic domain includes literary (humanities) and scientific streams, while the technical and vocational domains consist of subjects in engineering and technology amongst others. Students can elect to enter any one of these domains, but their right to entry is based on successful completion of Grade 10 and the results of assessments they undertake at the time.
- *University education:* The university stage consists of four years of college education for a Bachelor's degree, and two additional years for a Master's degree. Some colleges provide two years of education, and these lead to a diploma.

During the 2005/2006 school year, of the cohort of students of an age to attend basic school education (Grades 1 to 10), 92.1% were enrolled at the primary school level and 75.8% at the secondary school level. During this same school year, the student per teacher ratio across the education system was 22.1:1.

Public expenditure on education

Table 2.8 provides summary data on expenditure on education.

Degree of centralization

The PNA operates a centralized education system in regard to its curriculum, textbooks, instructions, and regulations. The administrative structure of the general education system is composed of 22 field directorates (districts) of education, 16 of which are in the West Bank and six in Gaza. The total number of schools in the system is 2,415, with 33,225 classes and 52,465 teachers[1] serving 1,103,649 students (MoEHE database, 2007).

Education directorates (districts) supervise the administrative and academic performance of their schools, and have authority to address issues related to these areas. However, in some cases, the directorates ask the MoEHE to work with them in order to deal with certain issues. The MoEHE is responsible for recruiting and training teachers

Table 2.8: Major Economic Indicators Relating to Education in the Remaining West Bank[1] and Gaza Strip

Indicator	2003[2]
Government expenditure on education as a percentage of total expenditure on education	33.9%
Government expenditure on education as a percentage of total government expenditure	17.8%
Education expenditure as a percentage of gross national income	10.7%
Percentage contribution of education to GDP	11.4%
Education expenditure as a percentage of final consumption	8.9%

Notes:
1 Remaining West Bank refers to all the West Bank minus those parts of Jerusalem that Israel annexed in 1967
2 The data are preliminary estimates

1 All school staff, except administrative, are considered to be teachers.

and liaising with the education directorates on training issues.

Public (or government-run) schools accommodate 70% of Palestinian students. Privately run schools accommodate 7%, while United Nation Relief and Work Agency (UNRWA) schools, which serve refugee camp children, account for 23% of students. The PNA has three types of school, demarcated according to gender. Thus, there are boys' schools, girls' schools, and co-educational schools, representing respectively 37%, 35%, and 29% of the schools.

Funding for the education system comes from the government budget through the Ministry of Finance. Just under 18% of the government budget is allocated to education (see Table 2.8), with the remaining funds coming from donors and international organizations. No special governmental funds are allocated for mathematics and science learning and teaching, but some donors specify that the money they give be spent on special teaching and learning programs, including mathematics and science. TIMSS provides one such example, as Palestine's participation in this study is funded by the United Nations Development Program (UNDP).

The MoEHE ensures that schools offering a scientific stream are provided with science and computer laboratories. There are 1,048 science laboratories, 1,059 computer laboratories, and 1,162 libraries across the Palestinian school system (MoEHE database, 2007).

Emphasis on mathematics and science

In 2000, the implementation phase of the national curriculum began with implementation of students' textbooks for all subjects for Grades 1 and 6. In 2001, textbooks were implemented for students in Grades 2 and 7. By the beginning of school year 2006/2007, all students in all grades were using Palestinian national textbooks.

A specialized committee formulated by the MoEHE sets up the strategic plans for curriculum and draws up guidelines for each subject. National teams of authors use the guidelines to write the students' textbooks and teachers' guides for all subjects and school grades.

The ministry's emphasis on mathematics and science is evident in its decision to have Palestinian students participate in the TIMSS 2003 and 2007 assessments. The ministry also arranged for the PNA to take part in the Education for All (EFA) assessment conducted in 2000. This regional study, involving several Arabic countries, assessed fourth graders in mathematics, science, and the Arabic language, and it provided the ministry with baseline data that it could use as a point of comparison with data from future assessment initiatives (MoEHE, 2000). Within Palestine's own national assessments of achievement conducted in 1999, 2000, 2003, and 2005, mathematics was one of the subjects assessed nationally in pivotal grades (4, 6, 8, and 10). Science, however, was assessed only at Grade 6.

Mathematics and science instruction in the primary and lower secondary grades

The implementation of the first Palestinian curriculum in 2000/2001 provided a formal plan of study for schools, which included the number of weekly classes for each subject in each grade. The schedules for mathematics and science are shown in Table 2.9. Slight changes to the instruction time for teaching science in 2002 saw four periods per week allocated to teaching science in Grades 5 to 10.

In Grades 1 to 10, students study general science. In Grades 11 and 12, students entering the scientific stream learn the separate branches of science, specifically physics, chemistry, and biology. Students entering the literary (humanities) stream have the option of continuing to study general science. The majority of science concepts are introduced through an activity approach. Thus, students at the lower grades carry out simple activities in class, while students in Grades 5 and higher work in science laboratories. The majority of these laboratories are equipped with instructional materials, tools, and devices that are recommended in curriculum guidelines. Work predicated on mathematics and science textbooks comprises about 30% of the course time. Students in Grades 1 to 6 also have access to ready-made worksheets, which support the content of the textbooks.

In addition to the traditional science subject, the new Palestinian Curriculum Plan introduced two other science-related subjects:

1. *Technology and applied sciences:* The instructional time covers two periods a week for Grades 5 to 10, and the aim is to reinforce learners' practical skills in these areas. A particular emphasis is

to make students aware of technology-related issues in their lives, such as the impact of technology on transportation and pollution, effective use of computers, an appreciation of hands-on technical skills, and an appreciation of how technical knowledge and skills can influence their selection of future careers.

2. *Hygiene and environmental sciences:* This is an elective subject for students in Grades 7 to 10. The subject's main goal is to enable students to understand concepts and learn skills relating to a wide variety of topics, such as the importance of water to life, water shortage and conservation, first aid, human interaction with the environment, diseases, car safety, food and nutrition, religion and environment, family and community health, biodiversity in the PNA, development and civilization, community and environmental laws and instructions, and other global issues.

The formal instructional resources for mathematics are:

- *Textbooks:* The organization of the mathematics curriculum is reflected in its textbooks, which usually cover eight units of work per grade level. Each unit contains a number of lessons, and each lesson contains one main theme, examples, and exercises. At the end of each unit, a cumulative review of various problems and activities is given.
- *Teacher's guidebooks:* To date, teachers' guides have been developed for Grades 1, 2, 3, 4, and 6. These help teachers extend their knowledge of mathematics content, provide additional exercises, and suggest methods of presentation and assessment.
- *Remedial worksheets:* These sheets, prepared by committees of teachers and supervisors at the ministry level, and with a remedial purpose, are distributed to all students in Grades 1, 2, 3, 4, 5, and 6. Students usually work on these sheets with the help of their families.

Some schools use technology such as computers for illustrative purposes and for simple activities in mathematics and science. However, in general, the extent to which IT is used in teaching and learning these subjects appears to be relatively minor at this time.

Teachers and teacher education

There is currently no national, comprehensive program of teacher education provision in the PNA. Although the universities and colleges prepare teachers in a variety of ways, teachers generally are inappropriately trained, in part because the providers offer insufficient opportunities for practical teaching in schools.

Today, all new teachers must possess at a minimum a Bachelor's degree, although a few are admitted with a teaching diploma. The following points summarize the present status of qualification and training for teachers of mathematics and of science in Palestine:

- Pre-training or certification has not been required until very recently.
- There have been no specific educational requirements in place for people wishing to teach mathematics and science.
- Any undergraduate person studying toward a Bachelor's degree in mathematics or science can be appointed but must still comply with certain criteria. These relate to the nature and quality of the person's academic qualifications, his or her university entrance examination results, and an interview.

Table 2.9: Number of Subject Classes (Periods) for Each Basic Stage Grade*

	Grade									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Mathematics	5	5	5	5	5	5	5	5	5	5
Science	3	3	3	3	5	5	5	5	5	5

Note: * One period corresponds to 45 minutes

Source: Palestinian Curriculum Development Center, 1998

Several districts have experienced shortages of mathematics and science teachers over the last three or so years in some districts. In some instances, non-specialized teachers have been appointed to teach these subjects in these districts.

Teacher professional development in mathematics, science, and technology

The Directorate General for Supervision and Qualification (DGSQ) is responsible for in-service teacher education. The directorate's training plan complements the objectives of the MoEHE's Five-Year Plan for improving the quality of education and the development of human resources (MoEHE, 2001). The training plan elaborates three programs of professional development, delivered according to the "cascade" model:

1. *Obligatory programs:* These aim to improve teachers' subject knowledge and their application of that knowledge in the classroom. The programs focus on the newly articulated subjects of mathematics, science, and technology within the Palestinian curriculum.
2. *Developing programs:* These focus on pedagogical issues and strategies, and provide visual aids for teachers as needed.
3. *Optional programs and projects:* These offer teachers opportunity to improve personal skills and abilities and to accelerate their students' skills through a science and mathematics education program known as CASE/CAME. This program is presently being used with Grades 6 to 8 students in 250 Palestinian schools.

Newly recruited teachers must also participate in an orientation course in order to ensure they are (at the very least) minimally prepared for work in the classroom. They must also attend a course on assessment and evaluation.

According to TIMSS 2003, 14% of the students who took part in the study had teachers with a two-year diploma, 78.5% had teachers with a Bachelor's degree, obtained after they had completed secondary school and obtained the General Certificate Examination, and 7.7% had teachers with a second degree (Master's) or higher. The most recent available data from the Palestinian MoEHE indicate that 19% of Grade 8 teachers have a two-year post-secondary-school diploma, 67% have a first university degree, 10% have a Bachelor's degree and a postgraduate diploma, and 3% have a Master's degree or higher.

The MoEHE in collaboration with the British Council recently established a program designed to evaluate the in-service training programs offered by the ministry. A particular purpose of the program is to help the ministry refine its training initiatives (British Council, 2006).

Grading and retention

Grades 1 to 3 do not have a grading system (marks) and there are no written formal tests at this level. Rather, teachers assess students on the basis of their progress. Teachers use formative assessment, observation, student portfolios, and other assigned student work as the basis of their judgments. As students progress through school (from Grades 1 to 12), a formal assessment card, called "the cumulative student card," travels with them. This card contains all necessary information about each student, his or her grades, and when he or she moves to another school.

Students in Grades 1 to 3 progress through each grade with their age cohort. Even if children are not achieving well, the ministry policy is not to hold them back a grade. However, from Grades 4 to 12, ministry regulations allow for 5% (maximum) of a class cohort to be held back, with the decision resting on students' total average achievement score for a year. Those students nominated to repeat a year do not receive any remedial teaching during their repeated year.

Examinations and assessment

The examination system is summarized in Table 2.10.

From 1997 to June 2005, the Assessment and Evaluation Center (AEC) and the General Directorate of Examinations shared the assessment activities conducted within the MoEHE. However, when the MoEHE was restructured in 2005, the Directorate General of Assessment, Evaluation, and Examinations (DGAEE) took over responsibility for all assessment and evaluation activities.

Since 1997, the basic purpose of educational evaluation in the ministry has been to disseminate a culture of educational evaluation throughout the Palestinian education system and to promote its principles. In 1998, AEC began the first round of national assessments, using standardized national tests along with other questionnaires. The aim of this program of national assessments was to provide policymakers, curriculum developers, and teacher educators at the MoEHE with valid and reliable indicators of the effectiveness of the Palestinian education system. In 2000, the MoEHE participated in a regional assessment of fourth graders. This study was carried out under the auspices of a UNESCO "Education for All" initiative. The target subjects of the assessment were mathematics, science, and the Arabic language.

The ministry also took responsibility for the PNA's participation in the TIMSS 2003 survey, which assessed Grade 8 students. Palestine's purpose in participating in the study was to obtain national achievement indicators that could be used for comparison within the international context, and to set baseline data for future comparisons. The ministry also used the findings to inform several reform initiatives, one of which involved the teaching and learning process inside classrooms. During 2007, the PNA participated for the second time in TIMSS (TIMSS 2007), with the aim of obtaining trend indicators on students' achievements in mathematics and science, and on other data related to some contextual variables.

Table 2.10: General Examination System

Exam type	Time	Purpose
1. Certificate of General Secondary Education Examination (High School). The examination is called Tawjihee and is sat by all Grade 12 students	June	To prepare Grade 12 students for admission to university
2. Grade 9-level examination	November	This is offered to students who have not completed Grade 9, or who have left school. Its aim is to enable these students to achieve a Grade 9 competency level, necessary for participants wanting to sit the Certificate of General Secondary Examination. (The admission examination no longer exists. The ministry decided to cancel this examination after 2007.)

2.8 COUNTRY PROFILE: SAUDI ARABIA

Location:
Middle East, bordering the Persian Gulf and the Red Sea, north of Yemen

Geographic coordinates:
25 00 N, 45 00 E

Area:

Land (in sq km):	2,149,690
Water (in sq km):	0

Population:
27,601,038 (Jul 2007 est.)

Major population subgroups:
Arab 90%, Afro-Asian 10%; Muslim 100%

Age structure:

0–14 years:	38.2%
15–64 years:	59.4%
65 years and over (Jul 07 est.):	2.4%

Language:
Arabic

Language(s) of instruction:
Arabic, English

Sources:

- International Association of Universities. *World higher education database (WHED)*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/xc.rtf. Accessed July 18, 2007.
- *The world factbook*. Available online at https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html. Accessed July 18, 2007.
- *UNESCO*. Available online at http://www.unesco.org/iau/onlinedatabases/systems_data/sa.rtf.

Overview of the Saudi education system

Saudi Arabia has a centralized education system. Curricula, teacher training and appointments, and school inspection are all centrally determined by specific departments within the Ministry of Education. The system consists of three levels of education: elementary (Grades 1 to 6); intermediate (Grades 7 to 9); and secondary (Grades 10 to 12). Saudi Arabia has three types of school instruction—public, private, and international. The period of basic compulsory education in Saudi Arabia covers all children aged 6 to 15 years.

The education system is currently undergoing reform in a number of areas and through different channels. One area of reform is the curriculum for mathematics and for sciences and for all grade levels (1 to 12). Saudi Arabia's participation in the TIMSS assessments is part of this development. Seventy-five percent of the content of the mathematics and science curricula relates to TIMSS test items.

Emphasis on mathematics and science

The Ministry of Education is strongly committed to improving mathematics and science education as illustrated by the minister's decision for Saudi Arabia to participate in the ongoing cycles of TIMSS. Other efforts to improve mathematics and sciences instruction have included an intense appraisal of mathematics and science instruction as it occurs in classrooms. As a result, a two-part comprehensive program of reform has been set up. The first part of the reform is targeting curriculum improvement; the second part is focusing on teacher training.

Mathematics and science instruction in the primary and lower secondary grades

Students receive four lessons of teaching time each week in science and mathematics at the primary and lower secondary school level. Each school is equipped with free textbooks and instructional materials and also has science and computer laboratories available. English as a second language is introduced into the system at Grade 6. Computing is introduced as a subject in Grade 10 but is practiced as an extra-curricular activity in all grades.

Teachers and teacher education

All teachers must hold a Bachelor's degree in order to teach in Saudi schools. They must also hold a teaching certificate and reach or exceed a designated score on the teacher minimum competency test (TMCT), which is administered twice a year. Every year, the Ministry of Education announces the number of teachers needed for schools in all subjects.

Teachers always have the opportunity to enroll in ongoing professional development programs. These programs help teachers improve their teaching skills and strategies, including those relevant to information technology. Teachers involved with the TIMSS assessment are required to participate in a very comprehensive program that covers test development and test administration. This program is designed to ensure the quality of test-taking and to eliminate the errors arising out of students being given unclear or inaccurate instructions during test administration.

Examinations and assessments

Saudi Arabia recently implemented a system of continuous evaluation across the country's elementary schools. Summative evaluation is used across the other two stages of the education system. Students are allowed to repeat a class twice. If they do not succeed at the end of this time, they transfer to another type of instruction, such as evening classes, which may better fulfill their learning needs.

2.9 COUNTRY PROFILE: TUNISIA

Location:
Northern Africa, bordering the Mediterranean Sea, between Algeria and Libya

Geographic coordinates:
34 00 N, 9 00 E

Area:

Land (in sq km):	155,360
Water (in sq km):	8,250

Population:
10,276,158 (Jul 2007 est.)

Major population subgroups:
Arab 98%, European 1%, Jewish and other 1%;
Muslim 98%, Christian 1%, Jewish and other 1%

Age structure:

0–14 years:	24%
15–64 years:	69.2%
65 years and over (Jul 2007 est.):	6.9%

Language(s):
Arabic (official and one of the languages of commerce), French (commerce)

Language(s) of instruction:
Arabic, French

Sources:

- *The world factbook*. Available on https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html. Accessed July 18, 2007.
- *UNESCO*. Available on http://www.unesco.org/iau/onlinedatabases/systems_data/sa.rtf.

Overview of the Tunisian education system

Tunisia's education system is centralized. The Ministry of Education is charged with coordinating and developing national education plans and providing technical and financial assistance for the development of education. The education system comprises two levels—basic education and secondary education.

- *Basic education (Grades 1 to 9):* Children enter school at the age of six for a nine-year period, divided into two stages. The first six-year stage takes place in primary schools; the second three-year stage in lower secondary schools (Grades 7 to 9). At the end of basic education, students are streamed either to secondary school or to vocational training. The language of instruction is Arabic. French is taught as a second language, starting from Grade 3, and English is taught as a third language, starting from Grade 5.
- *Secondary education (Grades 10 to 13):* Secondary education lasts four years and is divided into two stages, with one year of general education and three years of pre-specialized education. It leads to the baccalaureate in arts, mathematics, experimental sciences, technology, economics and management, foreign languages, or humanities. The language of instruction is Arabic for humanities and French for sciences, technology, and economics.

Table 2.11 presents the distribution of students according to grades and by gender.

Mathematics and science instruction in the primary and lower secondary grades

The targets of the last reform of the Tunisian education system led to the development of curricula emphasizing sciences, languages, and vocational training as well as integration of information and communication technologies (ICT) at all educational levels. The overall aim of these developments was to promote students' reasoning, thinking, and problem-solving skills and mastery of ICT.

The hours per week devoted to mathematics and science instruction within each grade of Tunisia's education system is set down in Table 2.12.

Table 2.11: Number of Students, by Level of Education and Gender

		Schools	Students		
			Boys	*Girls*	*Total*
Kindergarten		1,256	12,439	11,317	23,756
Basic education	*From Grade 1 to Grade 6*	4,492	585,535	534,889	1,120,424
	From Grade 7 to Grade 9	775	289,454	282,532	571,986
Secondary education		457	215,876	287,655	503,531
Professional education		90	10,321	5,759	16,800
Total		5,814	1,113,625	1,122,152	2,235,777

Source: www.ins.nat.tn

Table 2.12: Instructional Hours per Subject and Grade

Grades	1	2	3 to 4	5 to 6	7	8 to 9
Mathematics	5	5	5	5	4	4
Science	1	1	2	2	1.30	1.30
Technological education	1	1	1	1.30	1	1
Computational education					1	1
Physics					1.30	1.30
Total instructional time	20	20	25	30	32	33
Ratio	35%	35%	32%	28%	28%	27%

Source: www.edunet.tn

Teachers and teacher education

Until 2007, to be recruited as a primary teacher, an applicant had to have the baccalaureate—a diploma received at the end of secondary school—and a diploma from the Higher Institute of Primary Teachers' Education (ISFM),[2] an academic institute for educating primary school teachers. Since 2008, to be recruited as a primary teacher, an applicant must have the baccalaureate and a three-year university license degree. Students who have a license in mathematics, which comprises three years of study in mathematics, physics, and computer sciences, and who want to become mathematics teachers have to pass a written examination set by the Ministry of Education and Training.

To be recruited as a secondary teacher, an applicant must have a university Master's degree. Students who have a Master's degree in mathematics (comprising four years of study in mathematics, physics, and computer sciences) and who want to become mathematics teachers also have to pass a written examination set by the Ministry of Education and Training.

In Tunisia, retention of primary and secondary teachers is not a concern. Generally, once recruited, teachers stay in their job. When a primary teacher leaves, it is generally because he or she wants to become a secondary teacher. When a secondary teacher leaves, it is generally because he or she wants to teach at higher institutes of education.

Tunisian mathematics teachers' professional development

After completing their initial pre-service teacher education, teachers have access to ongoing in-service education. Primary teachers with qualifications in mathematics are qualified to teach all subjects in Grades 1 to 6, while lower and upper secondary teachers are required to teach mathematics only.

Until 2007, primary teacher training took two years. During the first year, students took general subjects[3] and educational subjects.[4] During the second year, students took general subjects,[5] educational subjects,[6] and teaching practices and strategies.[7] During their teaching practice in schools, student teachers learned how to prepare and analyze a lesson. They also observed classes and took over the usual teacher's work in a classroom. The practice component was staffed by primary teachers with considerable experience, and it was under the supervision of inspectors. Since 2008, this program of primary teacher training has been reduced to one year.

Mathematics is a compulsory subject for all student teachers and represents 8% of their total curriculum. The main objectives of this mathematics tuition framework are to provide future teachers with opportunity to develop problem-solving, thinking, reasoning, communication, and modeling skills and to learn how to teach mathematics by using appropriate methods and strategies. The target of this learning is to provide teachers not only with the understandings and abilities they will need to meet their students' needs but also to remain mindful of current curricular reforms in mathematics education.

The mathematics curriculum for primary teachers contains two components—a theoretical component and a practical component. The theoretical component focuses on mathematical, didactical, and pedagogical knowledge. The theoretical component is overseen by universities, secondary teachers, and primary school inspectors.

The initial mathematics education for secondary teachers involves two steps. The first and most important step is the academic mathematics education offered by the universities. The second step is the teacher training that is under the jurisdiction of the Ministry of Education and Training. Mathematics graduates who want to teach in secondary schools receive several months of such training, after which they sit a written examination. Those who pass this examination are then deemed eligible to be mathematics teachers,

2 The ISFM is being replaced by other institutes.

3 Mathematics (two hours per week), sciences (three hours per week), humanities (two hours per week), Arabic (four hours per week), French (four hours per week), arts (two hours per week), physical education (two hours per week), technology (two hours per week).

4 Philosophy of education (one hour per week), psychology (one hour per week).

5 Mathematics (two hours per week), sciences (three hours per week), Arabic (two hours per week), French (two hours per week), arts (two hours per week), physical education (two hours per week), technology (two hours per week).

6 Pedagogy (two hours per week).

7 Practices (eight hours per week).

but they first have to undergo three or four[8] months of training before sitting an oral examination. Those students who pass the oral examination are recruited as lower and upper secondary teachers. They are then given a further period of training (50 hours in total) over three weeks in a summer school, where the program focuses on subjects such as educational philosophy and psychology as well as ICT.

As with primary school pre-service education, the teacher training education for secondary teachers includes a theoretical component and a practical component, and is overseen by inspectors of mathematics. The theoretical training focuses on mathematical, didactical, and pedagogical considerations. During their practice teaching, the prospective teachers observe and analyze lessons under the supervision of a highly experienced teacher. They also have to prepare lessons and obtain instructional experience by taking the place of the supervising teacher in the classroom.

In-service teacher training

Until the educational reforms of 2002, mathematics teachers' in-service education was traditional in nature and focused on mathematics courses (especially in geometry), pedagogical methods, and assessment procedures. From 2003 on, these foci were considered no longer relevant to the content and provisions of the new mathematics curriculum. Today, mathematics education requires teachers to develop professional abilities that allow them to meet the challenges of providing all students with mathematics teaching of a high quality. Another requirement is that this provision not only takes account of students' different learning abilities and learning speeds but also offers students opportunities to use mathematics in other disciplines.

To help teachers meet these challenges and to promote the educational reform, the Tunisian Ministry of Education and Training conducted a parallel reform of teachers' in-service education and based it on the principle of professional development. The overall aim of the new training program now in place within the ministry is to improve students' achievement and other educational outcomes through innovation related to teaching objectives, subject-matter content, and teaching methodology.

This new framework[9] also accords teachers more autonomy in their role within the educational process. To this end, the framework provides teachers with opportunities to accomplish the following:

- Develop reflective skills;
- Consolidate their mathematical knowledge;
- Be well informed and aware of the new pedagogical and didactical methods;
- Learn by themselves;
- Have access to effective instructional and technological tools;
- Work collaboratively with other teachers; and
- Participate with other educational staff to improve the role of the school in society.

Ongoing mathematics training is compulsory for all primary teachers and is available throughout the year. It represents 30% of the total ongoing training for primary school teachers and is staffed by primary school inspectors. The newly developed framework mentioned above focuses on equipping primary school teachers with the following: mastery of all mathematics concepts within the school mathematics curriculum, problem-solving strategies (especially for problems related to everyday life), assessment procedures, and the teaching/learning process involved in mathematics. Training concerning pedagogical approaches and the use of technology is an integral part of the general training.

Ongoing training for secondary teachers is also available throughout the year, and is staffed by mathematics inspectors. Over a period of 15 weeks, one day (eight hours) per week is reserved for this professional development. This translates into a total of six days of in-service education per year that every teacher must attend. The in-service professional development program on offer to teachers in Tunisia also provides tuition in a summer school (usually involving one to three weeks) for teachers interested in a specific area (e.g., mathematics, ICT, pedagogy, didactics).

In general, an in-service curriculum is developed each year to serve as a guideline for what should be taught. It typically includes three components—

8 According to the date of the examination.
9 According to the mathematic training program of 2002–2003.

mathematics subjects, pedagogical and didactical subjects, and technology subjects. The training in mathematics concerns topics that are connected to changes in the curriculum and in the textbooks. The intention of this training is to update and bring depth to the teachers' knowledge of these topics, with the ultimate aim of improving student learning.

CHAPTER 3

Algeria: Analysis of differences in students' mathematics performance

A look at student gender, parental education, school location, teaching experience, and class size

Lazri Mokhtar

3.1 EXECUTIVE SUMMARY

Because Algeria did not join the TIMSS assessment program until 2007, the study documented in this chapter covers the two other Maghreb countries that participated in TIMSS 2003, namely Morocco and Tunisia. The aim of the study was to investigate the influence of certain factors on the TIMSS 2003 mathematics scores of a representative sample of Grade 8 students from these two countries. The factors under review included students' gender, parents' level of education, school location (urban, semi-urban, or rural), teachers' length of service, and number of students per class. This study included a comparison of the average mathematics performance for the two countries and a regression analysis to identify the relative strength of factors in predicting students' performance in mathematics. Results showed that:

- In both Tunisia and Morocco, boys performed significantly better than girls on the TIMSS mathematics assessment.
- For the two Maghreb countries, 47% of the students had parents who had completed primary education, 33% had parents who had completed upper or lower secondary education, and 20% had parents who had attained a university or equivalent qualification.
- In Morocco as well as in Tunisia, the general pattern was such that the higher the level of parental education, the higher the level of achievement. Moreover, with two exceptions, all differences were significant. When gender differences were examined by level of parental education, results showed that the gender gap favoring boys was bigger for lower levels of parental education in Tunisia, whereas no consistent pattern emerged in Morocco.
- In Morocco, no significant differences in mathematics performance were evident in regards to school location. In Tunisia, schools in semi-urban areas performed at a significantly higher level than schools in rural areas and schools in urban areas.
- In Tunisia, significant differences were observed between those students with teachers who had "up to 10 years' teaching experience" on the one hand and those students whose teachers had "between 11 and 25 years" or "26 years or more" of service on the other hand. Students taught by the more experienced teachers performed at a higher level in mathematics than students taught by the less experienced teachers. No significant differences were found in Morocco.
- In Morocco, no significant difference could be discerned between classes with up to 34 students and those with more than 34 students. The same could not be said of Tunisia. There, the mathematics performance of students in classes exceeding 34 students was clearly superior to the performance of students from classes with fewer students.

3.2 INTRODUCTION

In developing countries experiencing new demands imposed largely by developed countries, education is looked upon with considerable importance. Faced with the risk of being left behind, developing countries must give priority to education, which is the only alternative capable of bringing these countries to the level of those countries that have advanced scientific potential and know-how.

Aware of the weakness of their schools' performance, many developing countries have implemented plans designed to evaluate school curricula and to identify weaknesses created by a teaching staff generally in need of training or retraining as well as by an infrastructure that is sometimes inappropriate or even deficient. Pedagogy has evolved and now puts the student at the center of learning activities, while school education must enable entry to a world that is more demanding than ever of an educated populace. Today, technology is a pivotal element in society, and designing, using, and adapting to the changes brought about by it requires school graduates to have a more extensive knowledge than previously of, amongst other subjects, mathematics, physics, and the natural sciences. In addressing these concerns relative to the performance of the individual student and the individual school, we need to consider a number of questions, most notably:

- Which factors favor or inhibit students' performance in mathematics as a school subject?
- Does performance in mathematics in the Maghreb countries meet international standards?
- Are all factors (parents, teachers, schools, community) that influence students' school careers known, understood, and addressed by those involved with planning, implementing, and delivering educational programs?

Since the beginning of the 1960s, sociologists have shown that school achievement is strongly linked to the social origin of the students and particularly to the parents' level of education (Baudelot & Establet, 1989; Bourdieu & Johnson, 1993). Amongst the factors that influence a student's likelihood of continuing his or her studies and which tend to be mediated through mimicry (imitation of the value that other families, who often reside in the same areas, place on having children who succeed in the education system) or obstinacy (referring to parents who want their children to succeed at any price) is the parents' level of education. The impact of this factor on children's progress and achievement during their school career and its eventual impact on people's ability to enter more highly paid and regarded careers—generally the professions—cannot be overestimated. The mother tends to be particularly important in this context, as it is often she who is the family member most conscious of the importance of education. The value she places on education influences the extent to which her children regard education as important, which then influences achievement and the desire to pursue more academically oriented careers, for example in science (Lietz, Miller, & Kotte, 2002). Fathers tend to provide the occupational model (i.e., vocational choice) to which their children aspire or even surpass.

The cases of Morocco and Tunisia, however, are atypical in terms of paternal education considerations, especially when considered against Western norms. The level of parental education is quite different in Morocco and Tunisia from that in Western countries, as almost a third of the former two countries' overall populations and at least 50% of their women, especially in rural areas, are illiterate. Lacking sustained educational experience, illiterate and poorly educated parents often lack knowledge of the education system, making it difficult for them to fully participate within the school system and to encourage their children to do the same.

Other factors that were a particular focus of the present study were teachers' length of service, school location (urban, semi-urban, and rural), and class size. Schools located in an urban environment tend to have a school population drawn from families of relatively higher socioeconomic status than families of students in rural institutions. In general, more experienced teachers tend to gravitate toward the urban schools and those who are less experienced toward the rural schools. Also, Woessmann and West (2006) found in the TIMSS assessment that smaller classes exhibit beneficial effects in countries with relatively low teacher salaries (e.g., Morocco and Tunisia). Therefore, the large class sizes found in these countries may be associated with relatively poor performance.

These considerations gave rise to the following research questions and sub-questions:

- Are there significant differences in the overall mathematics performance between male students and female students in the two Maghreb countries?
- To what extent is parental education associated with TIMSS eighth grade educational achievement in Morocco and Tunisia?

- Do boys and girls show significant differences on mathematical performance based on their parents' education?
- Is there a significant difference in student achievement between the two Maghreb countries in terms of gender differences relative to the educational level of the parents?
- Is there a significant difference between school location (urban, semi-urban, rural) and TIMSS mathematics performance?
- Is there an association between student performance on TIMSS and teacher length of service?
- Does student performance differ depending on class size (i.e., more than 34 students per class and fewer than 34 students per class)?

3.3 METHOD

To address these questions, the analysis compared the average scores on the mathematics test in relation to students' gender, parents' level of education, school location, teachers' length of service, and number of students per class. Regression analysis was also used to determine if significant relationships between student achievement and parents' level of education, school location, teachers' length of service, and number of students per class could be observed.

The variables used in the comparisons of mean achievement in mathematics and in the regression analyses were:

- BSMMAT01–05: Mathematics achievement scores
- ITSEX: Student gender
- BSDGEDUP: Parental level of education
- IDSTRATI: School location (urban, semi-urban, rural)
- BTBGTAUT: Teachers' length of service
- BTBMSTUD: Number of students per class.

It is important to note that the responses to the questionnaires in Morocco did not provide data for Level 2 of the variable "BSDGEDUP." With this in mind, and to harmonize the level of education between the two countries, education Levels 1 and 2 were combined as follows:

- *Level of parental education—original*
  - Level 1: Completed university studies or equivalent
  - Level 2: Tertiary non-university education
  - Level 3: Completed secondary studies
  - Level 4: Completed lower secondary studies
  - Level 5: Did not go further than primary.
- *Level of parental education—used in the analyses*
  - Level 1: Completed university studies or equivalent or have completed non-university education
  - Level 3: Completed secondary studies
  - Level 4: Completed lower secondary studies
  - Level 5: Did not go further than primary.

In addition, the variable measuring school location was recoded as follows:

- Urban (1) = 1 ("more than 500,000 people")
- Semi-urban (2) = 2 ("100,001 to 500,000 people"), 3 ("50,001 to 100,000 people")
- Rural (3) = 4 ("15,001 to 50,000 people"), 5 ("3,001 to 15,000 people"), 6 ("3,000 people or fewer").

It should also be noted that the Moroccan sample did not completely meet international standards. Thus, while results based on the Moroccan data should be treated with caution, they can nevertheless be regarded as a preliminary indication of underlying patterns.

3.4 RESULTS

The research findings reported in this section align with the framework of research questions and methods presented above. Six tables are presented, each providing results separately for Morocco and Tunisia.

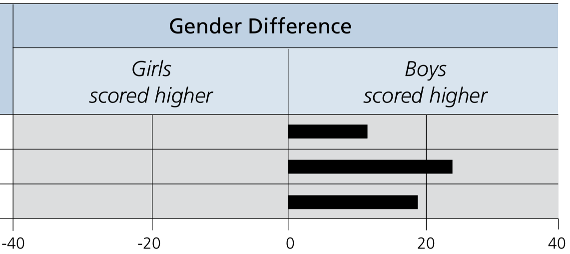
As can be seen in Table 3.1, there is a difference between boys and girls in both countries, with boys performing at a higher level than girls in mathematics. This advantage in favor of boys was significant in Morocco as well as in Tunisia.

Table 3.2 illustrates significant differences in mathematics performance depending on the three categories of parental education for the two Maghreb countries. With the exception of one instance in Morocco, the results show that the higher the parents' level of education, the higher the mean achievement of the students.

As indicated previously, education Levels 1 and 2 were merged for Morocco to allow a comparison between this country and Tunisia. In Morocco, no

Table 3.1: Average Mathematics Performance of Students by Gender in the Two Maghrebian Countries

Country	Girls		Boys		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
1 ‡ Morocco	50 (1.8)	381 (2.8)	50 (1.8)	393 (3.1)	12 (3.1)
Tunisia	53 (0.7)	399 (2.6)	47 (0.7)	423 (2.2)	24 (1.9)
Maghrebian average	51 (1.0)	390 (1.9)	49 (1.0)	408 (1.9)	18 (1.8)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
■ The difference is significant at (α=0.05).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.2: Average Mathematics Performance of Students by Parents' Level of Education in the Two Maghrebian Countries

Country	Finished univ/equiv/higher		Finished upper sec school		Finished lower sec school		No more than primary		Difference univ/upp (absolute value)	Difference uni/low (absolute value)	Difference uni/no more (absolute value)	Difference upp/low (absolute value)	Difference upp/no more (absolute value)	Difference low/no (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent scored higher*	*Average scored higher*	*Percent of students*	*Average scale score*						
1 ‡ Morocco	16 (1.3)	406 (4.8)	17 (0.9)	398 (5.3)	17 (1.1)	372 (5.6)	50 (1.7)	386 (3)	8 (6.4)	34 (7.1) ▲	21 (5.2) ▲	26 (7.8) ▲	13 (5.1) ▲	13 (6.8)
Tunisia	23 (1.4)	437 (4.2)	16 (0.7)	419 (3.7)	17 (0.7)	406 (2.8)	44 (1.5)	397 (2.4)	18 (4.0) ▲	31 (4.6) ▲	39 (4.7) ▲	13 (4.0) ▲	21 (4.0) ▲	8 (3.1) ▲
Maghrebian average	20 (0.9)	421 (3.2)	16 (0.5)	408 (3.2)	17 (0.7)	389 (3.1)	47 (1.1)	391 (1.9)	13 (4.0) ▲	32 (4.2) ▲	30 (3.5) ▲	19 (4.4) ▲	17 (3.2) ▲	2 (3.7)

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.
▲ The difference is significant at (α=0.05).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

significant difference in mathematics achievement emerged between students with parents who had undertaken university studies and those whose parents had completed secondary studies. Likewise, the difference between students whose parents had completed lower secondary schooling and those students whose parents had finished only primary schooling was not significant. In all other instances, however, significant differences in performance were observed between students relative to the different categories of parental education.

In Tunisia, the results were clear-cut because significant differences emerged across all four categories. Here, too, the higher absolute performance scores for higher levels of parental education demonstrated that students with more highly educated parents performed at a significantly higher level than their peers with less well-educated parents.

Table 3.3 differentiates mathematics performance according to gender and parental education. In general, the results in the table show that boys in both countries performed at a higher level than girls in mathematics and that this difference was evident for all levels of parental education. Thus, male students performed at a significantly higher level than female students in both countries. In Tunisia, this difference was evident regardless of whether the students' parents had a higher or a lower level of education.

A particular point to note is that, in Tunisia, gender differences increased as the amount of parental education decreased. In other words, gender differences became less pronounced as the level of parental education increased. However, this pattern was not observed in Morocco.

In the Maghreb region, the school is often viewed as the basic "cell" around which students, teachers, and parents revolve. As such, its location is assumed to be associated with student performance. Table 3.4 shows the differences in students' performance in regard to school location in the two Maghreb countries. As is evident from the table, no statistical differences in student achievement relative to school location were observed for Morocco. In Tunisia, however, statistically significant differences emerged between students from urban and students from semi-urban schools and between students from semi-urban and students from rural schools. These differences favored schools in semi-urban areas, which outperformed the schools in urban and rural locations in this country.

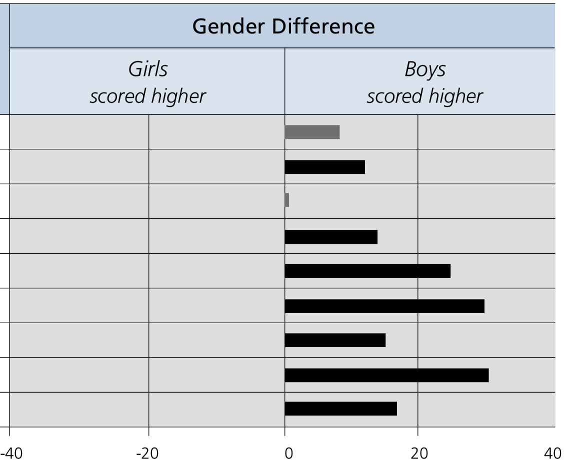
As noted earlier, students who are instructed by teachers with greater experience in educational practice might be expected to perform better academically than students with teachers with less teaching experience. However, the mathematics performance of students from Morocco did not support this assumption, as the results in Table 3.5 attest. In Tunisia, however, the performance of students of teachers with "up to 10 years of experience" was significantly lower than the performance of students whose teachers had "between 11 and 25 years" or "26 years and more" of service. However, the difference in average scores between students taught by teachers with "between 11 to 25 years" of service and students taught by teachers with "26 plus years" of service was not significant.

As noted above, another factor that appears to be associated with students' achievement scores to a greater or lesser extent is class size. When classes are overcrowded, individualization is difficult to apply. Indices of overcrowding vary cross-nationally, but for the current analysis an overly large class was defined as a class with more than 34 students. The expectation was that those students participating in TIMSS from classes with more than 34 students would perform less well than students from classes with 34 students or fewer. Table 3.6 shows the somewhat surprising results of this analysis.

In Morocco, the difference in average mathematics scores between students from classes with 34 students or fewer and those from classes with more than 34 students was not significant, while in Tunisia, students from classes with more than 34 students performed at a higher level than students from classes with fewer than 34 students. These results run counter to our initial assumption that students in smaller classes can be expected to perform at a higher level than students in larger classes. The reason for this result might lie in the composition of the larger classes in these countries, which could have consisted of students who had demonstrated such sound mathematical

Table 3.3: Average Mathematics Performance of Students by Parents' Level of Education and by Gender in the Two Maghrebian Countries

Country		Parents' level of education	Girls		Boys		Difference (absolute value)
			Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
1 ‡	Morocco	University studies or equivalent completed	49 (3.4)	402 (6.5)	51 (3.4)	410 (7.4)	7 (10.2)
	Tunisia	University studies or equivalent completed	48 (1.6)	432 (4.8)	52 (1.6)	441 (4.7)	9 (4.5)
1 ‡	Morocco	Secondary studies completed	51 (3.4)	398 (8.1)	49 (3.4)	398 (6.3)	0 (9.9)
	Tunisia	Secondary studies completed	54 (2.0)	413 (4.3)	46 (2.0)	426 (4.5)	13 (4.6)
1 ‡	Morocco	Lower secondary studies completed	54 (3.7)	361 (7.1)	46 (3.7)	385 (7.7)	24 (9.6)
	Tunisia	Lower secondary studies completed	51 (1.7)	391 (3.7)	49 (1.7)	421 (3.2)	29 (4.3)
1 ‡	Morocco	Did not go further than primary	50 (1.9)	378 (3.3)	50 (1.9)	393 (3.9)	14 (4.2)
	Tunisia	Did not go further than primary	56 (1.2)	384 (2.6)	44 (1.2)	414 (2.8)	30 (2.7)
Maghrebian average			52 (0.9)	395 (1.9)	48 (0.9)	411 (1.9)	16 (2.4)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 3.4: Average Mathematics Peformance of Students by School Location in the Two Maghrebian Countries

Country		Urban		Semi-urban		Rural		Difference urban/semi-urban (absolute value)	Difference semi-urban/rural (absolute value)	Difference urban/rural (absolute value)
		Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent of students*	*Average scored higher*			
1 ‡	Morocco	5 (2.7)	390 (12.4)	10 (2.8)	370 (10.2)	85 (3.0)	385 (2.9)	21 (16.4)	16 (10.9)	5 (13.2)
	Tunisia	3 (1.4)	401 (5.7)	17 (2.7)	429 (7.5)	80 (3.0)	406 (2.3)	28 (9.1) ▲	23 (7.8) ▲	5 (6.1)
Maghrebian average		4 (1.5)	396 (6.8)	14 (1.9)	399 (6.3)	83 (2.1)	396 (1.8)	3 (9.4)	4 (6.7)	0 (7.3)

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
▲ The difference is significant at (α=0.05)
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

ability in their schooling up to Grade 8 that they were considered able to cope with the larger class setting. At the same time, Grade 8 students who had displayed difficulties in mathematics in their school education might have been, where possible, put into smaller classes on purpose in order to assist them individually.

3.6 CONCLUSION

The analyses reported in this chapter were conducted in order to investigate differences in the mathematics performance of Grade 8 students in the two Maghreb countries for which data were available from the TIMSS 2003 assessment. The differences considered were student gender, parental education, school location, teacher experience, and class size.

In regard to gender, the results in mathematics differed significantly between boys and girls in both Tunisia and Morocco, with boys performing at a significantly higher level than girls. The examination of performance differences depending on parental education in combination with gender revealed that, in Morocco, gender differences were not significant for the two highest levels of parental education. For the lower two levels of parental education, the gender differences were significant. In Tunisia, the differences in performance between boys and girls were significant irrespective of the parents' level of education. In both countries, the gender differences in performance increased as the level of parental education decreased.

Descriptive statistics of parental education showed that, on average for the two countries, 20% of Grade 8 students had parents who had completed university education, 16% had parents who had completed upper secondary school, 17% had parents who had completed lower secondary school, and 47% had parents who had completed primary school education. The comparison of student performance for the different levels of parental education revealed significant differences. In general, children who had parents with a higher level of education performed significantly better than students who had parents with lower levels of education. This was certainly the case in Tunisia, where all differences between students from different parental education backgrounds were significant. In Morocco, however, two comparisons were not significant. One was the difference between students with parents who had undertaken university studies and those whose parents had completed their secondary studies. The other was the difference between students whose parents had completed only primary education and those with parents who had completed lower secondary education.

These results strongly support the view that the relationship between parents' educational attainment and students' school performance in mathematics is a reality that educational stakeholders within Morocco and Tunisia have to take into consideration. Parents should acknowledge themselves as important partners with schools, school staff, and educational policymakers in the educational environment. As shown in a number of studies (e.g., Keeves & Watanabe, 2003; Ware & Garber, 1972), parents contribute, by way of their level of education, to higher school achievement results not only in mathematics but also in other subjects. In general, there appears to be a greater likelihood of students whose parents have a lower level of education residing in areas that are socioeconomically disadvantaged. For these areas, an assistance strategy promoting the creation of libraries, cultural centers, and other schooling aid centers could help to increase the educational opportunities and ultimately the academic achievement of such students.

In Morocco and Tunisia, students from rural areas have traditionally performed less well than their peers in urban areas. However, a bold, dynamic educational policy in both countries directed at improving educational provision in the rural environment has substantially reduced this achievement gap. In both countries, no significant differences emerged in mathematics performance between students from schools in rural areas and students from schools in urban areas. In Tunisia, however, students in semi-urban schools were still outperforming students from rural and urban schools to a significant degree. One explanation for the general lack of differences across the three location environments in the two countries could be because recent improvement initiatives have led to rural and semi-urban schools no longer being disadvantaged in terms of staff or school equipment relative to schools in the urban environment.

Table 3.5: Average Mathematics Performance of Students by Teachers' Length of Service in the Two Maghrebian Countries

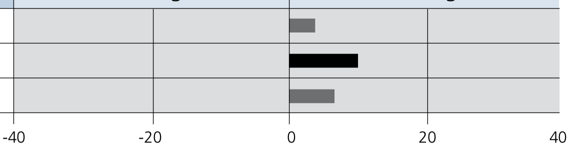
Country	<=10 years		Between 11–25 years		26 years and more		Difference (VA) <=10 years & 11–25 years value	Difference (VA) 11–25 years & 26 years and more	Difference (VA) <=10 years & 26 years and more
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent of scored higher*	*Average scored higher*			
1 ‡ Morocco	15 (4.9)	395 (14.5)	77 (5.4)	387 (4.0)	9 (4.0)	388 (12.3)	9 (15.0)	1 (19.9)	7 (13.3)
Tunisia	55 (4.3)	403 (2.7)	37 (4.4)	427 (5.6)	8 (2.9)	435 (10.3)	24 (6.2) ▲	8 (10.3)	32 (11.8) ▲
Maghrebian average	55 (3.3)	399 (7.4)	57 (3.5)	407 (3.5)	8 (2.5)	411 (8.0)	8 (8.1)	5 (11.2)	12 (8.9)

Notes:

1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
▲ The difference is significant at (α=0.05)
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

Table 3.6: Average Mathematics Performance of Students by Class Size in the Two Maghrebian Countries

Country	34 students or fewer		More than 34 students		Difference (absolute value)	Difference class size	
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*		*<= 34 students scored higher*	*> 34 students scored higher*
1 ‡ Morocco	31 (8.2)	387 (5.2)	69 (8.2)	391 (5.5)	4 (7.6)		
Tunisia	35 (3.6)	404 (2.9)	65 (3.6)	414 (3.4)	10 (4.4)		
Maghrebian average	33 (4.5)	395 (3.0)	67 (4.5)	402 (3.2)	7 (4.4)		



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

In Morocco, no statistically significant differences in students' mathematics performance were evident in terms of teachers' length of service. In contrast, in Tunisia, significant differences were observed between students whose teachers had "up to 10 years" of teaching experience on the one hand and students whose teachers had "between 11 and 25 years" or "26 years or more" of service on the other hand. In this case, the difference favored the students taught by the more experienced teachers.

Finally, in response to the question as to whether or not class size had an influence on the students' mathematics performance, no significant differences emerged in Morocco for students from classes with 34 students or fewer and those from classes with more than 34 students. In Tunisia, however, a clear difference emerged: students in larger classes attained higher mathematics achievement scores than did students in the smaller classes, a finding contrary to popular belief. Explanation for this interesting finding requires further research into the composition of these larger classes and the special circumstances and particular features of the schools in which these larger classes were and are found.

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CHAPTER 4

Egypt: Analysis of differences in achievement in regards to schools' use of enrichment and remedial work in mathematics and science

Mohammed Saad El Orabi

4.1 EXECUTIVE SUMMARY

The aim of the analyses reported in this chapter was to investigate if statistically significant differences could be observed between the performance in mathematics and science of Grade 8 students in Egyptian schools with enrichment and remedial programs and of Grade 8 students in Egyptian schools without such programs. To address this issue, data for Egypt were analyzed within both a national and a pan-Arabic context. The results showed that:

- In Egypt, no significant difference in student performance in mathematics or science could be observed depending on whether or not schools used enrichment or remedial work.
- Across the Arabic countries under review, Jordan was the only country in which student performance in mathematics was significantly higher for students who were offered enrichment programs in schools.
- Likewise, the only country in which performance in science differed significantly in terms of the presence or absence of an enrichment program was Jordan.
- Across the Arabic countries under review, the Palestinian National Authority was the only country in which performance in mathematics was significantly higher for students in schools with a remedial program.
- No significant differences in performance in science relative to the presence or absence of a remedial program were observed in any of the Arabic countries under review.

4.2 INTRODUCTION

Classroom instruction is usually designed for students whose intellectual abilities are at the level of the majority of their age group. Hence, special programs or activities are required to cater for students with differing intellectual abilities, either because they have learning difficulties or because they have unusually high abilities. In other words, schools have to offer different programs and activities that are designed to encourage the academic success of all students.

In this context, students with learning difficulties or impairments benefit from remedial activities that provide opportunities for positive reinforcement and strengthen academic learning of those skills that the students have already acquired. Here, the learning environments and activities that prevail are those that aim to achieve the following:

- Increase the child's experience of success;
- Involve the child in new social relationships; and
- Increase the child's interest in acquiring new abilities.

At the other extreme, schools have to create *enrichment programs* and plenty of activities for students of high ability in mathematics and science because the usual program aimed at the average level of ability will not fulfill their increased capacity to acquire knowledge and skills. In general, two different strategies exist to cater for such students. The first, called the acceleration strategy, gives students the opportunity to graduate before their fellow students of the same age. This strategy is not permitted in Egypt. The second strategy, called instructional enrichment, is based on activities and instructional materials that are provided in addition to those of the ordinary program. Moreover, this strategy allows the more able students to be instructed separately from their peers for a certain part of the time in order to develop and encourage their learning.

Because it is thought that remedial as well as enrichment programs influence student achievement, this report focuses on the extent to which schools in Egypt provide a supportive learning environment by offering such programs to their students in the subject areas of mathematics and science, and what the effect of the presence of such an environment is on student achievement in these subjects. Data from TIMSS 2003 provided policymakers in Egypt with an opportunity to examine this matter in relation to their own schools and students, as well as in relation to the other Arabic countries that participated in TIMSS 2003. The overarching hypothesis of this analysis was that the schools providing a supportive learning environment in the form of remedial and enrichment programs would show higher achievement in mathematics and science than would the schools not providing such an environment. Acceptance or rejection of this hypothesis depended on answers to the following specific research questions:

1. Across the eight Arabic countries, did the *mathematics* performance of Grade 8 students in schools with *enrichment* programs significantly differ from that of Grade 8 students in schools without such programs?
2. Across the eight Arabic countries, did the *science* performance of Grade 8 students in schools with *enrichment* programs significantly differ from that of Grade 8 students in schools without such programs?
3. Across the eight Arabic countries, did the *mathematics* performance of Grade 8 students in schools with *remedial* programs significantly differ from that of Grade 8 students in schools without such programs?
4. Across the eight Arabic countries, did the *science* performance of Grade 8 students in schools with *remedial* programs significantly differ from that of Grade 8 students in schools without such programs?

4.3 METHOD

Addressing these four questions involved the following steps:

1. Identification of those items in the TIMSS 2003 mathematics and science school questionnaires for Grade 8 that related to using enrichment and remedial works. These were "use enrichment works in mathematics" (BCBMSOEM), "use enrichment works in science (BCBSSOES), "use remedial works in mathematics" (BCBMSORM), and "use remedial works in science" (BCBSSORS). These items were the independent variables used in the analysis.
   2. Using the following IEA IDB Analyzer© settings:
      (a) The independent variable: frequencies of options (yes\no) for using enrichment as well as remedial works in mathematics and science,
      (b) Dependent variables: plausible values of overall mathematics and science achievement, and
      (c) Analysis procedure: "achievement regressions"

   in order to ascertain if differences in performance based on the use of remedial and enrichment works were significant.
3. Creation of results tables using Excel software.

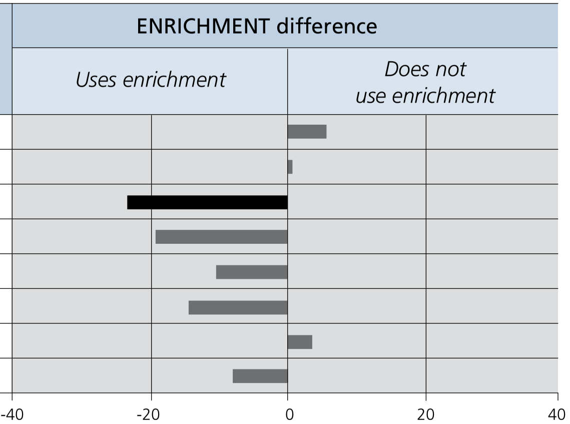
4.4 RESULTS

Table 4.1 presents the findings of the analysis on the relationship between mathematics achievement and the presence or absence of a school enrichment program. Table 4.2 provides the findings of the corresponding analysis for science achievement. Tables 4.3 and 4.4 present the findings of the analyses between respectively mathematics and science achievement and whether or not schools had remedial programs.

Table 4.1 shows that a significant difference in mathematics achievement depending on whether or not schools used enrichment activities emerged for only one country—Jordan. Here, students scored significantly higher in schools that had an enrichment program in mathematics than did students in schools that did not have an enrichment program. Although differences in favor of schools offering enrichment activities were reported in four of the eight Arabic countries, none of these differences was significant.

Table 4.1: Students' Average Achievement in Mathematics According to Presence or Absence of a School Enrichment Program in the Eight Arabic Countries

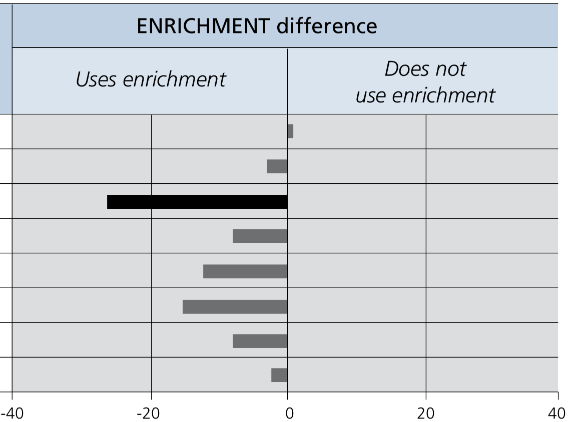
	Country	Uses enrichment program				Does not use enrichment program				Difference (absolute value)	
		Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
	Bahrain	92.82	(0.1)	399.22	(1.8)	7.18	(0.1)	406.05	(6.2)	6.83	(6.3)
	Egypt	74.65	(4.1)	409.45	(4.6)	25.35	(4.1)	410.27	(8.1)	0.82	(9.9)
	Jordan	63.62	(4.2)	433.93	(5.6)	36.38	(4.2)	409.39	(6.2)	24.55	(8.2)
	Lebanon	76.44	(7.2)	442.50	(9.0)	23.56	(7.2)	423.23	(11.3)	19.27	(14.5)
1 ‡	Morocco	45.78	(5.0)	390.25	(4.6)	54.22	(5.0)	380.77	(2.6)	9.48	(5.4)
	Palest. Natl Auth.	79.29	(2.8)	394.88	(4.2)	20.71	(2.8)	382.43	(7.7)	12.45	(8.8)
	Saudi Arabia	42.35	(5.4)	329.59	(7.9)	57.65	(5.4)	333.67	(5.6)	4.07	(9.7)
	Tunisia	39.92	(3.9)	414.95	(3.7)	60.08	(3.9)	407.20	(3.2)	7.75	(5.0)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 4.2: Students' Average Achievement in Science According to Presence or Absence of a School Enrichment Program in the Eight Arabic Countries

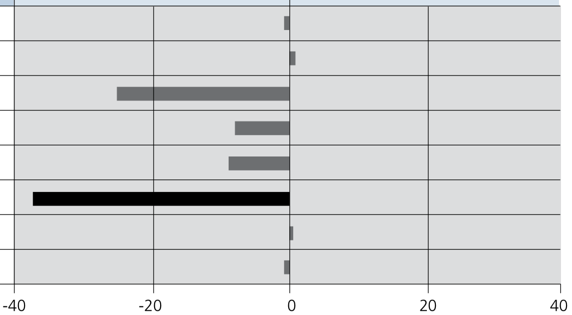
	Country	Uses enrichment program				Does not use enrichment program				Difference (absolute value)	
		Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
	Bahrain	95.26	(0.1)	437.92	(1.8)	4.74	(0.1)	438.86	(7.8)	0.94	(7.9)
	Egypt	75.25	(4.1)	425.40	(4.8)	24.75	(4.1)	421.94	(8.9)	3.46	(10.3)
	Jordan	61.41	(4.1)	486.49	(4.6)	38.59	(4.1)	459.30	(5.8)	27.19	(6.9)
	Lebanon	52.89	(4.3)	399.32	(7.2)	47.11	(4.3)	391.88	(7.0)	7.43	(11.1)
1 ‡	Morocco	29.11	(3.9)	405.38	(5.8)	70.89	(3.9)	392.72	(3.2)	12.66	(6.5)
	Palest. Nat'l Auth.	80.34	(3.4)	438.38	(4.2)	19.66	(3.4)	424.39	(10.3)	13.99	(11.9)
	Saudi Arabia	52.99	(6.6)	405.70	(5.1)	47.01	(6.6)	397.86	(7.1)	7.84	(8.2)
	Tunisia	40.27	(4.3)	405.06	(2.8)	59.73	(4.3)	402.03	(3.3)	3.04	(4.4)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 4.3: Students' Average Achievement in Mathematics According to Presence or Absence of a School Remedial Program in the Eight Arabic Countries

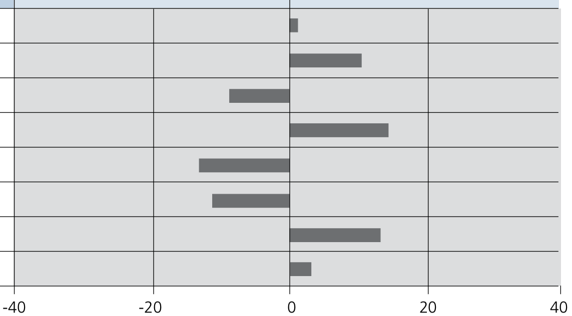
	Country	Uses remedial program		Does not use remedial program		Difference (absolute value)	REMEDIAL difference
		Percent of students	*Average scale score*	*Percent of students*	*Average scale score*		*Uses remediation* / *Does not use remediation*
	Bahrain	96.34 (0.1)	401.02 (1.8)	3.66 (0.1)	400.21 (7.0)	0.80 (7.2)	
	Egypt	64.51 (4.1)	405.71 (5.3)	35.49 (4.1)	406.44 (6.2)	0.73 (8.1)	
	Jordan	91.16 (2.5)	426.50 (4.6)	8.84 (2.5)	400.32 (13.0)	26.18 (14.1)	
	Lebanon	43.72 (9.1)	435.42 (15.3)	56.28 (9.1)	427.71 (10.7)	7.71 (18.6)	
1 ‡	Morocco	25.46 (5.5)	390.87 (6.7)	74.54 (5.5)	380.89 (2.9)	9.99 (7.5)	
	Palest. Nat'l Auth.	89.38 (2.3)	394.44 (3.5)	10.62 (2.3)	358.92 (10.6)	35.51 (11.7)	
	Saudi Arabia	44.76 (4.7)	331.69 (6.3)	55.24 (4.7)	332.15 (6.4)	0.46 (8.8)	
	Tunisia	62.36 (4.2)	410.75 (2.8)	37.64 (4.2)	409.60 (4.1)	1.14 (5.1)	



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 4.4: Students' Average Achievement in Science According to Presence or Absence of a School Remedial Program in the Eight Arabic Countries

	Country	Uses remedial program		Does not use remedial program		Difference (absolute value)	REMEDIAL difference
		Percent of students	*Average scale score*	*Percent of students*	*Average scale score*		*Uses remediation* / *Does not use remediation*
	Bahrain	90.33 (0.1)	435.80 (2.0)	9.67 (0.1)	437.49 (4.0)	1.69 (4.4)	
	Egypt	74.14 (3.9)	420.78 (5.5)	25.86 (3.9)	431.21 (8.1)	10.44 (9.5)	
	Jordan	88.96 (2.9)	476.18 (4.2)	11.04 (2.9)	467.95 (16.4)	8.24 (17.6)	
	Lebanon	38.90 (5.2)	390.30 (11.1)	61.10 (5.2)	403.10 (7.5)	12.80 (14.1)	
1 ‡	Morocco	32.87 (4.7)	405.65 (6.7)	67.13 (4.7)	393.11 (3.6)	12.54 (8.2)	
	Palest. Nat'l Auth.	79.34 (3.6)	437.90 (4.2)	20.66 (3.6)	427.55 (9.1)	10.35 (11.1)	
	Saudi Arabia	52.47 (6.0)	387.00 (4.6)	47.53 (6.0)	399.06 (7.0)	12.06 (7.5)	
	Tunisia	40.18 (4.2)	401.15 (3.2)	59.82 (4.2)	405.36 (3.1)	4.21 (4.4)	



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

This latter result is particularly surprising given that the descriptive statistics showed that in Egypt nearly three quarters (74.65%; SE 4.1%) of the Grade 8 students participating in TIMSS 2003 had access to enrichment activities. The only countries in which the percentages were higher were Lebanon and Palestine, yet Egypt was the Arabic country with the smallest difference in achievement between the two types of schools. Hence, the question arises whether the enrichment activities on offer were sufficient or of the quality needed to have a positive influence on students' mathematics achievement.

The results of the analysis presented in Table 4.2 showed a significant science achievement difference relative to enrichment programs for only one of the Arabic countries, and again this was Jordan. Thus, the scores of students in Jordanian schools offering enrichment activities were significantly higher than the scores of students in Jordanian schools not using enrichment resources. In Egypt, although students in schools using enrichment programs performed at a higher level in science than students in schools not offering such programs, the difference was not significant.

Nevertheless, researchers suggest that Egypt places greater emphasis on providing a school environment that favors and uses enrichment activities and on making sure that teachers receive more training in this area. Follow-up research of particular relevance would be a project designed to monitor and track the nature of science-related enrichment activities in those schools that offer them and to determine just how much time across a typical school week students spend on them. It is possible that students need to spend more time than they do presently on enrichment activities for these to be effective.

The results of the analysis presented in Table 4.3 also show a significant difference in only one of the eight Arabic countries. In Palestine, students in schools that used remedial works performed significantly better in mathematics than did students in schools that did not use these activities. While there were differences in mathematics performance in favor of schools offering remedial programs also in Jordan, Lebanon, and Morocco, there was virtually no difference between the two types of schools in Egypt.

This lack of an effect in Egypt could be a consequence of a mismatch between the type of remedial works and special classes available to students with learning difficulties and the manner in which they are taught. Teachers within the Egyptian system tend to focus on getting students through examinations and hence often repeat or present lessons in the same way and at the same speed for all students, regardless of the specific problems any of them might be facing.

As is evident from Table 4.4, the science performance of students in schools that used remedial works during teaching of science was not higher than the performance of students in schools that did not use remedial works during the teaching of science, as posited by the study's overarching hypothesis. Indeed, the differences, although not significant, went in both directions. In Jordan, Morocco, and Palestine, students who engaged in remedial activities achieved at a higher level than students in schools not offering such programs. The opposite applied in Egypt, Lebanon, Saudi Arabia, and, to a lesser extent, Tunisia and Bahrain, where students who were given the opportunity of doing remedial work achieved at a lower level than students in schools that did not offer this type of work.

The reasons for this lack of significant beneficial effect of remedial work could be twofold. First, the lack of difference might reflect different practices in decisions concerning the implementation of remedial works in the respective Arabic countries. Second, the reason might lie in the design of remedial activities for students and the lack of appropriate training for teachers to provide effective remedial instruction.

4.5 CONCLUSION

The analyses presented in this chapter sought to examine the extent to which school environments that offer their students enrichment and remedial activities in mathematics and science influence the performance of students in those subjects. The analyses used data pertaining to Grade 8 students in Egypt and seven other Arabic countries.

In relation to enrichment work, the results showed a significant difference in students' mathematics achievement scores for only one country, Jordan. Thus, the scores of students in schools offering enrichment work in mathematics were significantly higher than the scores of students in schools not offering such activities.

The same result was observed for science, where a significant difference in science achievement was again recorded for Jordan only.

As regards remedial work, a significant difference in mathematics achievement emerged only for Palestine, whereas in science not one significant difference was found across any of the eight countries. In Egypt, the analyses found no significant differences between student achievement in mathematics or science depending on the use of either enrichment work or remedial work.

Several reasons for these results are proposed. First, there may have been a mismatch between the needs of the students and the type and implementation of the remedial and enrichment activities. Second, teachers might not have been sufficiently trained to offer effective remedial and enrichment work. A particular question that remains is whether, in some way, the provision of remedial and enrichment work by schools could be linked to the wealth of the school. In other words, further analyses should aim to investigate if the differences reported in this chapter remain after wealth indices, maybe in terms of the availability of school resources, are taken into account.

Finally, although there was limited evidence as regards some of the points, the undertaking of this study and the findings that emerged from it highlight the following considerations for the teaching and learning of mathematics and science in Arabic schools in general and Egyptian schools in particular, and for research related to these issues.

1. The importance of conducting evaluation studies that assess the quantity and quality of enrichment work in mathematics and science;
2. The importance of conducting evaluation studies that assess the quantity and quality of remedial work in mathematics and science;
3. The desirability of increasing the training of teachers and supervisors for preparing and following up enrichment and remedial work in mathematics and science;
4. The desirability for schools to rearrange lessons to increase the time that is available for enrichment and remedial activities in mathematics and science; and
5. The desirability of including mathematics and science activities in Egyptian textbooks and teacher guides for enrichment and remedial purposes.

A final point arising from the analysis is the concern that the information provided by teachers and principals might not, in all cases, accurately reflect the educational context experienced in Egypt.

CHAPTER 5

Jordan: Analysis of differences in mathematics and science achievement according to student gender, school location, school authority, and school resources over time

Khattab Abulibdeh and Manal Abdelsamad

5.1 EXECUTIVE SUMMARY

This study addressed four issues of particular interest to Jordanian educational policymakers. First, it investigated whether or not differences existed in the levels of performance in mathematics and science of Grade 8 students in Jordan depending on certain factors, namely student gender, school location, and school authority. Second, it analyzed the relationship between student achievement in mathematics and science and the availability of school resources. And, third, it examined the percentages of Jordanian students reaching international benchmarks in terms of those factors. These three issues were addressed using TIMSS 2003 data. The focus of the fourth and final analysis was on a comparison of mathematics and science performance of Grade 8 Jordanian students in 1999 and 2003. The results showed that:

- Girls outperformed boys in mathematics and science. Urban students outperformed rural students in mathematics, whereas in science urban students and rural students performed similarly. The performance in mathematics and science of students in private schools was better than the performance in these subjects of students in public schools under the authority of the Jordanian Ministry of Education (MOE) and students in schools run by the United Nations Relief & Work Agency (UNRWA). Students in schools under the authority of the MOE and UNRWA performed similarly in mathematics and science.
- Student achievement in mathematics and science was positively related to availability of school resources regardless of student gender, school location, and school authority. The percentages distribution of students by index level of availability of school resources indicated that private schools were better equipped than MOE schools. The MOE schools, in turn, were better equipped than the UNRWA schools.
- In both mathematics and science, girls' performance levels were better than boys' performance levels as measured by the percentages of girls and boys reaching the international benchmarks at high, intermediate, and low levels, whereas the percentages of girls and boys reaching the international benchmarks were the same at the advanced level. Urban students' performance levels were better than rural students' performance levels as measured by the percentages of urban students and rural students reaching the international benchmarks at high, intermediate, and low level. The percentages of urban students and rural students were the same at the advanced levels. Private students' performance levels were higher than the performance levels of the MOE and UNRWA students as measured by the percentages of private, MOE, and UNRWA students reaching the international benchmarks at advanced, high, intermediate, and low levels. The percentages of MOE and UNRWA students reaching the international benchmarks at the four levels were similar for the MOE and the UNRWA students.
- Girls and boys performed at a higher level in science in 2003 compared to their performance in 1999. In mathematics, the performance of girls was similar on the two occasions whereas the performance of boys decreased significantly between 1999 and 2003. Urban students and rural students performed at a significantly higher level in science in 2003 than in 1999. Greater improvement in achievement could be observed for rural students than for urban students in science between 1999 and 2003.

- Students taught in public schools performed at a higher level in science in 2003 than in 1999 whereas their performance in mathematics was similar on the two occasions. UNRWA students performed at a significantly lower level in mathematics in 2003 compared to 1999 whereas their performance in science showed no significant difference. Students in private schools performed similarly in 2003 and 1999 in both subjects.

Based on these results, the following recommendations are made:

- Conduct further analyses to find the factors responsible for disparities in students' achievement in mathematics and science relative to student gender, school location, and school authority.
- Provide schools with sufficient resources, including needed textbooks, computer hardware and software, appropriate instructional space, and library materials, to support higher levels of student achievement in mathematics and science.
- Devote more support to rural schools and male students relative to the teaching and learning of mathematics and science.

In addition, steps should be taken toward conducting:

- A critical review of mathematics curricula in order to identify weaknesses in the curricula and to develop new curricula aimed at improving student achievement in mathematics.
- A reform program, led by the Ministry of Education, to improve the quality of education nationwide.

5.2 INTRODUCTION

Gender differences, school location, and school authority have occupied the minds and discussions of educational practitioners, researchers, and policymakers for many years (Jordan Ministry of Education, 2003). School resources and their relationship with student achievement and quality of education are another issue of discussion (Jordan Ministry of Education, 2006; Jordan Ministry of Planning, 2006). The TIMSS assessment program allows examination of these issues through analysis of data from actual classrooms. Because Jordan has participated in two cycles of TIMSS assessments (in 1999 and 2003), the TIMSS data also provide an opportunity to measure change in student performance in mathematics and science over time. Hence, answers to the following research questions were sought in the analysis of the relevant data presented in this chapter:

- How did the mathematics and science achievement of Jordanian Grade 8 students participating in TIMSS differ in terms of (a) student gender (male/female), (b) school location (urban/rural), and (c) educational authority (public/UNRWA/private)?
- Did the achievement in mathematics and science of Jordanian students differ more for boys or girls, for rural or urban schools, and for private, public, or UNRWA schools relative to the availability of school resources (high, medium, low)?
- What percentages of students reached the international benchmarks overall and by student gender, school location, and educational authority?
- How did the performance of Jordanian Grade 8 students in TIMSS 2003 compare with the performance of their TIMSS 1999 counterparts in general and in regard to (a) student gender (male/female), (b) school location (urban/rural), and (c) educational authority (public/UNRWA/private) in particular?

5.3 METHOD

The IEA IDB Analyzer© routine "PV means" was used to detect possible differences in performance due to gender, school location, and school authority, while "achievement regression" using dummy recoding was used to test the significance of these differences. In all analyses, plausible values of mathematics and science achievement (i.e., BSMMAT01–05, BSSSCI01–05, BSMALG01–05, BSMDAP01–05, BSMFNS01–05, BSMGEO01–05, BSMMEA01–05, BSSEAS01–05, BSSLIS01–5, BSSPHY01–05, BSSCHE01–05, BSSERI01–05) were used as the dependent variables.

For the benchmark analyses, the following additional variables were created using the IEA IDB Analyzer©:

- BSMADVL1, BSSADVL1: Students reaching the advanced benchmark level in mathematics and science respectively.

- BSMHIGL1, BSSHIGL1: Students reaching the high benchmark level in mathematics and science respectively.
- BSMINTL1, BSSINTL1: Students reaching the intermediate benchmark level in mathematics and science respectively.
- BSMLOWL1, BSSLOWL1: Students reaching the low benchmark level in mathematics and science respectively.

In addition, the following variables were extracted from the TIMSS 1999 and 2003 student-level and school-level data files for Jordan:

- IDSTRATI: Recoded into two new variables—AUTHORITY (MOE/public coded "1", private coded "2", UNRWA coded "3") and LOCATION (urban coded "1", rural coded "2").
- ITSEX: Student gender—girl coded "1", boy coded "2".
- BCDMST: Index of availability of school resources. This index was created from different options (five general, five mathematics related) of one and the same question. The index was based on (a) school principals' average responses (on Likert scales; see below) to five questions about shortages that affected the school's general capacity to provide instruction, and (b) the principals' average responses to five questions regarding shortages that affected mathematics instruction. The questions relating to general capacity concerned instructional materials (e.g., textbooks) and budgets for supplies (e.g., paper and pencils), school buildings and grounds, heating/cooling and lighting systems, and instructional space (e.g., classrooms). The questions concerning mathematics instruction related to computer hardware and software, calculators, library materials, and audio-visual resources for mathematics instruction. The average was computed based on a four-point scale: 1—none, 2—a little, 3—some, 4—a lot. A high level of school resources on this index was coded "1" and indicated that both shortages were, on average, lower than 2. A low level of school resources (coded "3") indicated that both shortages were on average greater than or equal to 3. All other combinations were considered to indicate a medium level of availability of school resources (Mullis, Martin, Gonzalez, & Chrostowski, 2004).
- BCDSST: Same as for BCDMST, except that the second average was based on five questions regarding shortages affecting science instruction, including the availability of laboratory equipment.
- BSMIBM01–05 and BSSIBM01–05: Plausible values for mathematics and science and the international performance benchmarking variables.

5.4 RESULTS

This section is structured as follows. The first set of results presented compares student achievement in mathematics and then in science in 2003 by gender, school location, and school authority. The second set documents differences in mathematics achievement followed by differences in science achievement depending on the availability of school resources by student gender, school location, and school authority. The next set presents the percentages of students reaching the international benchmarks (including standard errors) in mathematics and science by gender, school location, and school authority. The final set of results compares the mathematics and science performances of the Jordanian students who participated in TIMSS 2003 and the Jordanian students who participated in TIMSS 1999. This last set of analyses over time also consider gender, school location, and school authority.

Results of the analysis presented in Table 5.1 and Figures 5.1 and 5.2 show that the Grade 8 Jordanian girls outperformed the Grade 8 Jordanian boys in mathematics; the average overall scores were 438 for girls and 411 for boys. The same pattern was observed for each of the subscales of the mathematics test (number, geometry, algebra, data, measurement), with the greatest difference in favor of girls for algebra (35 score points) and the smallest difference in favor of girls for measurement (15 score points).

Table 5.2 presents the results of the analysis that compared student performance in mathematics relative to school location. It can be seen that urban school students outperformed rural school students in terms of the overall mathematics score (433 vs. 411). The same pattern was observed for each of the subscales (number, geometry, algebra, data, and measurement; see Figures 5.1 and 5.3).

Table 5.1: Mathematics Achievement of Jordanian Grade 8 Students by Gender (2003 data)

Scale	Boys (Average scale score)	Girls (Average scale score)	Difference (absolute value)	Difference: *Boys scored higher*	Difference: *Girls scored higher*
Mathematics	411 (5.8)	438 (4.6)	27 (6.8)		
Number	401 (6.3)	426 (5.5)	25 (8.1)		
Geometry	438 (5.8)	455 (4.4)	17 (6.8)		
Algebra	417 (6.4)	452 (4.8)	35 (7.4)		
Data	420 (4.7)	441 (3.7)	21 (5.2)		
Measurement	410 (5.5)	426 (5.7)	15 (7.1)		

-40 -20 0 20 40

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant

Figure 5.1: Mathematics Achievement of Jordanian Grade 8 Students by Selected Characteristics (2003 data)

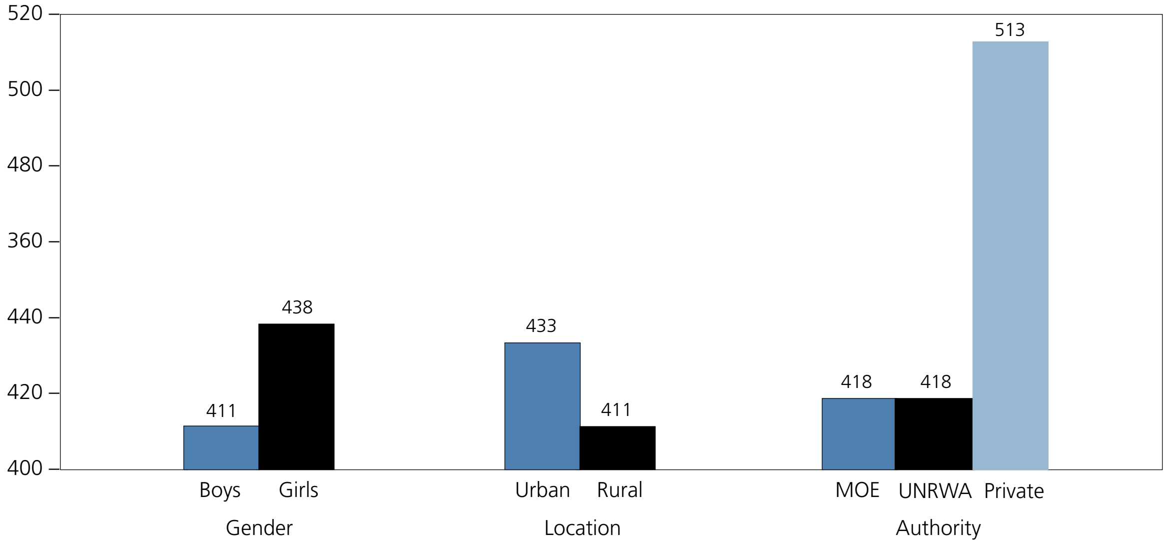


Figure 5.2: Mathematics Achievement of Jordanian Grade 8 Students by Gender (2003 data)

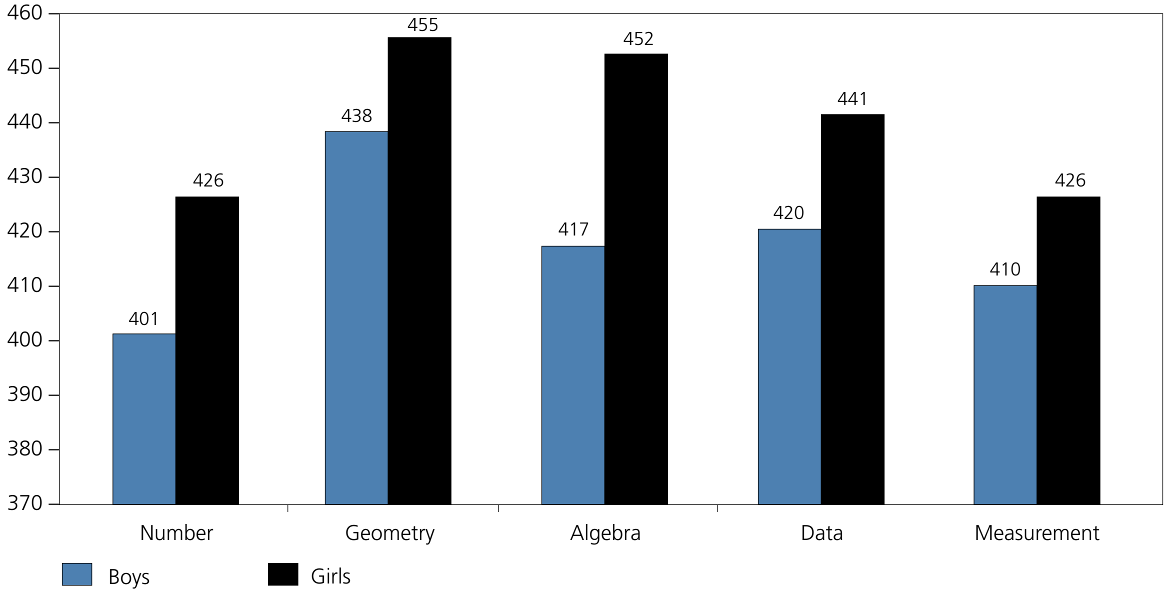
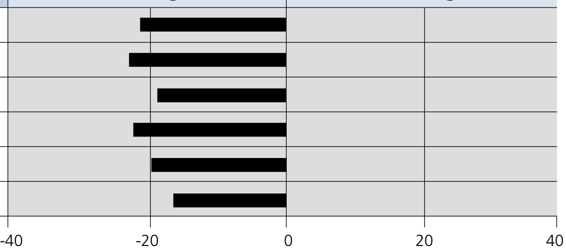


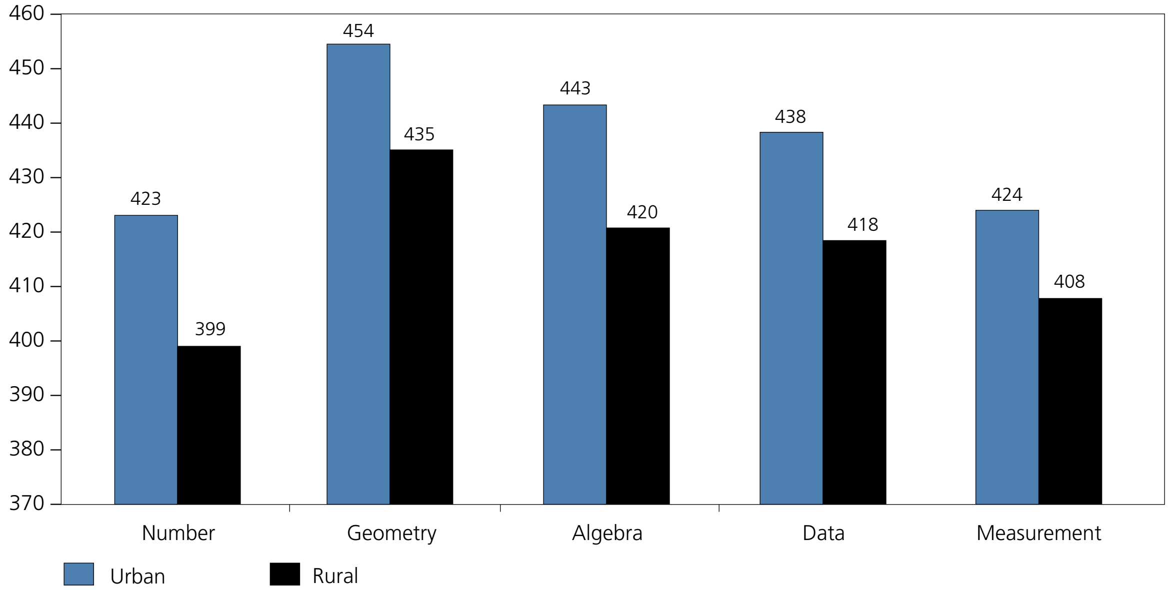
Table 5.2: Mathematics Achievement of Jordanian Grade 8 Students by School Location (2003 data)

Scale	Urban (Average scale score)	Rural (Average scale score)	Difference (absolute value)	Difference	
				Urban school students scored higher	*Rural school students scored higher*
Mathematics	433 (5.4)	411 (5.7)	22 (8.0)		
Number	423 (5.8)	399 (6.3)	24 (8.5)		
Geometry	454 (5.3)	435 (5.0)	19 (7.1)		
Algebra	443 (5.6)	420 (6.5)	23 (8.4)		
Data	438 (4.1)	418 (4.9)	21 (6.0)		
Measurement	424 (5.6)	408 (5.5)	15 (7.2)		



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
The difference is statistically significant

Figure 5.3: Mathematics Achievement of Jordanian Grade 8 Students by School Location (2003 data)



The results reported in Table 5.3 show that private school students outperformed MOE school students and UNRWA school students in mathematics. The average achievement score for private school students was 513, whereas it was 418 for public and for UNRWA school students. A comparison of the performance of UNRWA school students and MOE school students revealed similar levels of overall mathematics performance. The same pattern was observed for each of the subscales—number, geometry, algebra, data, and measurement; see Figures 5.1 above and 5.4 below.

From Table 5.4 it can be seen that Jordanian girls outperformed Jordanian boys in science. The average achievement score for girls was 489. For boys, it was 462. The same pattern was observed for each of the subscales (life science, chemistry, physics, earth science, and environmental science; see Figures 5.5 and 5.6).

The results set out in Table 5.5 provide evidence that urban school students and rural school students performed similarly in terms of overall science achievement (480 vs. 466). The urban school students and rural school students also performed similarly in earth science and environmental science. The average scores were 477 versus 465 and 497 versus 486, respectively. However, the urban school students significantly outperformed the rural school students in life science, chemistry, and physics. The average scores were 481 versus 466, 484 versus 468, and 471 versus 456, respectively (see Figure 5.7).

Table 5.3: Mathematics Achievement of Jordanian Grade 8 Students by School Authority (2003 data)

Scale	MOE (Average scale score)	UNRWA (Average scale score)	Private (Average scale score)	Difference UNRWA–Private (absoute value)	Difference UNRWA–MOE (absolute value)	Difference MOE–Private (absolute value)
Mathematics	418 (3.7)	418 (10.3)	513 (16.2)	96 (19.3) ▲	0 (10.9)	96 (16.6) ▲
Number	407 (4.1)	405 (11.0)	505 (16.8)	100 (19.8) ▲	1 (11.6)	98 (17.4) ▲
Geometry	441 (3.4)	438 (8.8)	524 (17.7)	86 (19.3) ▲	2 (9.4)	84 (17.5) ▲
Algebra	428 (4.3)	428 (10.3)	518 (16.3)	91 (19.3) ▲	0 (10.9)	91 (16.9) ▲
Data	425 (3.2)	423 (7.5)	501 (11.8)	78 (13.5) ▲	2 (8.0)	76 (11.9) ▲
Measurement	413 (3.9)	409 (10.2)	492 (19.5)	83 (21.7) ▲	4 (10.1)	79 (19.8) ▲

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

Figure 5.4: Mathematics Achievement of Jordanian Grade 8 Students by School Authority (2003 data)

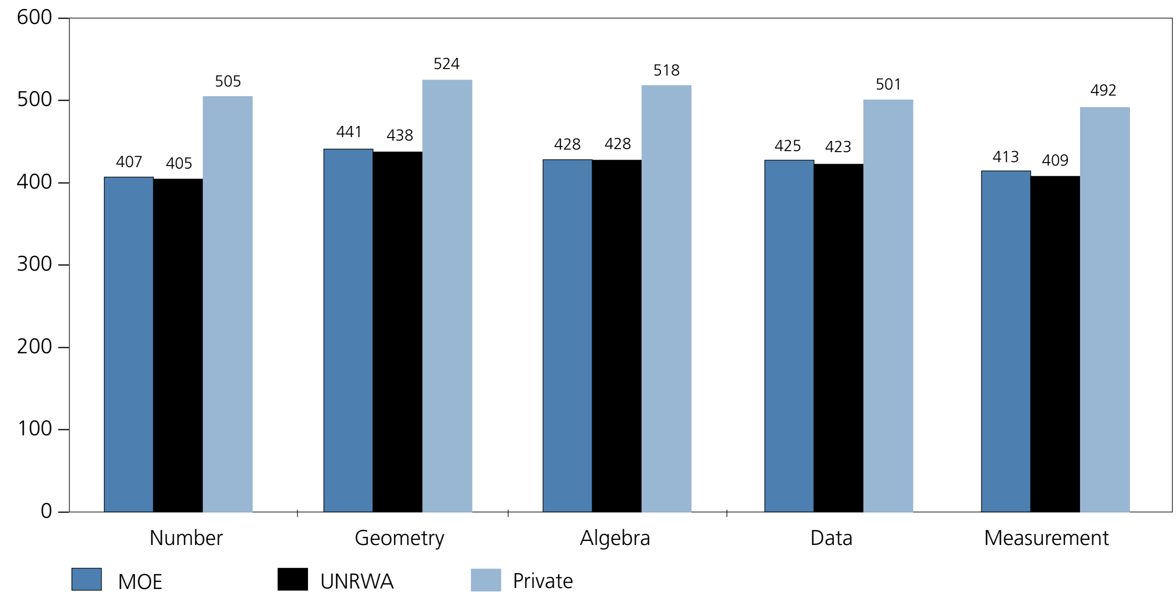
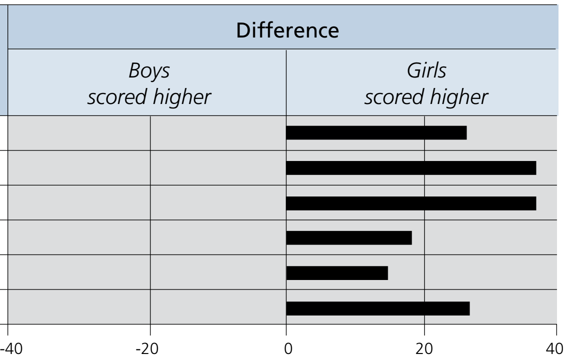


Table 5.4: School Achievement of Jordanian Grade 8 Students by Gender (2003 data)

Scale	Boys (Average scale score)	Girls (Average scale score)	Difference (absolute value)
Science	462 (5.6)	489 (4.6)	27 (6.9)
Life science	458 (5.3)	493 (4.8)	35 (6.5)
Chemistry	460 (6.2)	496 (5.2)	35 (7.5)
Physics	457 (5.5)	474 (4.8)	17 (7.0)
Earth science	466 (5.5)	479 (4.2)	13 (5.8)
Environmental science	479 (4.7)	507 (4.1)	28 (6.2)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▬ The difference is statistically significant

Private school students outperformed MOE school students and UNRWA school students in science (see Table 5.6). The average science score for private school students was 547, but it was 469 for public school students and 471 for UNRWA school students. The UNRWA school students and the MOE school students performed similarly in science (Figures 5.5 and 5.8).

Table 5.7 shows that, in relation to mathematics instruction, 16% of the Jordanian students who participated in TIMSS 2003 enjoyed a high level of school resources. Seventy-four percent of the students were studying in schools with a medium level of school resources, and 10% were in schools experiencing a low level of school resources. In science instruction, 17% of the Jordanian TIMSS 2003 students had access to a high level of school resources, 69% had access to a medium level of school resources, and 14% were experiencing a low level of school resources.

An examination of the mathematics achievement for the differently equipped schools revealed the highest achievement (an average of 466 score points) in schools with the highest availability of resources whereas the lowest level of achievement was reported for those schools with fewest resources (an average of 405 score points). Students in schools with a medium level

Figure 5.5: Science Achievement of Jordanian Grade 8 Students by Selected Characteristics (2003 data)

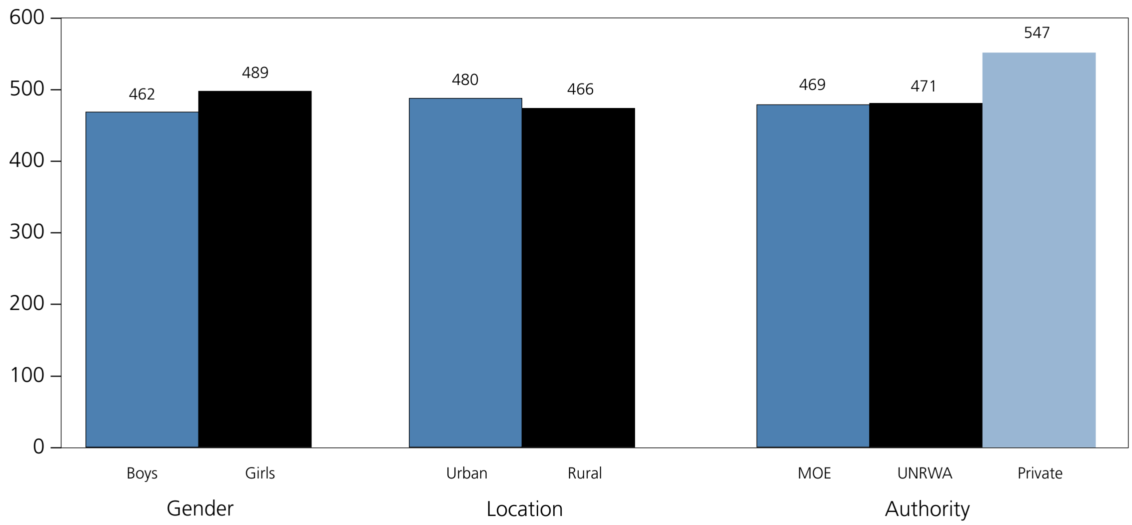


Figure 5.6: Science Achievement of Jordanian Grade 8 Students by Gender (2003 data)

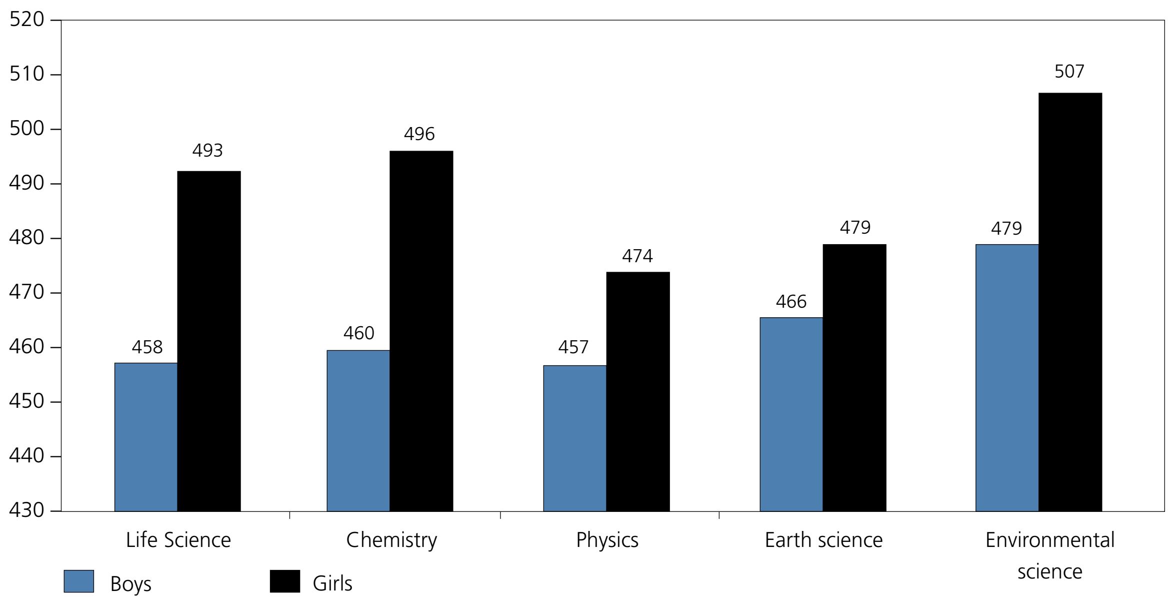
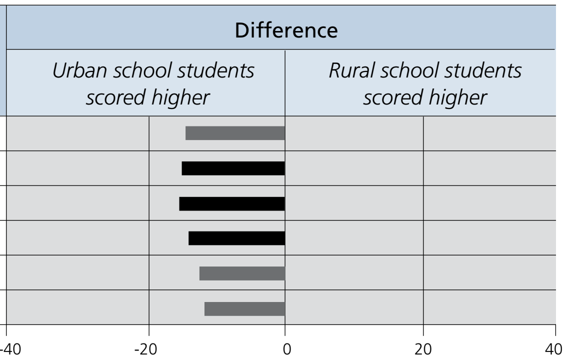


Table 5.5: Science Achievement of Jordanian Grade 8 Students by School Location (2003 data)

Scale	Urban (Average scale score)	Rural (Average scale score)	Difference (absolute value)
Science	480 (4.7)	466 (6.4)	14 (7.9)
Life science	481 (4.7)	466 (6.3)	15 (7.6)
Chemistry	484 (5.4)	468 (6.4)	16 (7.9)
Physics	471 (4.9)	456 (6.0)	16 (7.8)
Earth science	477 (5.0)	465 (5.2)	12 (6.6)
Environmental science	497 (3.9)	486 (5.7)	11 (7.0)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Figure 5.7: Science Achievement of Jordanian Grade 8 Students by School Location (2003 data)

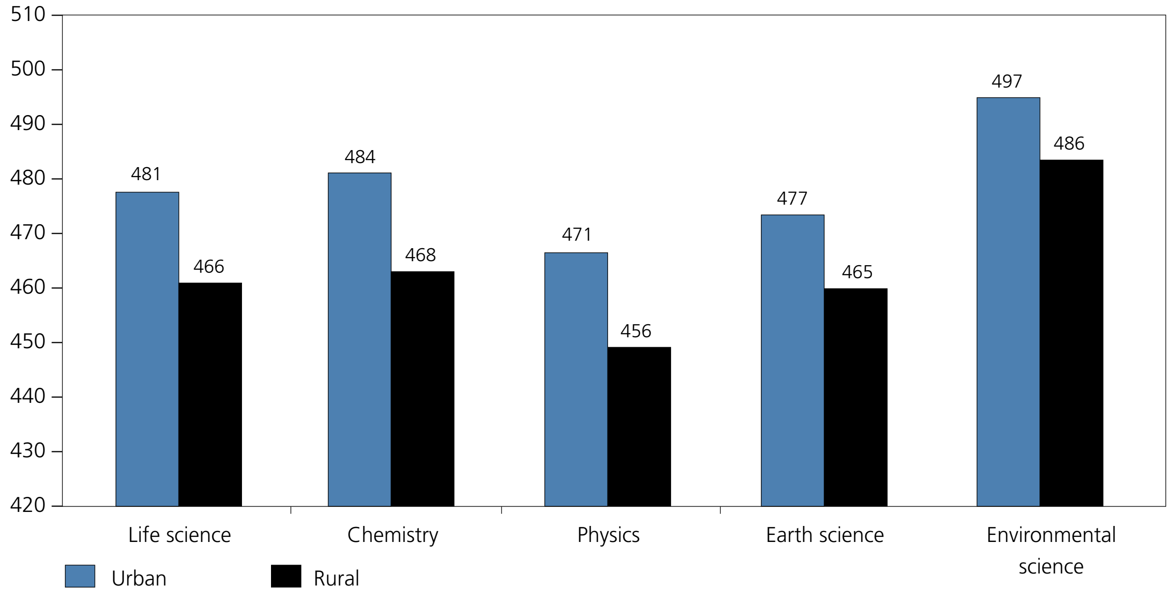


Table 5.6: School Achievement of Jordanian Grade 8 Students by School Authority (2003 data)

Scale	MOE (Average scale score)	UNRWA (Average scale score)	Private (Average scale score)	Difference UNRWA–Private (absolute value)	Difference UNRWA–MOE (absolute value)	Difference MOE–Private (absolute value)
Science	469 (4.0)	471 (7.0)	547 (10.6)	76 (12.6) ▲	2 (8.0)	78 (11.5) ▲
Life science	470 (4.2)	469 (8.1)	546 (9.5)	77 (12.7) ▲	1 (9.3)	77 (9.7) ▲
Chemistry	471 (4.5)	474 (9.1)	557 (8.6)	83 (11.5) ▲	2 (9.7)	85 (8.8) ▲
Physics	459 (4.0)	462 (7.5)	543 (9.3)	81 (12.1) ▲	3 (8.6)	84 (9.6) ▲
Earth science	467 (4.2)	469 (7.0)	538 (9.4)	69 (11.8) ▲	2 (7.8)	71 (9.7) ▲
Environmental science	488 (3.6)	488 (7.5)	547 (6.5)	59 (9.8) ▲	0 (8.4)	58 (7.1) ▲

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

Figure 5.8: Science Achievement of Jordanian Grade 8 Students by School Authority (2003 data)

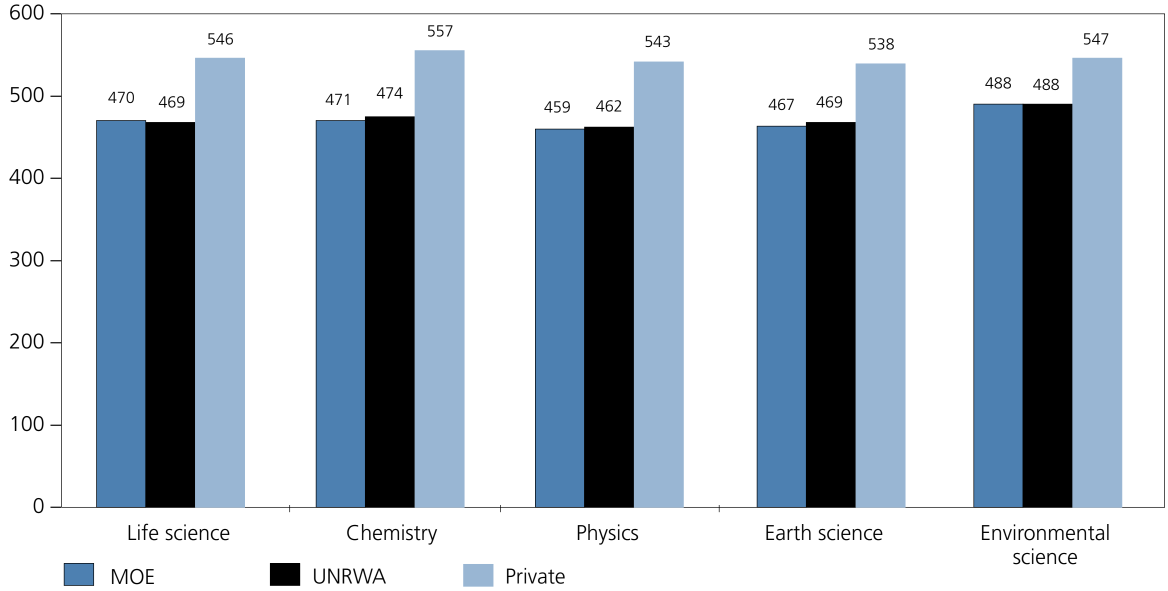


Table 5.7: Availability of School Resources for Mathematics and Science Instruction in Jordan (2003 data)

Scale	High		Medium		Low		Difference Medium–Low (absolute value)	Difference Medium–High (absolute value)	Difference High–Low (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent of students*	*Average scale score*			
Mathematics	16 (3.4)	466 (15.6)	74 (3.7)	419 (4.0)	10 (2.5)	405 (10.8)	13 (11.5)	47 (16.3) ▲	61 (18.8) ▲
Science	17 (3.6)	508 (11.8)	69 (3.9)	469 (4.1)	14 (2.8)	464 (9.6)	5 (10.9)	39 (11.8) ▲	44 (15.2) ▲

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

of resources achieved an average of 419 score points on the mathematics test. The differences between schools with high resources on the one hand and those with medium or low availability of resources on the other hand were significant. These relationships between availability of school resources and achievement in mathematics were observed irrespective of student gender, school location, and school authority (Figures 5.9, 5.10, and 5.11).

As was the case for mathematics achievement, achievement in science was also higher in schools that were better equipped in terms of instructional space and materials as well as computers and computer laboratories, among other resources. The highest average achievement was among students in schools with a high level of resources (508 score points), followed by schools with a medium level of resources (469 score points) and schools with a low level of resources (464 score points); this latter difference was not significant. This relationship between availability of school resources and achievement was again apparent irrespective of student gender, school location, and school authority (Figures 5.12, 5.13, and 5.14).

Table 5.8 shows that students in schools with a high level of resources displayed higher performances in mathematics and science and that this pattern applied regardless of student gender, school location, and school authority. However, with respect to mathematics, the table also shows that a higher percentage of girls (22%) than boys (9%) were enjoying a higher level of school resources. Likewise, more rural schools (15%) than urban schools (9%) were better equipped, and the same could be said for private schools relative to schools operating under the other two authorities.

Figure 5.9: Availability of School Resources for Mathematics Instruction in Jordan by Gender (2003 data)

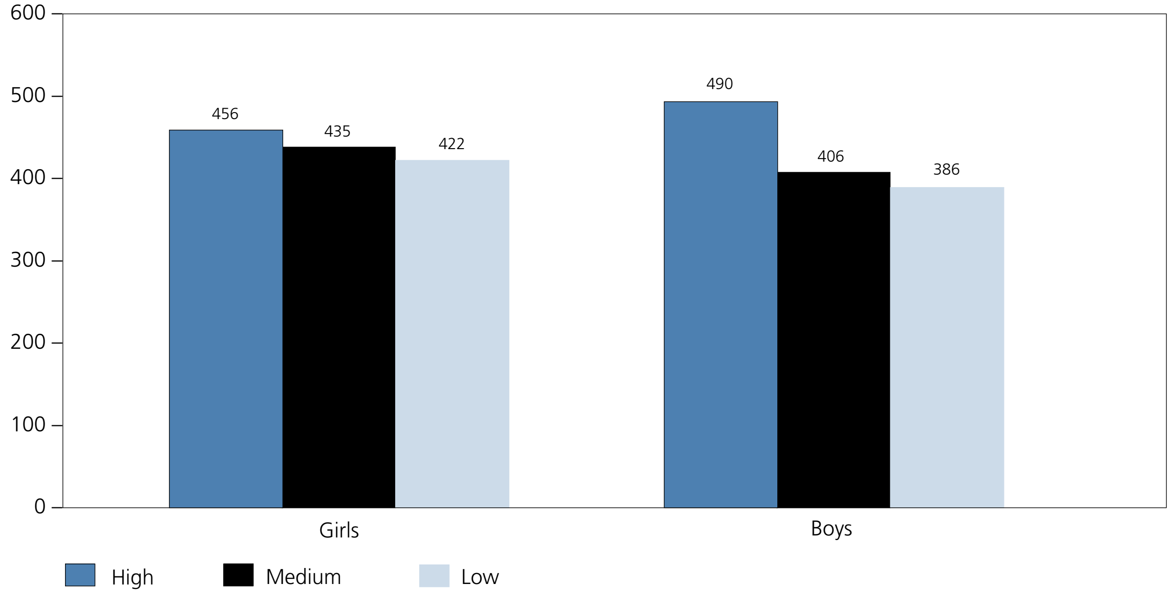


Figure 5.10: Availability of School Resources for Mathematics Instruction in Jordan by School Location (2003 data)

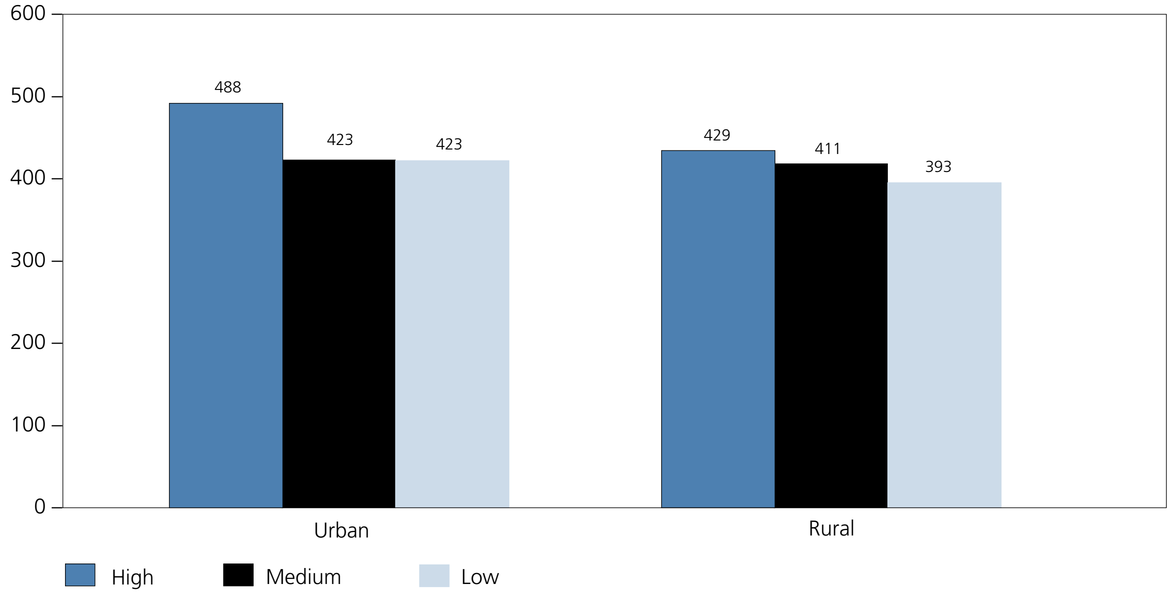


Figure 5.11: Availability of School Resources for Mathematics Instruction in Jordan by School Authority (2003 data)

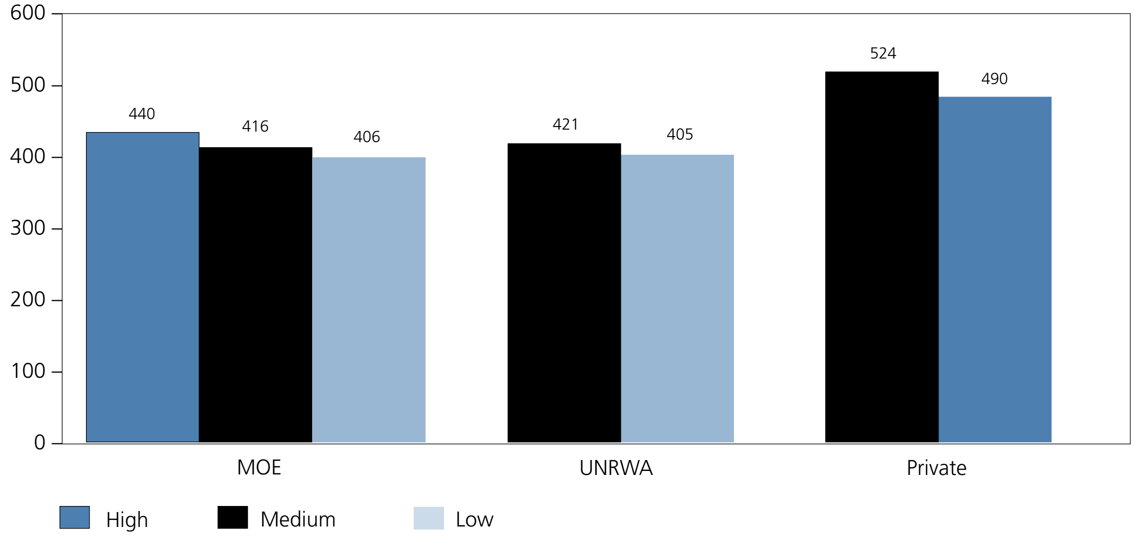


Figure 5.12: Availability of School Resources for Science Instruction in Jordan by Gender (2003 data)

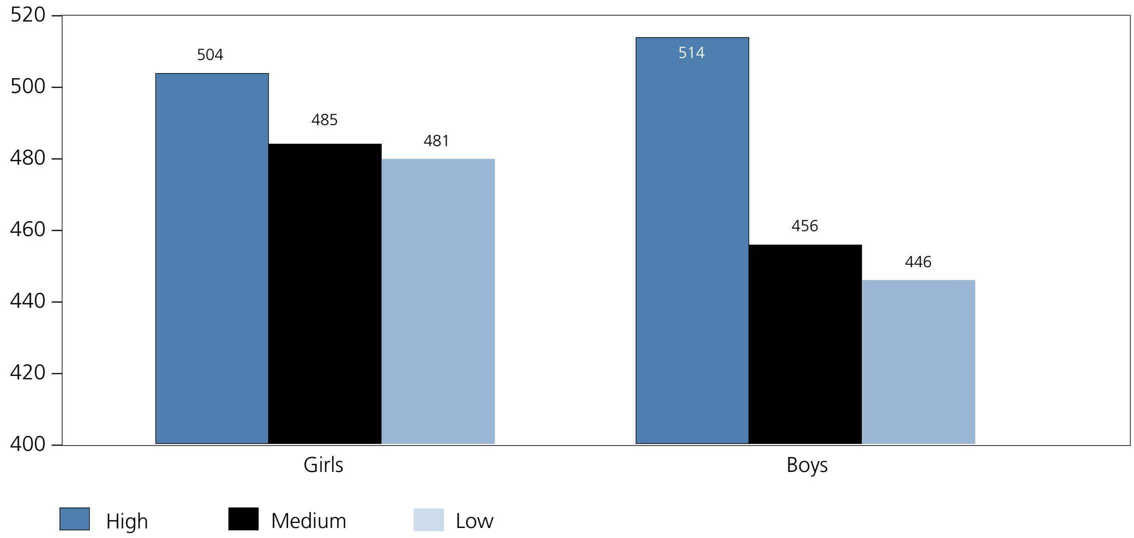


Figure 5.13: Availability of School Resources for Science Instruction in Jordan by Location (2003 data)

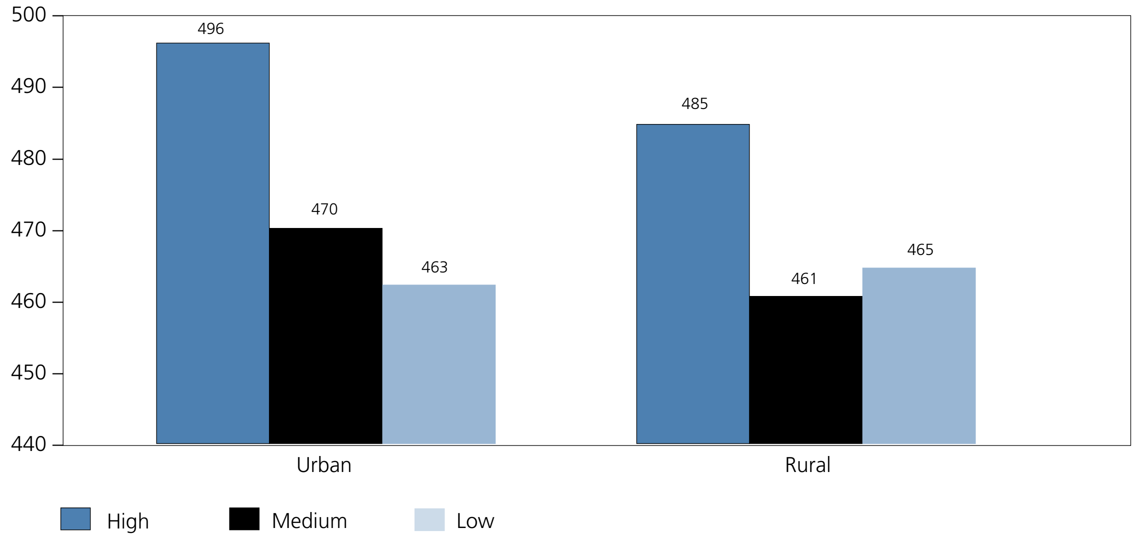


Figure 5.14: Availability of School Resources for Science Instruction in Jordan by School Authority (2003 data)

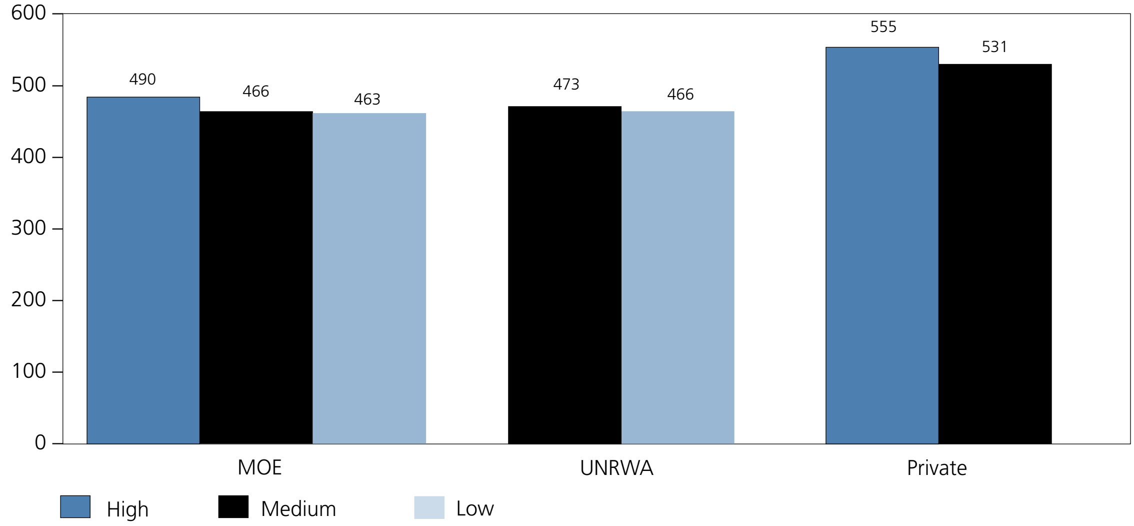


Table 5.8: Availability of School Resources for Mathematics and Science Instruction in Jordan by Selected Characteristics (2003 data)

Mathematics												
Selected characteristics	High				Medium				Low			
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*		*Percent of students*		*Average scale score*	
Gender												
Girls	22	(5.0)	456	(15.0)	66	(6.0)	435	(5.0)	11	(3.0)	422	(11.0)
Boys	9	(3.0)	490	(28.0)	82	(4.0)	406	(5.0)	9	(4.0)	386	(16.0)
Location												
Urban	9	(2.0)	488	(18.1)	83	(2.9)	423	(4.5)	8	(3.2)	423	(17.8)
Rural	15	(5.3)	429	(16.9)	70	(6.9)	411	(7.8)	15	(4.5)	393	(13.8)
Authority												
MOE	14	(3.3)	440	(10.9)	77	(3.7)	416	(4.1)	9	(2.9)	406	(13.9)
UNRWA	0		–		80	(7.0)	421	(11.2)	20	(7.0)	405	(17.7)
Private	69	(22.0)	524	(18.9)	31	(22.0)	490	(11.7)	0		–	
Science												
Selected characteristics	High				Medium				Low			
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*		*Percent of students*		*Average scale score*	
Gender												
Girls	22	(5.3)	504	(13.0)	63	(5.6)	485	(6.0)	15	(4.3)	481	(8.0)
Boys	13	(4.2)	514	(18.0)	74	(5.0)	456	(5.0)	13	(3.7)	446	(14.0)
Location												
Urban	11	(3.3)	496	(10.7)	78	(4.6)	470	(4.8)	11	(3.9)	463	(17.5)
Rural	18	(6.1)	485	(16.8)	61	(5.9)	461	(7.1)	21	(4.9)	465	(11.7)
Authority												
MOE	16	(4.0)	490	(10.2)	72	(3.9)	466	(4.5)	12	(2.9)	463	(13.6)
UNRWA	0		–		68	(10.7)	473	(8.2)	32	(10.7)	466	(9.9)
Private	69	(22.0)	555	(8.5)	31	(22.0)	531	(9.8)	0		–	

Note:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

Sixty-nine percent of private schools were enjoying a high level of resources but the same could be said for only 14% of the MOE schools. No UNRWA school was classified as having high resources.

An interesting point emerged from this particular analysis. Two groups that were shown to perform at a higher level than their comparison groups, namely girls and private schools, also had a greater proportion of students in schools with high availability of resources. The third group, namely students in urban schools, that showed higher performance than its comparison group, namely students in rural schools, had a lower percentage of students in schools with high resources (see Table 5.8).

The percentages of Jordanian students reaching the international benchmarks in the TIMSS 2003 assessment are presented in Table 5.9. Only one per cent of the Jordanian students reached the advanced benchmark in mathematics and only 3% reached this mark in science. Eight percent of the students reached the high benchmark in mathematics and 21% managed this level of attainment in science. Thirty percent and 53% of the students reached the intermediate benchmark in mathematics and science, respectively, whereas 60% of students reached the low benchmark in mathematics and 80% reached this benchmark in science.

A comparison of the Jordanian Grade 8 girls' and boys' performance (also presented in Table 5.9) in relation to the international benchmarks in mathematics showed about equal numbers of boys and girls reaching the advanced benchmark. In addition, more girls than boys scored at the low benchmark for this subject (Figure 5.15). In science, the number of girls also exceeded the number of boys reaching the advanced, high, intermediate, and low benchmarks (Figure 5.18).

Table 5.9: Percentage of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Mathematics and Science Achievement by Selected Characteristics (2003 data)

Mathematics								
Selected characteristics	Advanced		High		Intermediate		Low	
Gender								
Girls	1	(0.3)	10	(1.1)	35	(2.4)	67	(2.1)
Boys	1	(0.3)	6	(1.2)	25	(2.5)	55	(3.0)
Location								
Urban	1	(0.3)	10	(1.5)	33	(2.7)	64	(2.2)
Rural	0	(0.2)	5	(0.7)	24	(2.4)	55	(3.4)
Authority								
MOE	1	(0.2)	6	(0.6)	27	(1.7)	58	(2.1)
UNRWA	0	(0.2)	6	(1.3)	26	(4.5)	58	(4.9)
Private	5	(2.0)	31	(7.5)	71	(9.8)	94	(2.9)
All (Jordan)	**1**	**(0.2)**	**8**	**(1.0)**	**30**	**(1.9)**	**60**	**(1.9)**
Science								
Selected characteristics	Advanced		High		Intermediate		Low	
Gender								
Girls	4	(0.7)	25	(2.0)	59	(2.3)	85	(1.4)
Boys	3	(0.6)	17	(1.7)	47	(2.6)	75	(2.0)
Location								
Urban	4	(0.7)	22	(1.9)	55	(2.1)	82	(1.4)
Rural	3	(0.6)	18	(1.8)	48	(3.1)	77	(2.4)
Authority								
MOE	3	(0.4)	19	(1.2)	50	(2.0)	78	(1.5)
UNRWA	3	(0.8)	18	(2.4)	49	(4.1)	80	(2.3)
Private	12	(3.7)	50	(8.0)	87	(3.7)	97	(1.6)
All (Jordan)	**3**	**(0.5)**	**21**	**(1.4)**	**53**	**(1.8)**	**80**	**(1.3)**

Note:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

Figure 5.15: Percentages of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Mathematics Achievement by Gender (2003 data)

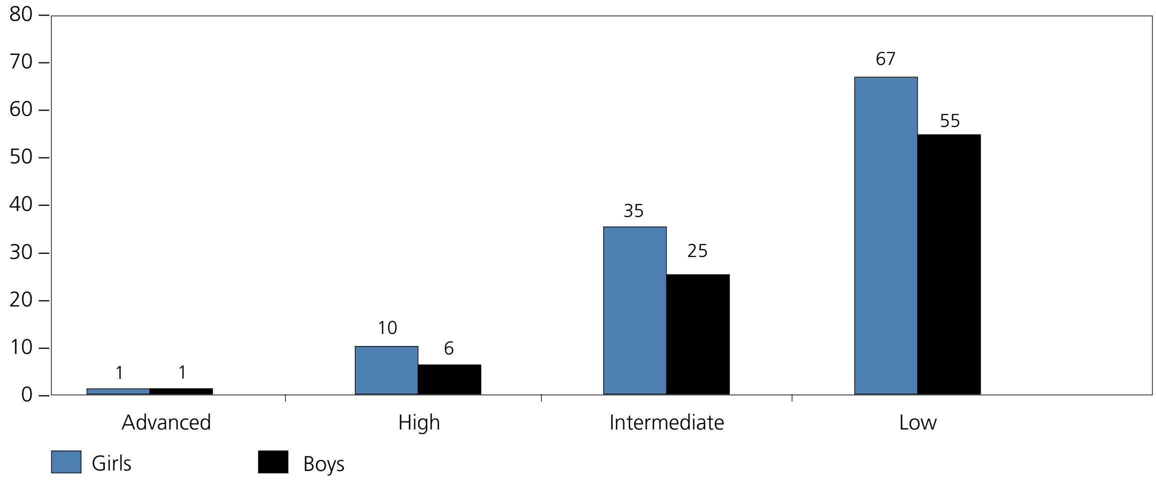
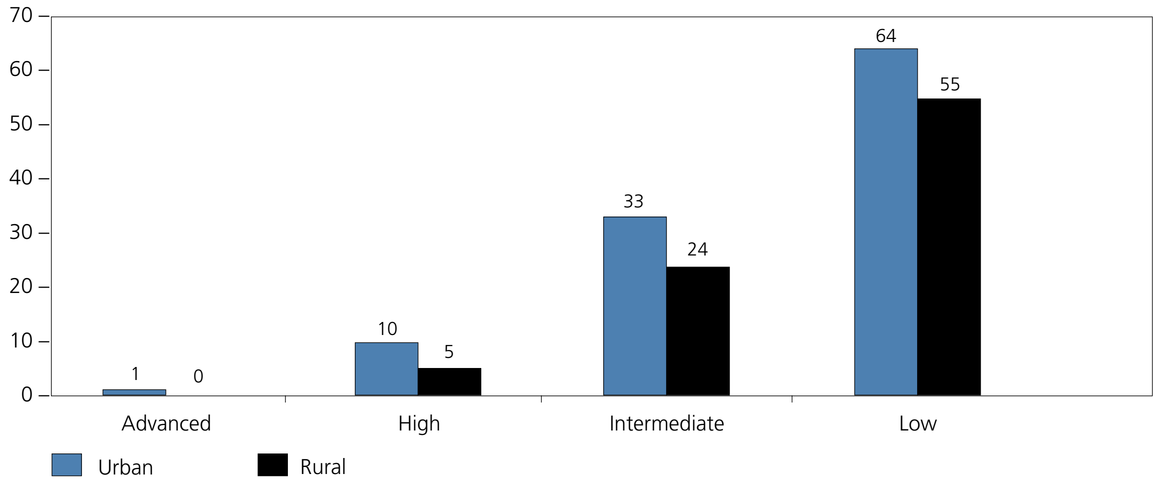


Figure 5.16: Percentages of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Mathematics Achievement by School Location (2003 data)



Higher percentages of urban school students than rural school students reached the advanced, high, intermediate, and low benchmarks in both mathematics and science (Figures 5.16 and 5.19). In terms of school authority, a higher percentage of private school students than MOE students reached the advanced benchmark in mathematics. No students from the UNRWA schools reached this benchmark (Figure 5.17). The percentage of students reaching the high, intermediate, and low benchmarks in mathematics was virtually the same in the MOE and UNRWA schools, while the percentage of students reaching each of these benchmarks was the highest for private schools.

In science, more girls than boys reached the four benchmarks (Figure 5.18). The percentages of students reaching the four benchmarks were higher in urban than in rural schools (Figure 5.19). Private schools were at the fore in relation to the percentage of students reaching the advanced benchmark in science. The percentages of students reaching this benchmark in the other two school authorities were the same. Private schools also had the highest percentage of students reaching the high and intermediate benchmarks. They were followed by the MOE schools and the UNRWA schools. The percentage of students achieving at the low benchmark was highest in the private schools, followed by the UNRWA and MOE schools (Figure 5.20).

Table 5.10 presents the results of the comparative analysis for the various variables across the two TIMSS assessments for mathematics achievement. Here, we can see a slight decrease in overall mathematics achievement between 1999 and 2003. The average respective scores were 428 and 424, but the difference was not significant. A slight increase took place in the mathematics achievement of girls between 1999 and 2003, but again the difference (431 vs. 438) was not significant. Between 1999 and 2003, the boys' average achievement scores showed a decrease over the time period (a score of 425 in 1999 and a score of 411 in 2003; see also Figure 5.21). In urban schools (Figure 5.22), students' mathematics achievement was slightly lower in 2003 than in 1999 (average scores of 433 and 440, respectively). In rural schools, the average scores increased slightly across the four-year period—from 403 in 1999 to 411 in 2003.

The information presented in Table 5.10 also shows a slight increase in the mathematics achievement of MOE school students in 2003 compared to 1999 (scores of 413 and 418, respectively). The scores of the UNRWA school students decreased significantly between 1999 and 2003 (476 vs. 418). A decrease in the mathematics

Figure 5.17: Percentages of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Mathematics Achievement by School Authority (2003 data)

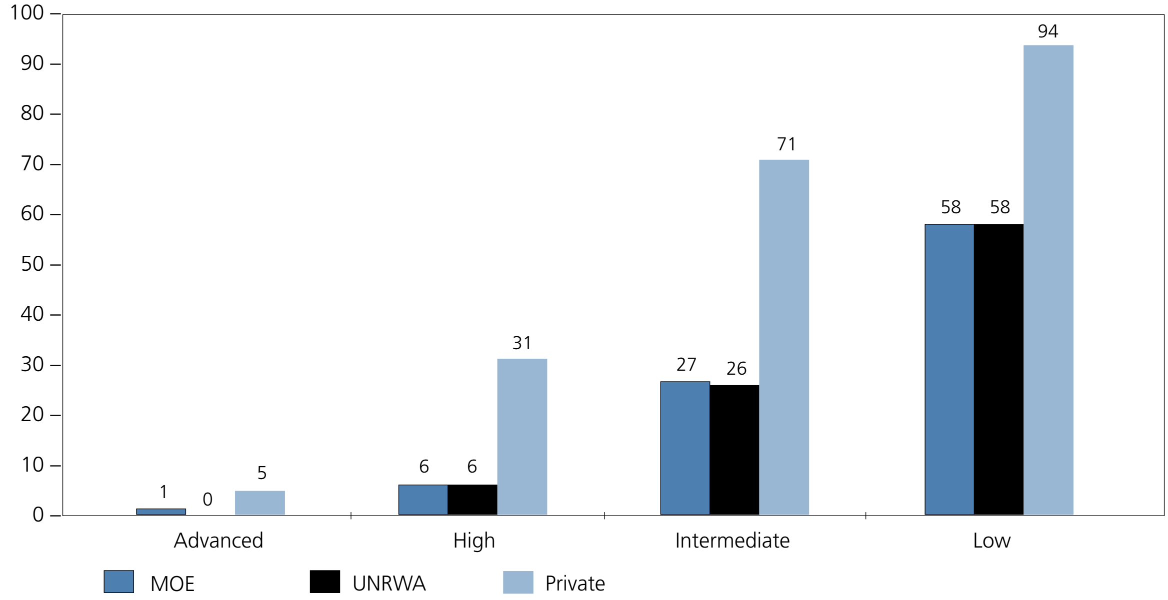


Figure 5.18: Percentages of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Science Achievement by Gender (2003 data)

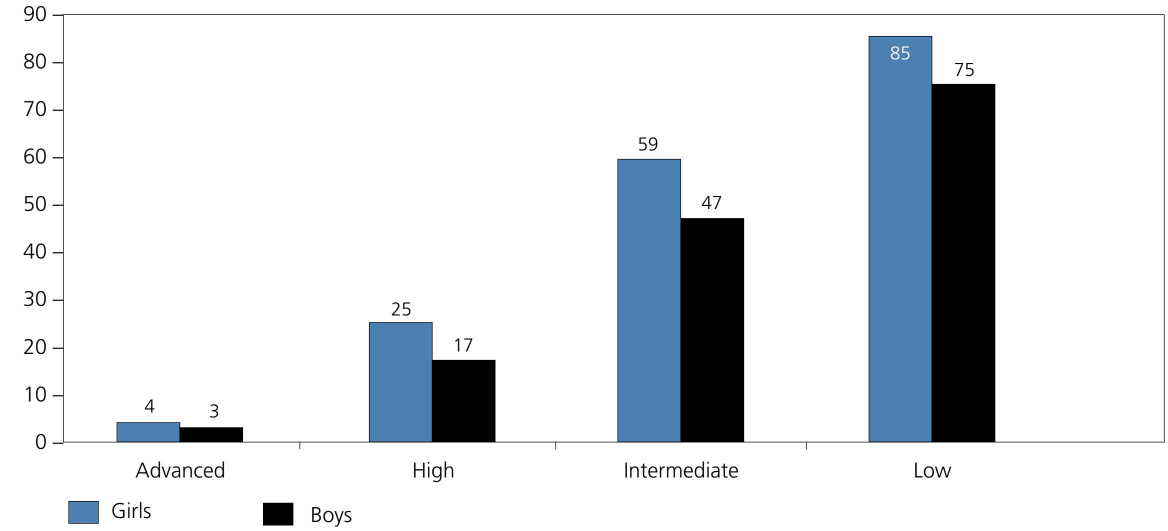


Figure 5.19: Percentages of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Science Achievement by School Location (2003 data)

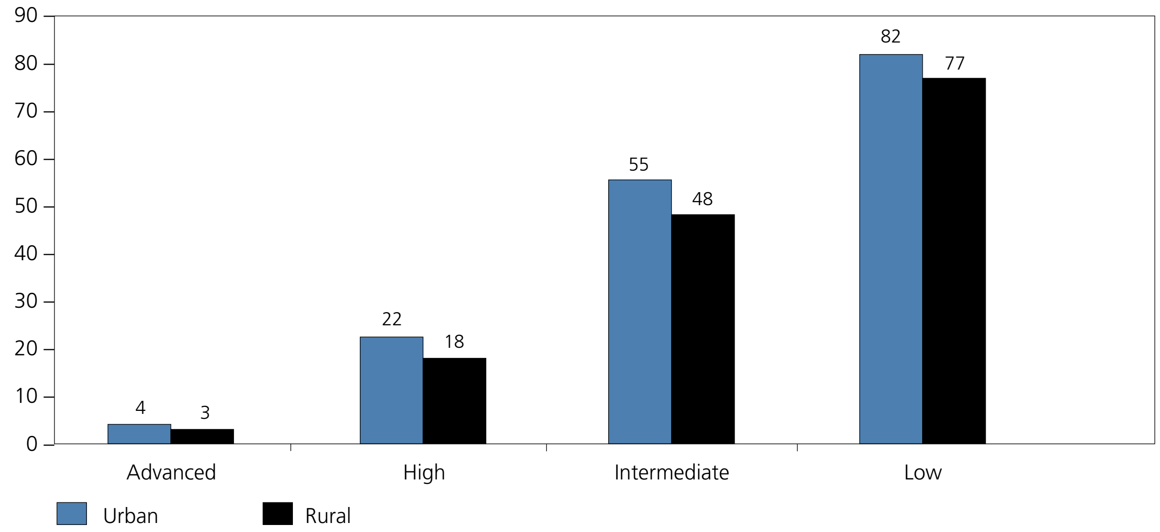
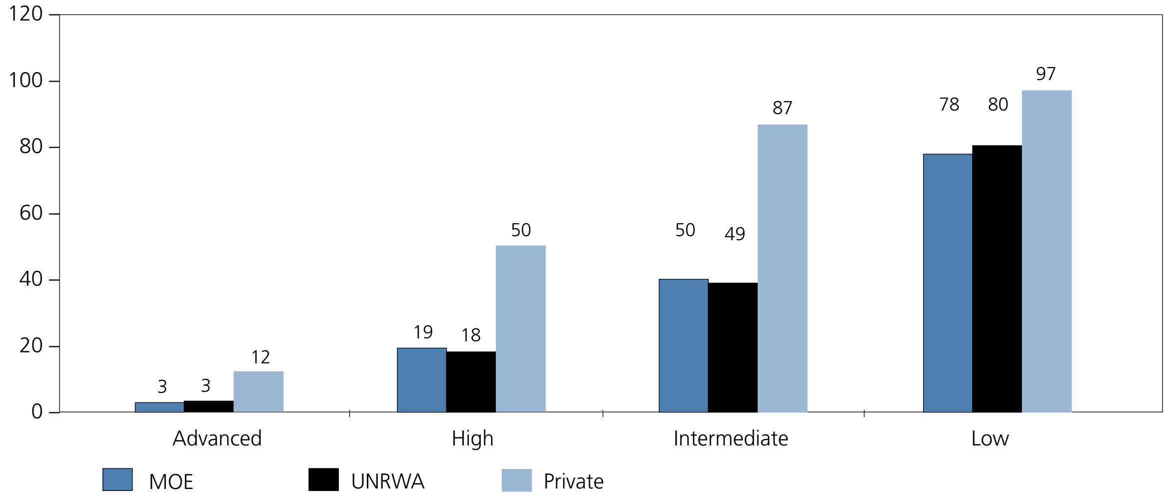


Figure 5.20: Percentages of Jordanian Students Reaching the TIMSS 2003 International Benchmarks of Science Achievement by School Authority (2003 data)

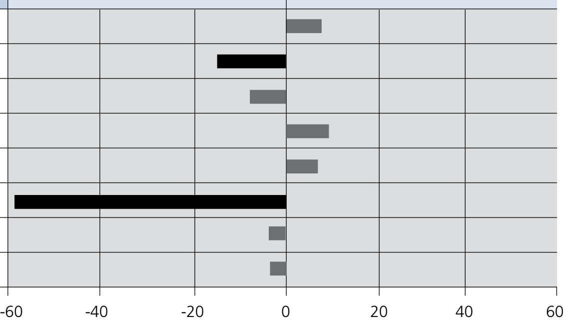


achievement of private school students also occurred between 1999 and 2003, but this difference, as is evident in Figure 5.23, was slight (517 vs. 513).

Overall science achievement in Jordan increased significantly between 1999 (an average achievement score of 450) and 2003 (a score of 475). Likewise, as can be seen in Table 5.11, the average score for girls increased in 2003 (489) compared to 1999 (460), while the average score for boys was 462 in 2003 and 442 in 1999. These differences for both boys and girls across the four-year period were significant (Figure 5.24). Urban school students also achieved a higher average science achievement on the 2003 TIMSS assessment than on the 1999 assessment. The respective scores of 480 and 462 denoted a significant difference. Students in the rural schools also achieved a significant increase in achievement between 1999 and 2003. The respective scores were 428 and 466 (Figure 5.25). MOE students also achieved a significant increase in science achievement between 2003 (469) and 1999 (440). In UNRWA schools, the average score showed a slight decrease in 2003 compared to 1999 (478 vs. 471), while in private schools the average score increased slightly from 530 in 1999 to 547 in 2003 (Figure 5.26), although neither difference was significant.

Table 5.10: Mathematics Achievement of Jordanian Grade 8 Students, by Selected Characteristics (1999 and 2003 data)

Selected characteristics		1999 Average scale score		2003 Average scale score		Difference (absolute value)	
Gender	Girls	431	(4.7)	438	(4.6)	8	(6.5)
	Boys	425	(5.9)	411	(5.8)	15	(7.4)
Location	Urban	440	(4.3)	433	(5.4)	8	(6.7)
	Rural	403	(5.3)	411	(5.6)	9	(7.9)
Authority	MOE	413	(3.8)	418	(3.7)	6	(4.8)
	UNRWA	476	(11.7)	418	(10.3)	59	(16.8)
	Private	517	(18.2)	513	(16.2)	5	(20.2)
Jordan (all)		**428**	**(3.6)**	**424**	**(4.1)**	**3**	**(5.5)**



Notes:

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

The difference is statistically significant

The difference is not statistically significant

Figure 5.21: Mathematics Achievement of Jordanian Grade 8 Students, by Gender, between 1999 and 2003

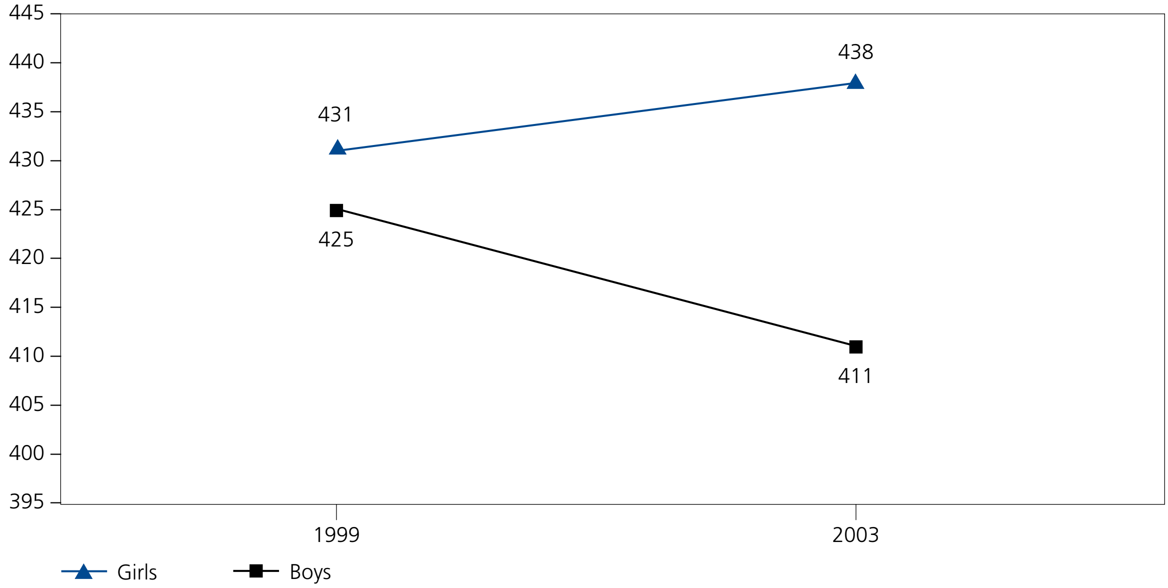


Figure 5.22: Mathematics Achievement of Jordanian Grade 8 Students, by School Location, between 1999 and 2003

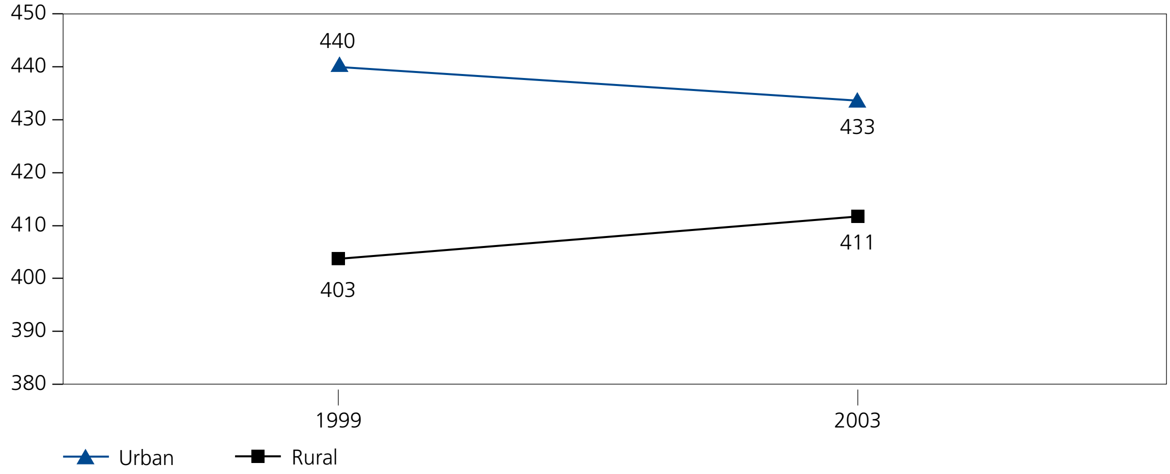


Figure 5.23: Mathematics Achievement of Jordanian Grade 8 Students, by School Authority, between 1999 and 2003

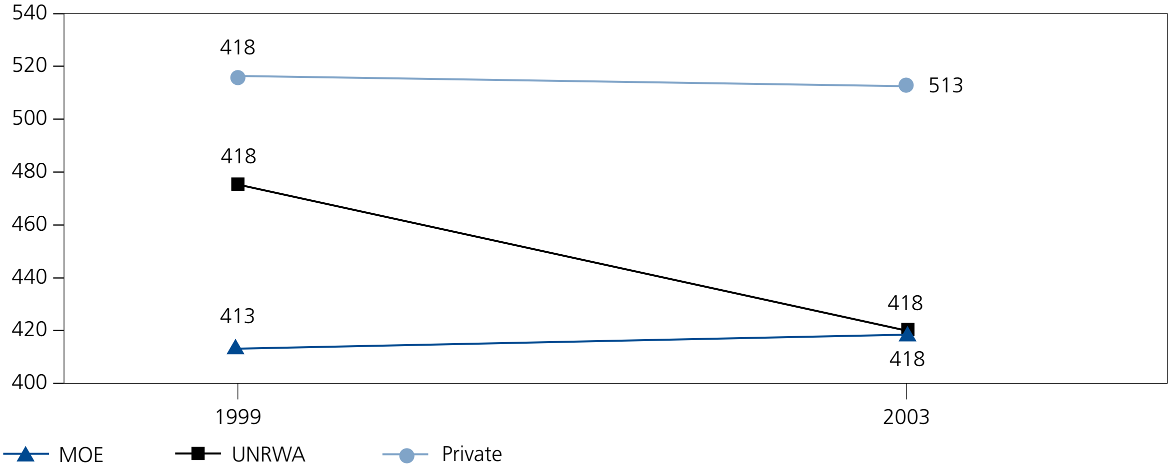


Table 5.11: Science Achievement of Jordanian Grade 8 Students by School Location (2003 data)

Selected characteristics		1999 *Average scale score*		2003 *Average scale score*		Difference (absolute value)		Difference: *Higher scores in 1999*	Difference: *Higher scores in 2003*
Gender	Girls	460	(5.0)	489	(4.5)	30	(7.4)		
	Boys	442	(5.9)	462	(5.5)	21	(7.5)		
Location	Urban	462	(4.2)	480	(6.3)	19	(6.0)		
	Rural	428	(7.1)	466	(6.3)	39	(9.8)		
Authority	MOE	440	(4.6)	469	(4.0)	30	(5.4)		
	UNRWA	478	(9.4)	471	(7.0)	8	(10.6)		
	Private	530	(14.1)	547	(10.6)	18	(15.1)		
Jordan (all)		**450**	**(3.8)**	**475**	**(3.8)**	**25**	**(5.5)**		

-40 -20 0 20 40

Notes:

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

■ The difference is statistically significant

■ The difference is not statistically significant

Figure 5.24: Science Achievement of Jordanian Grade 8 Students, by Gender, between 1999 and 2003

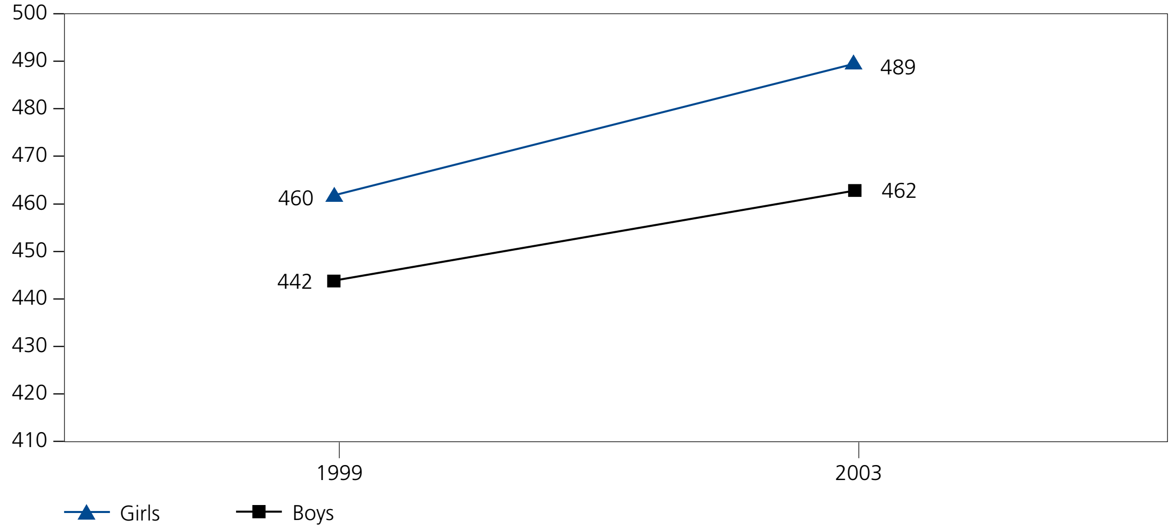


Figure 5.25: Science Achievement of Jordanian Grade 8 Students, by School Location, between 1999 and 2003

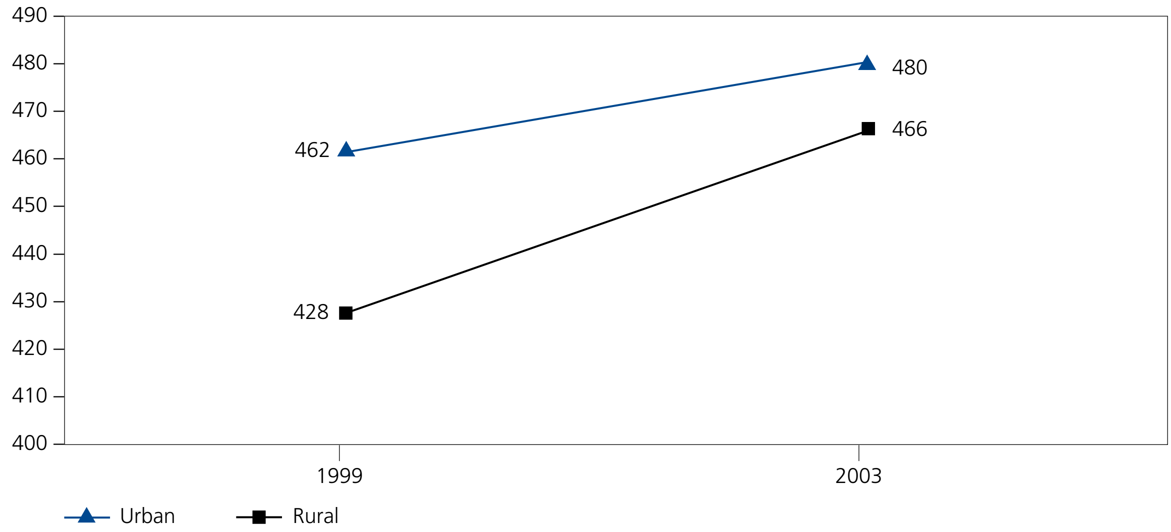
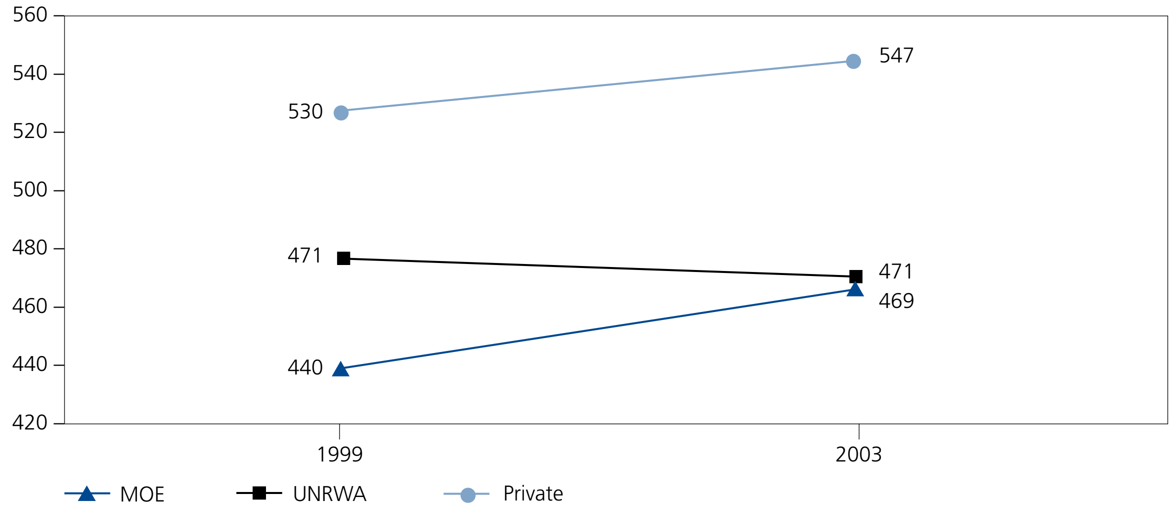


Figure 5.26: Science Achievement of Jordanian Grade 8 Students, by School Authority, between 1999 and 2003



5.5 CONCLUSION

The results presented in this chapter showed that, among the Grade 8 students who participated in the two TIMSS assessments, girls outperformed boys, urban school students outperformed rural school students, and private school students outperformed MOE school students and UNRWA school students in mathematics and science. The mathematics and science achievement of students in Jordan was positively related to availability of school resources, such as appropriate school buildings and laboratories. These results stress the need for Jordan to have as an objective providing all schools with such resources.

Because the performance of Jordanian students in mathematics was well below the international average and because the performance of these students in science was also relatively low compared to the international average, a critical review of the nation's mathematics and science curricula should be conducted to identify weaknesses in them, and from there it will be necessary to develop new curricula designed to improve students' achievement in these subjects. It is acknowledged, however, that between the two TIMSS assessments of 1999 and 2003, Jordanian eighth graders lifted their performance in science. As such, some of the efforts during these years to improve science education appear to have been successful, and might serve as a guide to further improvement of the science curriculum as well of education in mathematics, where achievement decreased slightly between 1999 and 2003.

Finally, further analyses of the TIMSS data should aim to examine more closely the factors that are contributing to the disparities between boys and girls, between students in rural and urban areas, as well as between students in UNRWA and MOE and private schools as regards achievement in mathematics and science in Jordan.

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Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., & Chrostowski, S. J. (2004). *Findings from IEA's Trends in International Mathematics and Science Study at the fourth and eighth grades.* Chestnut Hill, MA: Boston College.

CHAPTER 6

Morocco: Analysis of the relationship between the availability and use of computers and students' performance in mathematics

Said Bouderga

6.1 EXECUTIVE SUMMARY

This chapter addresses the differences in mathematics performance of students in the eight Arabic countries that participated in TIMSS 2003. It looks at this performance in relation to the extent to which the students' schools were using computers. The chapter also considers how the Moroccan teachers involved in TIMSS were using computers during mathematics lessons and if their students' achievement results differed depending on the kind of tasks for which computers were being used during these lessons. The results can be summarized as follows:

- In the Palestinian National Authority, Egypt, and Tunisia, significant differences in mathematics achievement emerged between students using computers at school only and those students who did not use computers at all. In Tunisia, this difference favored students using computers at school, but in Egypt and Palestine the difference favored students who were not using computers at all. In Morocco, no significant difference between these two groups was found.
- From the analysis comparing the performance of students who used computers somewhere (at home, at school) with the performance of students who were not using computers at all, significant differences in favor of students using computers emerged in four of the nine Arabic countries: Bahrain, Lebanon, Saudi Arabia, and Tunisia.
- In Morocco, activities involving the use of computers during mathematics lessons appeared to influence the mathematics performance of Grade 8 students under certain circumstances. Students participating in two out of four computer-related activities, namely "practice skills and procedures" and "process and analyze data," during at least some lessons significantly outperformed those students who reported not taking part in these activities at all.

6.2 INTRODUCTION

The Moroccan Ministry of National Education places considerable importance on having information technologies as a part of its forward-looking perspective for the country's schools. As such, it is interesting to know what impact the use of these technologies is having on students' performance. The international study TIMSS 2003, in which Morocco, along with many countries around the world, participated, constitutes an important source of data for examining the relationship between the use of these technologies in education and students' performance.

The research presented in this chapter focuses on using computer technology to facilitate learning. The analyses are limited to the mathematics results of students in what TIMSS refers to as Population 2 (generally comprising eighth graders) and which in Morocco corresponds to the second year of the education system's *enseignement collégial.* While the majority of the analyses documented here concern performance comparisons between the eight Arabic countries that participated in TIMSS 2003, information regarding computers and mathematics achievement across all countries that participated in TIMSS 2003 is used for comparative purposes.

The following research questions guided the analyses:

- To what extent is the capacity of schools to provide instruction affected by a shortage of computers?
- How does the level of computer ownership by students in Morocco compare to this ownership in other Arabic countries?
- At which places do Moroccan students use computers?
- Does using a computer contribute to improved school achievement for students?
- How and when is computer usage most effective in terms of student achievement?

6.3 METHOD

For the following analyses, I used data from Arabic countries participating at the Grade 8 level in TIMSS 2003. An additional source of information was the *TIMSS 2003 International Mathematics Report*. Variables included in the analyses were:

- Use of computers in mathematics lessons (Question 31 of the TIMSS 2003 questionnaire for mathematics teachers): "In teaching mathematics to the TIMSS class, how often do you have students use a computer for the following activities: practice skills, discover principles, look up ideas, process data?"
- A derived variable (BSDGCAVL) based on Questions 14 and 27 of the TIMSS 2003 student questionnaire, which sought information on the level of access students had to computers and where they had that access.

6.4 RESULTS

In order to address the first research question, I conducted an examination of the extent to which Moroccan headmasters and teachers of the students who participated in TIMSS 2003 thought that instruction was adversely affected by a shortage of computer hardware in their schools. The descriptive statistics revealed that 59.6% of the students had principals who stated that instruction was adversely affected "a lot" by a shortage of computer hardware, while 56.6% of the students had teachers who said that a shortage of computers limited their teaching "a lot." Thus, the majority of headmasters and teachers of Moroccan students reported a lack of computer availability as a hindrance to their instruction, emphasizing the importance of this tool in education.

To address the second research question, I compared the level of computer ownership in Moroccan schools with the level of ownership across the other Arabic countries and across all countries that participated in 2003. As Mullis, Martin, Gonzalez, & Chrostowski (2004, p. 160) noted in the *TIMSS 2003 International Mathematics Report*:

- At the international level, 60% of Grade 8 students claimed to own a computer;
- At the Arab level, this percentage was below 50% except for three Arabic countries, namely Bahrain (81%), Lebanon (59%), and Saudi Arabia (57%);
- At the Moroccan level, the percentage was only 18%, which was the second lowest value among the Arabic TIMSS 2003 countries.

Recognizing that ownership of a computer does not necessarily mean students use this tool, the researchers conducting the TIMSS 2003 study asked for information about the places where students actually accessed computers. To this end, the TIMSS 2003 international mathematics report included an index (BSDGCAVL) derived from two different computer-related questions (14 and 27) of the TIMSS 2003 student questionnaire. This index involved five groups of students:

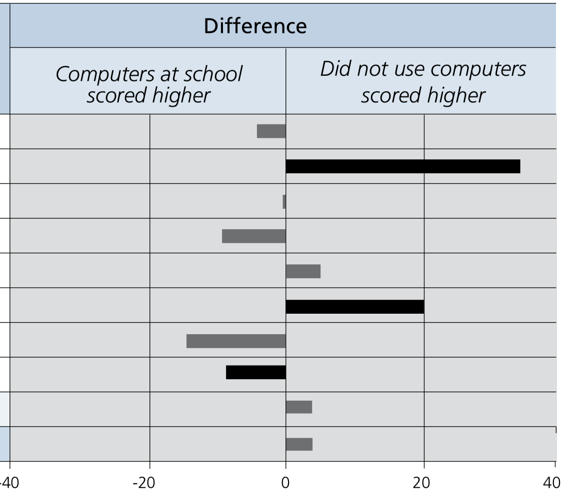
- Group 1: students who use a computer at school and at home;
- Group 2: students who use a computer at home and not at school;
- Group 3: students who use a computer at school and not at home;
- Group 4: students who use a computer only in a place other than at home or at school; and
- Group 5: students who have not used a computer at all.

Of the entire sample of Moroccan Grade 8 TIMSS 2003 students, 15% reported using a computer at school and at home, whereas 39% of students across all participating countries reported using a computer at school and at home. Twenty percent of the Grade 8 Moroccan students had not used a computer at all compared with 14% of the students at the international level. Of the Moroccan students who said they had used a computer, the largest number (28%) claimed to have done so only in a place other than at home or at school. This finding relates to the fact that, in order to use a computer, Moroccan students generally go to cyber cafés, which are very popular with Moroccan young people.

As can be seen in Table 6.1, across the nine Arabic countries, the proportion of Grade 8 students who claimed to use a computer at school but not at home (Group 3) differed quite markedly across the eight Arabic countries. On the one hand, this usage was very high for students in Egypt (62%), Jordan (43%), Palestine (33%), and Syria (58%), and was certainly considerably higher than the international average of 19%. On the other hand, this usage was very low for students in Bahrain (8%) and Saudi Arabia (5%).

Table 6.1: Mathematics Achievement of Students in Arabic Countries Who Had Used Computers at School and Who Had Not Used Computers At All

Country	Used computers at school but not at home				Did not use computers at all				Difference (absolute value)	
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
Bahrain	8	(0.4)	383	(6.0)	6	(0.4)	379	(6.5)	4	(8.7)
Egypt	62	(1.4)	403	(3.5)	7	(0.7)	437	(6.8)	34	(7.2)
Jordan	43	(1.5)	413	(3.7)	4	(0.5)	412	(7.7)	1	(7.9)
Lebanon	21	(2.0)	426	(5.7)	10	(1.2)	417	(4.9)	9	(7.9)
1 ‡ Morocco	21	(1.7)	388	(5.1)	20	(1.5)	393	(4.2)	5	(5.1)
Palest. Nat'l Auth.	33	(1.6)	378	(3.9)	10	(0.9)	397	(5.4)	19	(6.4)
Saudi Arabia	5	(0.8)	332	(6.4)	25	(1.9)	321	(6.5)	12	(8.5)
Tunisia	16	(1.5)	408	(3.3)	36	(1.7)	399	(2.3)	9	(3.8)
Arabic average	26	(0.5)	392	(1.7)	15	(0.4)	394	(2.0)	3	(2.5)
International average	19	(0.2)	441	(1.0)	14	(0.2)	420	(1.3)	- - -	- - -



Notes:

1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
- - - Values not displayed, as not relevant for analysis
■ The difference is statistically significant
■ The difference is not statistically significant

While the international mathematics achievement mean was clearly higher among students in schools that used computers compared to students in schools that did not use computers at all (441 vs. 420 points), this relationship was not so clear-cut among the Arabic countries (see Table 6.1). In five of the eight countries under review, students who were using a computer at school performed at a higher level in mathematics than those students who had not used a computer at all. This difference in favor of students who used computers at school but not at home was highest in Saudi Arabia (12 score points), followed by Tunisia and Lebanon (both 9 score points). It was lowest in Jordan (1 point). However, the difference was significant only for Tunisia. The remaining three countries showed the opposite result in that students who had not used a computer at all achieved at a higher level than students who had used a computer at school but not at home. The greatest difference in this direction was recorded for Egypt (34 score points), followed by Palestine (19 points). Both differences were significant.

To clarify this issue further, an additional analysis was performed. Here, all groups of students who had used a computer somewhere (i.e., Groups 1 to 4) were combined and their mathematics performance was compared with the performance of the group of students who reported not having used a computer at all (Group 5). As is evident from Table 6.2, in four of the eight Arabic countries, namely Bahrain, Lebanon, Saudi Arabia, and Tunisia, those students who had used a computer obtained significantly higher scores in mathematics than those students who had not used a computer. The differences ranged from 17 score points in Saudi Arabia to 25 score points in Bahrain in favor of those students who had used a computer. In Egypt, a different effect became evident: students who had not used a computer significantly outperformed those students who had used a computer. In all other countries, including Morocco, no significant differences could be identified between the two groups.

While the results of the Arabic countries for which the comparisons are significant confirm the positive relationship between the use of computers and students' performance, the relationship is again not entirely clear-cut, especially in regard to Egypt, where the reverse relationship was found. A reason for this might be that, in Egypt, the use of computers is particularly widespread among lower performing students. While not significant, differences in mathematics achievement also emerged in Palestine and Morocco in favor of students who had not used computers. A closer look at this result for Morocco involved examining if any differences in achievement would emerge when consideration was given to the purpose for which Moroccan teachers used computers during mathematics lessons. To this end, the teachers' responses to Question 31 on the teacher questionnaire were analyzed. Table 6.3 presents the results.

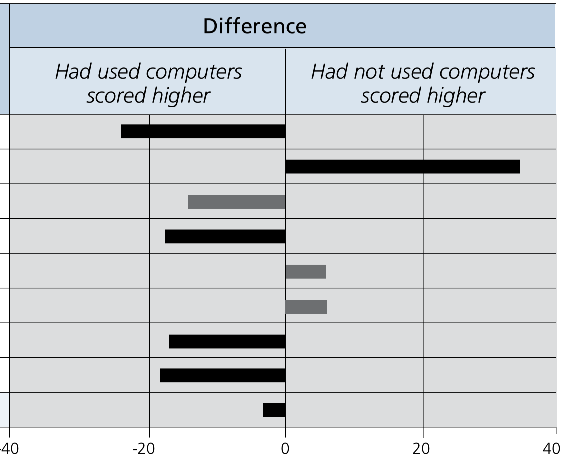
As can be clearly seen from Table 6.3, significant differences emerged for two of the listed activities—"practice skills and procedures" and "process and analyze data." Moroccan students who used computers for these purposes in at least some of their mathematics lessons significantly outperformed those students whose teachers never used computers for these activities. It is also apparent from the table that the differences in performance relative to the activity "look up ideas and information" was close to significant. These findings indicate that purposeful use of computers in mathematics classes could promote higher student performance.

6.5 CONCLUSION

The results reported in this chapter can be summarized as follows. First, differences in the extent to which schools and their students owned and could access computers emerged across the eight Arabic countries participating in TIMSS 2003, as was the case across all the countries that participated in TIMSS 2003. Second, comparisons between the performance of students who used computers at school only and those who did not use computers at all showed a significant difference in favor of computer usage at school in only one of the eight Arabic countries. This picture changed somewhat when all groups of students who used a computer, regardless of where they accessed it, were combined and their achievement in mathematics was compared to the performance of those students who said they had not used computers at all. Here, four of the Arabic countries showed significant

Table 6.2: Mathematics Achievement of Students in Arabic Countries Who Had Used Computers "Somewhere" and of Studens Who Had Never Used Computers

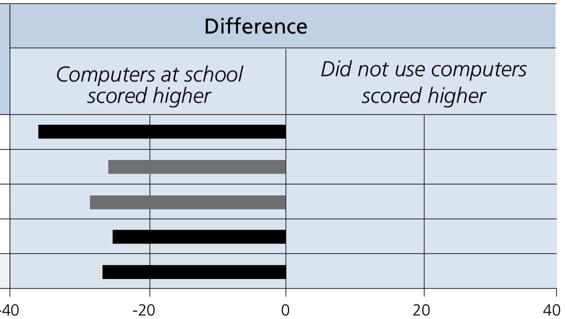
Country	Used computers				Did not use computers at all				Difference (absolute value)	
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
Bahrain	94	(0.4)	404	(1.7)	6	(0.4)	379	(6.5)	25	(6.3)
Egypt	93	(0.7)	405	(3.6)	7	(0.7)	437	(6.8)	32	(6.9)
Jordan	96	(0.5)	426	(4.2)	4	(0.5)	412	(7.7)	14	(7.8)
Lebanon	90	(1.2)	436	(3.3)	10	(1.2)	417	(4.9)	18	(5.4)
1 ‡ Morocco	80	(1.5)	387	(2.6)	20	(1.5)	393	(4.2)	6	(3.8)
Palest. Nat'l Auth.	90	(0.9)	390	(3.2)	10	(0.9)	397	(5.4)	7	(5.4)
Saudi Arabia	75	(1.9)	337	(4.4)	25	(1.9)	321	(6.5)	17	(5.8)
Tunisia	64	(1.7)	418	(2.6)	36	(1.7)	399	(2.3)	18	(2.9)
Arabic average	85	(0.4)	400	(1.2)	15	(0.4)	394	(2.0)	6	(2.0)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 6.3: Mathematics Achievement of Students in Morocco According to How Computers at School Were Being Used in Mathematics Lessons

Activities	Used computers in at least some lessons				Never used computers				Difference (absolute value)	
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
Practice skills	32	(13.5)	408	(8.5)	68	(13.5)	374	(10.8)	34	(14.1)
Discover principles	45	(15.6)	399	(9.0)	55	(15.6)	373	(13.5)	26	(17.0)
Look up ideas	37	(14.3)	403	(8.9)	63	(14.3)	374	(11.7)	29	(15.2)
Process data	17	(6.7)	406	(8.1)	83	(6.7)	381	(10.2)	25	(12.3)
Average	33	(6.5)	404	(4.3)	67	(6.5)	376	(5.8)	29	(7.4)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

differences in favor of those students who said they had used computers. Finally, an examination of achievement differences relative to four different activities involving computers during mathematics lessons, as reported by teachers, revealed that those students whose teachers reported using these activities outperformed students whose teachers said they never used computers for any of these activities. Taken together, these results suggest that efforts to improve students' performance in mathematics must go beyond merely providing schools with computers. It is also necessary for teachers to know how they and their students can effectively use computers for *purposeful* activities during mathematics lessons.

Reference

Mullis, I. V. S., Martin, M. O., Gonzalez, E., & Chrostowski, S. J. (2004). *TIMSS 2003 international mathematics report: Findings from IEA's Trends in International Mathematics and Science Study at the fourth and eighth grades.* Chestnut Hill, MA: Boston College.

CHAPTER 7

Oman: Analysis of differences in mathematics achievement of Grade 8 students in Arabic countries depending on the availability and use of computers

Ali Juma Alrasbi, Moza Said Albalushi, Salim Abdulah Alkharusi, Salim Said Alharhty, and Amal Mohammed Alzadjali

7.1 EXECUTIVE SUMMARY

The aim of the analyses reported in this chapter was to examine whether or not significant differences on specified variables were apparent in the mathematics performance of Grade 8 students of the Arabic countries that participated in TIMSS 2003. The countries were Bahrain, Egypt, Jordan, Lebanon, Morocco, the Palestinian National Authority, Saudi Arabia, Syria,[1] and Tunisia,[2] and the variables considered were the following:

- Whether students had access to a few or many computers within their schools;
- Whether students were using computers inside or outside school;
- Whether computers were available during mathematics lessons; and
- Whether students were using computers to look up ideas and information relating to mathematics.

To address these questions, the research team analyzed data from TIMSS 2003 for all Arabic countries for which data were available in that testing cycle and that had approved sampling procedures. The results can be summarized as follows:

- In Egypt, Lebanon, and Saudi Arabia, student performance on the mathematics assessment was significantly higher in schools that had a high number of computers. In Tunisia, however, students being taught in schools with only a few computers achieved the significantly higher achievement scores.
- In Bahrain, Egypt, Jordan, Lebanon, and Saudi Arabia, students using computers inside the school outperformed students using computers outside the school.
- Students who had access to computers during mathematics lessons in TIMSS classes in Bahrain, Jordan, Lebanon, the Palestinian National Authority, and Saudi Arabia scored at a higher level than the students in these countries who did not have access to computers during their mathematics lessons. However, these differences were significant for only the first three countries.
- No significant differences were found in any of the eight Arabic countries in relation to using computers to look up ideas and information relating to mathematics.

7.2 INTRODUCTION

Students in Omani schools have been using computers for over nine years, so a research team in the country considered it would be timely to evaluate the effectiveness of using computers in schools in terms of student achievement. To do this, the team drew on student mathematics achievement data from the TIMSS 2003 assessment. Because Oman did not participate in TIMSS 2003, it did not have data relevant to this issue. However, the research team decided that utilizing data from Arabic countries that did take part in the 2003 study would provide insights relevant to Oman. Specifically, the research team analyzed the TIMSS 2003 data to examine if significant relationships existed between certain aspects of computer availability and mathematics achievement among Grade 8 students in the Arabic countries. The following research questions guided the analysis:

- In the eight Arabic countries under review, to what extent was the mathematics performance

1 While Syria did participate in TIMSS 2003, it did not meet internationally agreed sampling specifications and was therefore not included in the current analysis.

2 Oman did not participate in TIMSS 2003, so is not included in these analyses.

of Grade 8 students influenced by whether their school had a few or many computers?
- In the eight Arabic countries under review, to what extent was the mathematics performance of Grade 8 students influenced by whether they were using computers inside and outside of school (considered "inside school") or outside of school only (considered "outside school")?
- In the eight Arabic countries under review, to what extent was the mathematics performance of Grade 8 students affected by computer availability during mathematics lessons?
- In the eight Arabic countries under review, to what extent was the mathematics performance of Grade 8 students influenced by whether or not students used computers to look up ideas and information relating to mathematics during mathematics lessons?

7.3 METHOD

First, descriptive statistics of the four aspects of computer availability and usage in schools stated in the above research questions and the corresponding mathematics achievement, which was calculated as the mean of the five plausible values indicating each student's overall mathematics achievement, were calculated. The IEA IDB Analyzer© software was then used to undertake linear regression analyses in order to identify if any differences regarding students' mathematics achievement for the various levels of computer availability and usage in schools were significant.

Ability to answer the first research question required some recoding of the TIMSS school questionnaire variable encapsulated in the question, "What is the total number of computers in your school that can be used for educational purposes by eighth grade students?" This variable (BCBGCMPS) was recoded into a new variable called "NOCOMP." Schools with between 0 and 16 computers were recoded into 1="few." Schools with 17 or more computers were recoded into 2 ="many." This new recoded variable was regarded as the independent variable, and the average of the five plausible values of overall mathematics achievement was used as the dependent variable.

Some recoding was also required to carry out the analysis directed at answering the second research question. A new variable, called "COMPUSE," was computed from the index "use of computers" (BSDGCAVL), which was derived from the student questionnaire questions 14a and 14b. Here, the students who responded that they used computers "both at home and at school" and "at school but not at home" were recoded into 1="in school," while the students who indicated using computers "at home but not at school" and "only at places other than home" were recoded into 2 ="outside the school." The fifth category of this variable ("do not use computers at all") was excluded from the analysis. This recoded variable then became the independent variable, while the five plausible values of overall mathematics achievement became the dependent variables.

The first part of Question 30 in the TIMSS teacher questionnaire was used for the analysis related to the third research question. This question, "Do the students in the TIMSS class have a computer during their mathematics lessons?" (BTBMCOMA), was coded 1="yes" and 2 ="no." This variable became the independent variable in this analysis, and the five plausible values of overall mathematics achievement became the dependent variable.

Recoding was also carried out to analyze the data relevant to the fourth research question. The teacher questionnaire variable "BTBMCALI" ("During teaching of mathematics, how often did students in the TIMSS class use computers to look up ideas and information?") was recoded into a new variable called "COUINF." The answers "every or almost every lesson," "about half the lessons," and "some lessons" were recoded into 1="used," while the answer "never" was recoded into 2 ="not used". This variable was the independent variable, and the five plausible values of overall mathematics achievement became the dependent variable.

7.4 RESULTS

As shown in Table 7.1, in four of the eight Arabic countries under review, namely, Bahrain, Jordan, Morocco, and Palestine, the differences in performance between students in schools with many computers and students in schools with few computers were not significant. Thus, the students were achieving similar results regardless of the number of computers their schools provided.

In three countries in which performance was positively correlated with the number of computers in schools, namely Egypt, Lebanon, and Saudi Arabia, the difference was in favor of schools that had many computers available. In other words, those students learning in schools with many computers scored relatively better on the mathematics test than did students attending schools with a limited number of computers. In contrast, in Tunisia, students in schools with only a few computers scored significantly better than students taught in schools with many computers.

Table 7.2 shows the differences in student achievement on the basis of whether the students were using computers inside school or outside school. In Bahrain, Egypt, Jordan, Lebanon, and Saudi Arabia, students who reported using computers in school scored significantly higher on the mathematics test than did students who said they used computers outside school. The largest difference in favor of using computers in school emerged for Lebanon (a difference of 35 score points), followed by Saudi Arabia (18 points), Jordan (15 points), Egypt (14 points), and Bahrain (12 points).

Table 7.3 presents the results of the analysis that compared student performance in mathematics according to the availability of computers during mathematics lessons in class. No information on this question was available for Egypt, as the question was not administered in this country. No significant differences emerged for four of the eight Arabic countries depending on whether or not students had access to computers during mathematics lessons. The countries in which a significant difference was found included Jordan (a difference of 63 score points), Lebanon (22 points), and Bahrain (8 points). In these instances, students who had access to computers during their mathematics lessons scored significantly better than students who did not have this access.

From Table 7.4, we can see that while differences in performance favored students who used computers for looking up ideas and information during their mathematics lessons, none of these differences was significant in any of the Arabic countries under review. Again, no information was available for Egypt because the relevant question was not administered in that country.

7.5 CONCLUSION

The analyses documented in this chapter investigated if the number of computers available in a school, student access to computers outside or inside the school, availability of computers during mathematics lessons in class, and using computers to look up ideas and information during mathematics lessons were significantly associated with the mathematics performance of Grade 8 students in eight Arabic countries that participated in TIMSS 2003.

The results showed that in Egypt, Lebanon, and Saudi Arabia, student performance was significantly higher in schools with many computers, while in Tunisia the significant difference showed the opposite trend. In the other four Arabic countries, the performance differences were not significant. An explanation of this result, which was somewhat contrary to expectations, might be that students were not using computers in an effective manner.

In line with expectations, in Bahrain, Egypt, Jordan, Lebanon, and Saudi Arabia, students using computers inside the school outperformed students using computers outside the school. The positive effect on mathematics achievement for this independent variable might stem from the fact that in schools students use computers with their teachers' guidance on work aimed at educational activities, whereas outside school students tend to use computers mainly for entertainment purposes.

As regards achievement differences, the results of the analyses concerning whether or not students had access to computers during mathematics lessons showed that students with access outperformed students without such access in Bahrain, Jordan, and Lebanon. This positive effect might be due to the use of computers for solving and checking problems.

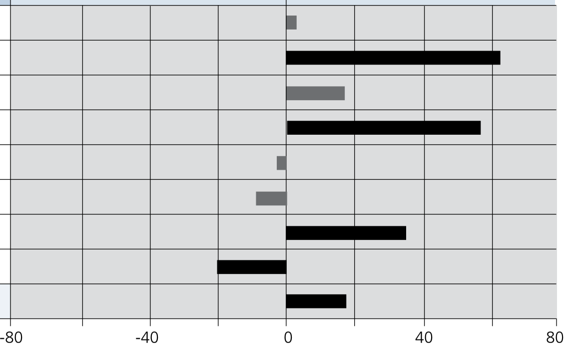
Finally, differences in mathematics achievement relative to how computers were used during mathematics lessons were found in all the Arabic countries, except Palestine. These differences favoured students using computers to look up ideas and information during mathematics lessons. Thus, students not using computers for this purpose tended not to do as well as their computer-using peers on the achievement test, but these differences were not significant.

Table 7.1: Average Mathematics Achievement of Students in Arabic Countries by Number of Computers

Country	Low		High		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
Bahrain	41 (0.2)	399 (3.0)	59 (0.2)	403 (2.2)	4 (3.7)
Egypt	94 (1.3)	402 (3.7)	6 (1.3)	464 (18.0)	62 (18.6)
Jordan	50 (3.9)	417 (5.7)	50 (3.9)	431 (6.3)	14 (8.9)
Lebanon	59 (4.6)	419 (4.9)	41 (4.6)	472 (4.9)	53 (7.0)
1 ‡ Morocco	86 (4.1)	386 (3.1)	14 (4.1)	381 (6.6)	4 (7.5)
Palest. Nat'l Auth.	74 (3.8)	393 (3.9)	26 (3.8)	385 (6.6)	8 (8.0)
Saudi Arabia	84 (2.8)	326 (6.0)	16 (2.8)	359 (15.6)	33 (16.7)
Tunisia	95 (2.0)	411 (2.4)	5 (2.0)	390 (9.9)	21 (10.1)
Arabic average	73 (1.1)	394 (1.5)	27 (1.1)	411 (3.6)	17 (3.9)

Difference

Fewer than 16 computers scored higher | *Seventeen computers or more scored higher*



Notes:

1 National Desired Population does not cover all of International Desired Population

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

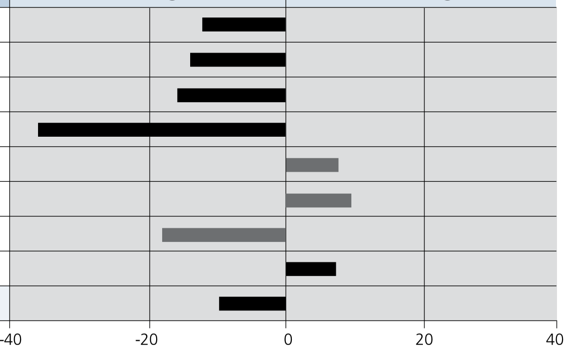
■ The difference is statistically significant

Table 7.2: Average Mathematics Achievement of Students in Arabic Countries by Computer Use Inside/Outside School

Country	In school		Outside school		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
Bahrain	42 (1.6)	411 (2.9)	59 (1.6)	399 (2.3)	12 (3.8)
Egypt	86 (1.0)	407 (3.5)	14 (1.0)	393 (6.4)	14 (5.4)
Jordan	82 (1.5)	429 (4.4)	18 (1.5)	414 (6.3)	15 (6.1)
Lebanon	67 (2.3)	447 (4.2)	33 (2.3)	412 (4.3)	35 (5.6)
1 ‡ Morocco	45 (2.2)	383 (4.3)	55 (2.2)	390 (3.1)	8 (5.4)
Palest. Nat'l Auth.	65 (2.4)	387 (4.0)	35 (2.4)	397 (4.5)	10 (5.2)
Saudi Arabia	22 (2.4)	351 (9.3)	78 (2.4)	333 (4.3)	18 (9.1)
Tunisia	33 (2.4)	412 (3.2)	67 (2.4)	421 (3.3)	9 (4.6)
Arabic average	55 (0.7)	403 (1.7)	45 (0.7)	395 (1.6)	8 (2.1)

Difference

In school scored higher | *Outside school scored higher*



Notes:

1 National Desired Population does not cover all of International Desired Population

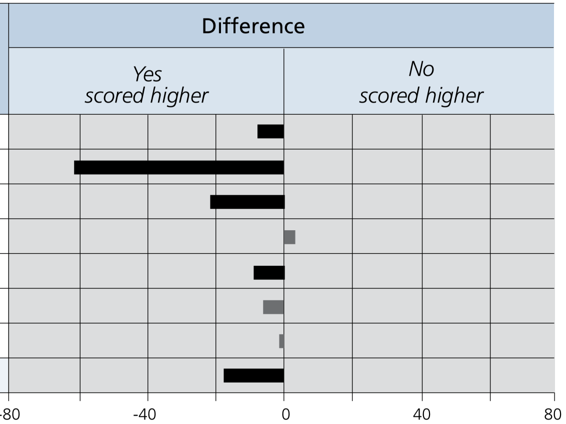
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent

■ The difference is statistically significant

Table 7.3: Average Mathematics Achievement of Students in Arabic Countries by Availability of Computers in Mathematics Lessons

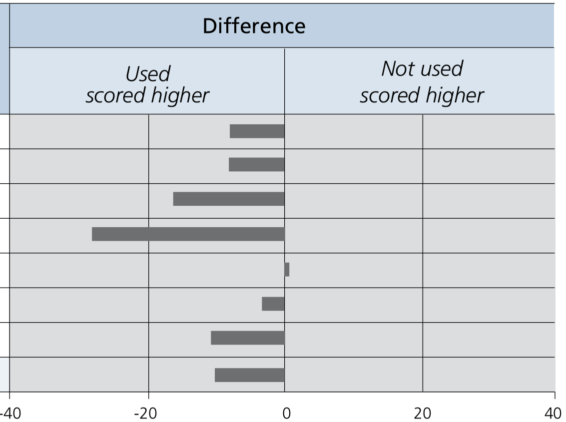
Country	Yes		No		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
Bahrain	35 (3.5)	406 (3.8)	65 (3.5)	399 (2.4)	8 (3.5)
Jordan	11 (2.8)	481 (17.5)	89 (2.8)	418 (3.7)	63 (2.8)
Lebanon	24 (3.8)	450 (8.0)	76 (3.8)	428 (3.7)	22 (3.8)
1 ‡ Morocco	17 (4.3)	385 (9.0)	83 (4.3)	389 (4.1)	4 (4.3)
Palest. Nat'l Auth.	29 (4.1)	397 (7.2)	71 (4.1)	387 (3.6)	10 (4.1)
Saudi Arabia	19 (3.6)	339 (7.0)	81 (3.6)	332 (4.7)	7 (3.6)
Tunisia	23 (3.5)	411 (5.3)	77 (3.5)	410 (2.4)	2 (3.5)
Arabic average	22 (1.4)	410 (3.5)	78 (1.4)	395 (1.4)	15 (1.4)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 7.4: Average Mathematics Achievement of Students in Arabic Countries Relative to Using/Not Using Computers for Information during Mathematics Lessons

Country	Used		Not used		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
Bahrain	86 (5.4)	406 (4.3)	14 (5.4)	399 (19.4)	7 (19.8)
Jordan	77 (18.2)	493 (27.9)	23 (18.2)	485 (100.9)	8 (104.3)
Lebanon	95 (3.2)	453 (8.4)	5 (3.2)	438 (48.4)	15 (49.0)
1 ‡ Morocco	37 (14.3)	403 (8.9)	63 (14.3)	374 (11.7)	29 (15.2)
Palest. Nat'l Auth.	65 (8.3)	399 (8.4)	35 (8.3)	400 (15.0)	0 (16.8)
Saudi Arabia	81 (8.7)	342 (7.9)	19 (8.7)	339 (26.1)	3 (28.3)
Tunisia	48 (9.0)	419 (9.9)	52 (9.0)	407 (5.9)	11 (12.1)
Arabic average	70 (4.0)	416 (4.9)	30 (4.0)	406 (4.0)	11 (17.6)



Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is not statistically significant

Further analyses should focus on the reasons behind these differences. For example, the availability and use of computers in schools might be more of an indicator of the wealth of schools than it is an indicator of the effective use of these resources for instructional purposes. It would therefore be of interest to examine the effects of computer availability and use on achievement while controlling for the socioeconomic background in which schools operate. It is important that such inter-relationships between potentially influential factors are identified so that educational policymakers can bring in appropriate measures to improve the mathematics performance of all students in their respective countries.

CHAPTER 8

Palestinian National Authority: Analysis of factors related to mathematics teachers and their effect on the achievement of students studying in government and UNRWA schools in Palestine

Mohammed Matar Mustafa and Khaled Bisharat

8.1 EXECUTIVE SUMMARY

This chapter investigates the relationship between the mathematics performance of Palestinian students in schools overseen by different supervisory authorities, namely the government and the United Nations Relief and Work Agency (UNRWA), and factors derived from responses to the teacher questionnaire used in the TIMSS 2003 assessment. These factors were:

- Teacher interaction in terms of (a) teachers' outside-class interaction and (b) exchange visits between teachers;
- Teacher in-service training as reflected by teachers' professional development in (a) mathematics curriculum topics and (b) assessment and evaluation;
- Teachers' satisfaction with their jobs;
- Teachers' expectations of their students' performance;
- Parental involvement; and
- Homework assignments.

Five of these eight factors were found to have a significant effect on the mathematics achievement of students studying in either government or UNRWA schools within the Palestinian National Authority.[1] The factors were teachers' outside class interaction,[2] teacher training in assessment and evaluation, parental involvement in school activities, teacher expectations of their students' performance, and homework assignments.

More specifically, in relation to the eight factors and the two school types, the results were as follows. With most of these factors, analysis of the differences in mean achievement indicated positive as well as negative associations. However, the majority of these differences were not significant.

- For both UNRWA and government schools, students taught by teachers who reported engaging in exchange visits with other teachers performed at a lower level than students taught by teachers who said they did not engage in such visits. These differences, however, were not significant.
- For both UNRWA and government schools, no significant differences in mathematics achievement were found between students taught by teachers who reported having more in-service training in mathematics curriculum topics and students taught by teachers who reported having less training in these topics.
- For UNRWA schools, no significant differences in mathematics achievement were found between those students taught by teachers who reported experiencing in-service training in assessment and evaluation and students taught by teachers who said they did not experience such training.
- For government schools, students taught by teachers who reported receiving in-service training in assessment and evaluation performed at a significantly higher level on the TIMSS mathematics assessment than students taught by teachers who reported not receiving such training.
- For both UNRWA and government schools, no significant differences in mathematics achievement were found between students taught by teachers who reported different levels of job satisfaction (high/medium/low).

1 Supervision of the education system in Palestine is actually shared between *three* authorities. The first is the government authority, which covers about 70% of Palestinian students and is supervised directly by the Ministry of Education and Higher Education (MoEHE). The second is the UNRWA authority, which serves about 24% of the Palestinian students in the refugee camps on the West Bank and Gaza, with coverage more extensive in the Gaza strip (about 44% of the students). The third authority is the private sector, which serves about 6% of Palestinian students.

2 Only one percent of government teachers reported no outside class interaction. Thus, this group is really too small to allow meaningful comparisons, and results for this variable should be treated with great caution.

- For UNRWA schools, mathematics achievement associated positively with the level of teacher expectation of student performance. The differences were found to be statistically significant between students who had teachers with a medium level of expectation and students who had teachers with a low level of expectation. The same result was found between students with teachers with high expectations of their students' achievement and students of teachers with low expectations.
- For government schools, no significant differences emerged in regard to mathematics achievement and teacher expectation.
- For UNRWA schools, students taught by teachers who reported a medium level of parental involvement showed significantly higher scores on the achievement test than students taught by teachers who reported a low level of parental involvement.
- For government schools, no significant differences in mathematics achievement were found in relation to teachers' reports of different levels of parental involvement.
- For UNRWA schools, significant differences in mathematics achievement were found between students taught by teachers who reported assigning homework every or almost every day and students taught by teachers who reported assigning homework during half or less than half of mathematics lessons. The differences favored students assigned the lower amount of homework.
- For government schools, no significant differences in mathematics achievement were found between students taught by teachers who reported assigning higher amounts of homework and students taught by teachers who reported assigning lower amounts of homework.

In summary, the eight teacher factors under review did not provide a clear and sufficient explanation of the difference in mathematics achievement between government and UNRWA students in TIMSS 2003. Further research into the TIMSS data will be required to account for this variation.

8.2 INTRODUCTION

The findings of national assessments conducted in Palestine since 1999 have consistently shown that students from UNRWA schools outperform their peers from government schools in mathematics (Assessment and Evaluation Center/AEC, 1998, 2006a; Matar, Al-Khaleeli, & Al-Janazreh, 2000). The data for the Palestinian National Authority from TIMSS 2003 showed the same result. Students studying in schools under government supervision attained a mean mathematics achievement score of 380 while students studying in schools under the supervision of UNRWA achieved a mean score of 404. The difference was statistically significant, as presented in Table 8.1 on page 93 (see also AEC, 2006b).

Given that Palestine has a centralized education system, under which all schools have the same curriculum per subject and the same textbooks, this variation in achievement based on supervising authority has raised a huge debate among Palestinian educators and decisionmakers. Differences between teachers in government and UNRWA authorities—in terms of pre- and in-service teacher training and other inside-school teacher-related factors—offer one possible explanation, among others, for this difference in achievement. Data collected during Palestine's participation in the TIMSS 2003 assessment provided an opportunity for examining this issue. Answers to the following research questions were sought through an analysis of the relevant data:

- How does the mathematics achievement of students in government schools differ from that of students in UNRWA schools relative to the extent to which the students' teachers interact with one another (both within and across schools)?
- How does the mathematics achievement of students in government schools differ from that of students in UNRWA schools relative to the amount of in-service training experienced by the students' teachers?
- How does the mathematics achievement of students in government schools differ from that of students in UNRWA schools relative to the level of job satisfaction reported by the students' teachers?

- How does the mathematics achievement of students in government schools differ from that of students in UNRWA schools relative to the expectations teachers have of their students' performance?
- How does the mathematics achievement of students in government schools differ from that of students in UNRWA schools relative to the extent to which parents are involved in the school (as reported by teachers)?
- How does the mathematics achievement of students in government schools differ from that of students in UNRWA schools relative to the amount of homework the students' teachers assign?

8.3 METHOD

The data examined in relation to these six questions came from the Palestinian teachers' responses to Questions 12, 13, 16, and 22 of the TIMSS 2003 teacher questionnaire. To address the six research questions, which covered eight factors, several variables and indices based on the information obtained from responses to the four original questions were developed as follows:

- RESEARCH QUESTION 1
  1. *Outside class interaction:* This new index was derived from Question 12(a)—discussions with other teachers about teaching mathematics (BTBGOTDC)—and Question 12(b)—working with other teachers when preparing instructional materials (BTBGOTPM).
  2. *Exchange visits between teachers:* This new index was derived from Question 12(c)—visit another teacher in his or her class (BTBGOTVT)—and 12(d)—another teacher visits me to observe my teaching (BTBGOTAT).

  The new derived scale for each of these two indices was developed by recoding "mostly not exist" into "no interaction" and by recoding the responses "2–3 times per month," "1–3 times per month," and "1–3 times per week" into "interaction."
- RESEARCH QUESTION 2
  1. *Teacher in-service training in mathematics curriculum topics:* This new index was derived from Questions 13(a)—in-service training in mathematics content (BTBMPDMT)—and 13(c)—in-service training in the mathematics curriculum (BTBMPDMC). The scale for this new index was developed by recoding two affirmative ("yes") responses for the two questions into a "high" category, and recoding one affirmative ("yes") and one negative response ("no") or two negative responses ("no") into a "low" category.
  2. *Teacher in-service training in assessment and evaluation:* This variable was derived from Question 13(f)—attend in-service training in assessment and evaluation in mathematics (BTBMPDMA). For this variable, the same international category (yes/no) was used in the current analysis.
- RESEARCH QUESTION 3
  1. *Teacher job satisfaction:* This variable was derived from Question 16(a) (BTBGCHTS). The new derived scale for this variable was developed by recoding the "very high" and "high" responses as the "high" category. The "medium" response remained the same, while the two responses "low" and "very low" were recoded as the "low" category.
- RESEARCH QUESTION 4
  1. *Teacher expectations for their students' performance:* This variable was derived from Question 16(d)—teacher expectations for student achievement (BTBGCHES). The new derived scale for this variable was developed by recoding the "very high" and "high" responses as the "high" category, by leaving the "medium" response the same and recoding the two responses "low" and "very low" as the "low" category.
- RESEARCH QUESTION 5
  1. *Parental involvement in school activities:* This new index was derived from Questions 16(e)—parental support for student achievement (BTBGCHPS)—and Question 16(f)—parental involvement in school activities (BTBGCHPI). The scale for this new index was developed by adding the responses to the two question parts 16(e) and 16(f) to which the codes 1="very high," 2 = "high," 3 ="medium," 4 ="low," and 5 = "very low" were applied. The 2, 3, and 4 responses

were then recoded into a "high" category, the 5, 6, 7 responses into the "medium" category, and the 8, 9,10 responses into the "low" category.

- RESEARCH QUESTION 6
  1. *Homework assignments:* This was derived from Question 33 of the mathematics teacher questionnaire. The new scale for this variable was developed by keeping the "every or almost every lesson" response as it was, and combining the answers indicating "about half the lessons" and "some lessons" into a category labeled "half or less than half of the lessons."

The "achievement regression" module of the IEA IDB Analyzer© was used for the subsequent analyses, with the five plausible values for Grade 8 mathematics achievement as dependent variables, the type of supervising authority (government or UNRWA) as the classification factor, and the eight derived variables as separate independent variables.

8.4 RESULTS AND DISCUSSION

The reporting of results follows the six research questions. Thus, results are presented and compared for government and UNRWA schools in terms of differences in student performance based first on teacher interaction and then on teacher in-service training, teacher job-satisfaction, expectations of student performance, and finally on parental involvement and homework assignment.

Teacher interaction

Because opportunity for professional development is not necessarily structured by the school, teacher interaction plays an important role in developing the skills that teachers use inside their classrooms (Mullis, Martin, Gonzalez, & Chrostowski, 2004), which is why this study looked at the impact of teachers' interactions with one another on their students' achievement. As shown in Table 8.2, all (100%) UNRWA students were taught by teachers who reported having outside-class interaction with other teachers, while 99% of the government students were taught by teachers who reported this outside-class interaction. As a consequence, the second group—teachers having no interaction—was too small to allow a useful comparison of student achievement for the two groups.

Exchanging class visits between mathematics teachers is considered another feature of teachers' interaction. Table 8.3 shows that 31% of students in government schools had teachers who said they did not exchange class visits; the corresponding percentage for UNRWA schools was higher—59%. Although for both the UNRWA and government schools, a negative association was evident, in that the mean achievement in both types of schools was lower for those teachers who reported exchange visits than for students whose teachers did not report such visits, the difference was not statistically significant. Thus, the analysis of the TIMSS 2003 data for Palestine did not support the view that teachers' interactions with other teachers have a positive impact on their students' achievement. This finding raises many questions about the nature and content of these visits—questions that could be answered by researchers engaging in site visits and classroom observation techniques.

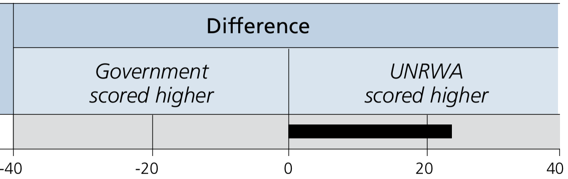
Teachers' in-service training

In the period between 1995 and 2005, that is, the period roughly covering the entire history of the Palestinian National Authority, the number of teachers increased, on average, a staggering 9.2% each year (Aref & Daraghma, 2005). This figure points to the major challenge of ensuring adequate teacher training in Palestine and is one reason why in-service teacher training is considered to be a major challenge and an important quality indicator of Palestine's education system. What needs to be remembered here is that teacher pre-service training programs within the tertiary education sector in Palestine do not include teaching practice—an extended internship—at schools. The only exceptions are those programs offered by the UNRWA Faculty of Education Sciences and Al-Quds Open University. The lack of pre-service practicum for pre-service teachers obviously impacts negatively on the quality of teaching (World Bank, 2006). These reasons underpinned the present study's consideration of the impact of teachers' in-service training on their students' achievement in mathematics.

By the year 2001, the first national Palestinian curriculum had been implemented in all Palestinian schools for Grades 1 and 6, an endeavor that was

Table 8.1: Average Mathematics Achievement According to Supervising Authority in Palestine

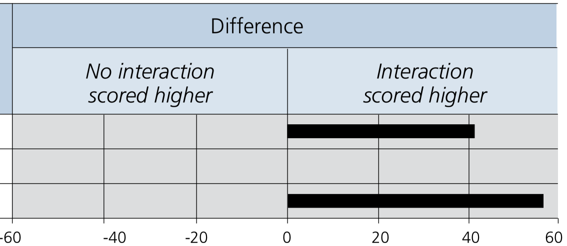
Country	Government		UNRWA		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
Palest. Nat'l. Auth.	66 (1.9)	380 (3.8)	34 (1.9)	404 (4.6)	24 (5.6)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant

Table 8.2: Mathematics Achievement According to Supervising Authority in Palestine, by Outside-Class Interaction

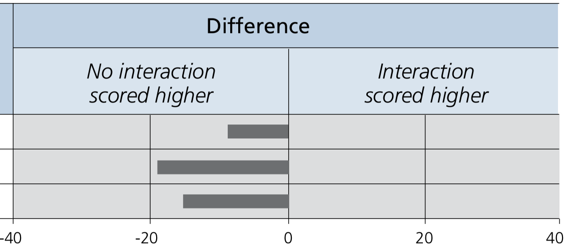
Supervising authority	No interaction		Interaction		Difference (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	
Government	1 (0.9)	339 (17.5)	99 (0.9)	380 (3.9)	41 (18.2)
UNRWA			100 (0.0)	404 (4.8)	
Average	1 (0.9)	339 (17.5)	99 (0.5)	392 (3.1)	54 (18.2)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant

Table 8.3: Mathematics Achievement According to Supervising Authority in Palestine, by Exchange Visits Between Teachers

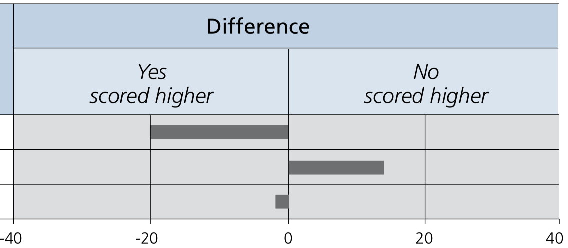
Supervising authority	No interaction				Interaction				Difference (absolute value)	
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
Government	31	(4.9)	386	(8.3)	69	(4.9)	376	(4.9)	9	(10.6)
UNRWA	59	(7.1)	412	(6.8)	41	(7.1)	393	(6.8)	19	(10.1)
Average	45	(4.3)	399	(5.4)	55	(4.3)	385	(7.3)	14	(7.3)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is not statistically significant

Table 8.4: Mathematics Achievement According to Supervising Authority in Palestine, by Teacher In-Service Training in Mathematics Curriculum Topics

Supervising authority	No				Yes				Difference (absolute value)	
	Percent of students		*Average scale score*		*Percent of students*		*Average scale score*			
Government	74	(4.2)	384	(4.2)	26	(4.2)	364	(9.4)	20	(10.6)
UNRWA	70	(5.9)	400	(5.9)	30	(5.9)	413	(8.2)	13	(10.4)
Average	72	(3.6)	392	(3.6)	28	(3.6)	389	(6.2)	4	(7.4)



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is not statistically significant

coupled with intensive teacher-training programs on the new curriculum (Belgian Technical Co-operation, 2004). According to the British Council (2006), this initiative is one of the major teacher training activities carried out since 2001.

Table 8.4 shows the relationship between teachers' in-service training in the mathematics curriculum and the mathematics achievement of their students. The descriptive results show that 74% of students in government schools and about the same percentage (70%) of students in UNRWA schools had teachers who reported having attended training in mathematics curriculum topics during the past two years. In the government schools, students whose teachers had received the higher amounts of training in the mathematics curriculum performed at a higher level than students taught by teachers with low exposure. The opposite trend was evident in the UNRWA schools. Here, mathematics achievement was lower for students whose teachers reported higher levels of training in the mathematics curriculum. However, neither difference was statistically significant.

These results suggest that teacher training in mathematics curriculum issues may be more beneficial for students in government schools than it is for students in UNRWA schools. It should be kept in mind, however, that until recently, teacher training in terms of preparing training modules and training materials and selecting teacher trainers and trainees was conducted under MoEHE supervision for schools in the government sector and by agencies within the UNRWA sector for UNRWA schools.

Training in assessment and evaluation is considered to be another important in-service training program within the MoEHE (British Council, 2006). The Assessment and Evaluation Center, established within the MoEHE at the end of 1997, is responsible for disseminating a culture of educational evaluation throughout the various sectors of the Palestinian education system. Until the center began offering training in assessment and evaluation techniques, no qualitative or quantitative indicators of the impact of such training on the academic achievement of Palestinian students had been available (World Bank, 2006). The present analysis therefore sought to remedy this situation somewhat by comparing the mathematics performance of government students with the mathematics performance of UNRWA students according to the extent to which their teachers had experienced in-service training in assessment and evaluation.

The descriptive statistics given in Table 8.5 show that 37% of government students had teachers who reported never having attended training in assessment and evaluation. The corresponding percentage for the UNRWA teachers was 29. The differences in mathematics performance between students taught by teachers who had attended in-service training in assessment and evaluation and students whose teachers had not attended such training went in the opposite direction for the two school types. In the government sector, students who were taught by teachers with training in assessment and evaluation performed significantly better than students taught by teachers without such training. The reverse was the case in UNRWA schools, where students whose teachers had not participated in professional development regarding assessment and evaluation performed at a higher level than their peers who were taught by teachers with such training. This difference, however, was not statistically significant.

The results related to this variable indicated that about one third of students in both the government and the UNRWA sectors had teachers who had not attended training in assessment and evaluation. This finding stresses a need for decisionmakers within the MoEHE to tackle this situation by ensuring that greater numbers of teachers have opportunity to access this training. Today, assessment and evaluation are considered two highly important factors influencing the quality of educational provision (National Council of Teachers of Mathematics, 2000).

Although the UNRWA students outperformed their peers from the government sector in mathematics in general, the results presented here raise questions about the quality of the training programs in assessment and evaluation provided within the UNRWA sector. In-service teacher training in Palestine depends to a great extent on individual projects supported by international donors, but a national strategy/vision in that regard is still to be developed. Further consideration of teacher training initiatives and decisions as to which teachers receive such training may offer explanations for the presently somewhat unclear impact of teacher training on learning outcomes.

Teachers' job satisfaction

Table 8.6 sets out the results of the analysis of the impact of teachers' job satisfaction on students' achievement in mathematics in both government and UNRWA schools. Thirty-three percent of the government students had teachers who reported being highly satisfied with their jobs whereas nearly double that figure (63%) of the UNRWA teachers reported this level of satisfaction. No clear relationship, let alone a statistically significant one, emerged between student achievement and teacher satisfaction in the government schools. Here, the mean achievement scores of the students taught by teachers with high, medium, and low satisfaction were 389, 371, and 385, respectively. In contrast, within the UNRWA schools, mathematics achievement associated positively with degree of teacher job satisfaction, with mean achievement scores of 411, 395, and 390 for students taught by teachers reporting high, medium, and low job satisfaction, respectively. However, none of these differences was significant.

Job satisfaction can be defined in terms of teacher salaries, the extent of respect and support accorded to teachers, and the taking of policy measures designed to make the teaching profession a more attractive one. Sabri, Abu Daqua, and Mohammed (2006) suggest that these measures are far more beneficial for UNRWA teachers than for teachers in the government sector, a consideration that may explain the findings reported in Table 8.6.

Teachers' expectations of student performance

Table 8.7 presents the results of the analysis that compared the mathematics achievement of students in the government and UNRWA sectors according to the expectations the teachers in these sectors had of their students' performance. About 97% of the government students had teachers who reported that they had high (59%) or medium (38%) expectations of their students' achievement. About 95% of the teachers in the UNRWA schools reported these levels of expectation.

Within the UNRWA schools, students' mean achievement in mathematics was positively associated with teacher expectation. The difference in achievement was statistically significant between students whose teachers had medium expectations of their students' performance and students whose teachers had low expectations. The same result was found between students whose teachers had high expectations and students whose teachers had low expectations. No pattern between mathematics achievement and teacher expectation could be discerned for the students in the government schools.

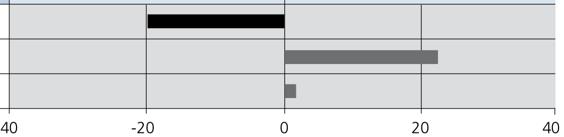
These results could indicate that teachers' expectations in government schools are not realistic and valid, and that teachers' expectations in UNRWA schools are realistic and valid. A possible explanation for this claim is that government teachers, most of whom are newly appointed and many of whom have been shifted from place to place because of the unstable political situation, lack not only familiarity with the curriculum but also professional stability. In contrast to their government sector colleagues, teachers in UNRWA schools have much greater stability in their careers, longer experience in their jobs, and a more stable system within which to operate.

Parental involvement

The results presented in Table 8.8 show that about one third of students in government schools had teachers who reported low parental involvement in school activities whereas more than half (55%) of students in UNRWA schools had teachers who reported this level of involvement. This result can be explained by the difficult economic and social conditions that parents of UNRWA students experience, since they usually come from refugee camp regions. Positive associations were found between students' mathematics achievement and degree of parental involvement in both the government and the UNRWA schools. For UNRWA schools, the difference in mathematics achievement between students whose teachers reported medium parental involvement and students whose teachers reported low parental involvement was statistically significant, with the difference favoring the medium level of involvement. In contrast, differences in achievement according to teachers' reports about parental involvement in the government schools were not significant.

Table 8.5: Mathematics Achievement According to Supervising Authority by Teacher In-Service Training in Assessment and Evaluation

Supervising authority	Yes		No		Difference (absolute value)	Difference
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*		*High scored higher* / *Low scored higher*
Government	63 (5.7)	387 (4.7)	37 (5.7)	367 (7.0)	19 (9.0)	
UNRWA	71 (7.4)	398 (3.9)	29 (7.4)	421 (12.2)	23 (12.5)	
Average	67 (4.7)	392 (3.1)	33 (4.7)	394 (7.0)	2 (7.7)	



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

Table 8.6: Mathematics Achievement According to Supervising Authority by Teachers' Job Satisfaction

Supervising authority	High		Medium		Low		Difference Medium–Low (absolute value)	Difference Medium–High (absolute value)	Difference High–Low (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent of students*	*Average scale score*			
Government	33 (4.7)	389 (8.4)	46 (4.8)	371 (4.8)	21 (3.8)	385 (9.1)	14 (10.4)	18 (9.7)	5 (13.2)
UNRWA	63 (6.1)	411 (6.1)	28 (6.1)	395 (9.1)	9 (4.4)	390 (16.5)	5 (19.2)	16 (10.8)	20 (17.9)
Average	48 (3.9)	400 (5.2)	37 (3.9)	383 (5.1)	15 (2.9)	387 (9.4)	5 (10.9)	17 (7.2) ▲	12 (11.1)

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

Table 8.7: Mathematics Achievement According to Supervising Authority by Teachers' Expectations of Student Achievement

Supervising authority	High		Medium		Low		Difference Medium–Low (absolute value)	Difference Medium–High (absolute value)	Difference High–Low (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent of students*	*Average scale score*			
Government	59 (5.3)	381 (5.7)	38 (5.0)	375 (5.7)	3 (1.7)	385 (10.3)	10 (11.7)	6 (8.3)	4 (11.6)
UNRWA	53 (7.5)	405 (7.5)	42 (8.3)	405 (7.6)	5 (3.3)	387 (4.1)	18 (8.4) ▲	0 (11.5)	18 (8.5) ▲
Average	56 (4.6)	393 (4.7)	40 (4.9)	390 (4.8)	4 (1.9)	386 (5.6)	4 (7.2)	3 (7.1)	7 (7.2)

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

The low percentage of teachers across both school sectors reporting some degree of parental involvement in school activities raises concern about the apparent lack of co-operation between homes and local communities and schools. This concern has particular relevance when set against the fact that the teaching day in Palestinian schools is short by international standards. It usually lasts only five hours, starting at 8 a.m. and ending at 1 p.m. Support at home and from parents is vital in terms of helping teachers do their jobs in the peculiar social and political situation in which Palestinian students live.

Assignment of homework

As evident in Table 8.9, 82% of government school students had mathematics teachers who reported assigning homework "every" or "almost every" lesson. The corresponding percentage in the UNRWA schools was higher at 93%. In the UNRWA schools, the difference in mathematics achievement depending on the amount of homework assigned by teachers was statistically significant, favoring students taught by teachers who assigned less homework. Within the government schools, students whose teachers reported assigning more homework performed at a higher level in mathematics than students whose teachers assigned less homework, but the difference was not statistically significant.

One reason for different relationships between homework assignment and student achievement across the two sectors may relate to homework assignments being used as a means of covering an overloaded curriculum, and that these assignments form part of textbook exercises that the teacher did not manage to cover or explain sufficiently in class (Matar, 2006). The general lack of clarity regarding the relationship between achievement and homework evident in the results of the present analysis and speculation about the reasons for these results present an important area of future study. There is a need to investigate the nature of homework assignments in both sectors, and to observe what strategies, if any, teachers use to check students' homework.

8.5 CONCLUSION

The analyses undertaken in this chapter investigated relationships between a number of teacher-related variables and the mathematics achievement of Grade 8 students according to two educational supervising authorities in Palestine—the government and UNRWA. When dealing with teacher factors, one must take into consideration that what teachers believe or report through questionnaires or surveys is not always what they do in the actual teaching situation. That said, the overall mathematics achievement of UNRWA students was higher than that of the government students, and the difference was statistically significant. Of the eight variables analyzed, most showed positive or negative associations with mathematics achievement, and five were statistically significant relationships.

In the UNRWA schools, the following variables were negatively associated with mathematics achievement: teachers exchanging visits with one another (although it should be noted here that only one percent of the teachers reported not having exchange visits); teacher training in mathematics curriculum topics; teacher training in assessment and evaluation; and amount of homework assigned. These differences were statistically significant. Positive associations were found between the extent to which teachers were satisfied with their jobs, the extent to which parents were involved with the school, and the type and extent of teachers' expectations of their students' performance.

In the government schools, the following variables were positively associated with mathematics achievement: interaction outside class; in-service training in mathematics curriculum topics; in-service training in assessment and evaluation; parental involvement in school activities; and homework assignments. Mathematics achievement was negatively (but not significantly) associated with exchange visits between teachers. A curvilinear relationship was evident between teachers' satisfaction with their jobs and mathematics achievement. Here, students of teachers reporting a medium level of job satisfaction showed the lowest performance in mathematics. Again, however, only a few of these differences were significant.

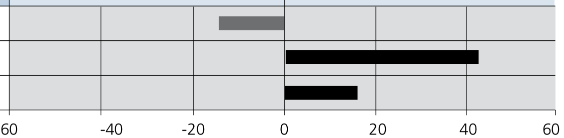
Table 8.8: Mathematics Achievement According to Supervising Authority by Parental Involvement

Supervising authority	High		Medium		Low		Difference Medium–-Low (absolute value)	Difference Medium–High (absolute value)	Difference High–Low (absolute value)
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*	*Percent of students*	*Average scale score*			
Government	9 (3.1)	389 (7.7)	61 (5.1)	379 (3.8)	31 (5.2)	378 (9.9)	1 (11.2)	9 (8.1)	11 (10.9)
UNRWA	7 (4.1)	419 (14.6)	38 (7.9)	416 (7.5)	55 (7.9)	395 (6.2)	21 (10.5) ▲	3 (13.4)	24 (15.9)
Average	8 (2.6)	404 (8.3)	49 (4.7)	398 (4.2)	43 (4.7)	386 (5.9)	11 (7.7)	6 (7.8)	17 (9.6)

Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

Table 8.9: Mathematics Achievement According to Supervising Authority by Homework Assigned

Supervising authority	Every or almost every lesson		Half or less than half of the lessons		Difference (absolute value)	Difference	
	Percent of students	*Average scale score*	*Percent of students*	*Average scale score*		*Almost every lesson scored higher*	*Half or less than half lessons scored higher*
Government	82 (3.8)	382 (4.3)	18 (3.8)	368 (10.1)	14 (11.1)		
UNRWA	93 (4.2)	401 (4.2)	7 (4.2)	444 (20.1)	43 (20.3)		
Average	87 (2.8)	392 (3.0)	13 (2.8)	406 (2.7)	14 (2.8)		



Notes:
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
■ The difference is statistically significant
■ The difference is not statistically significant

The findings regarding exchange visits between teachers raise concerns regarding the nature and content of these visits. Addressing these concerns may rest on site visits from supervisors and evaluators. Observation of and discussion with teachers and head teachers could identify the best way of approaching such visits, and this practice might, in turn, lead to developing further the concept of exchange visits (along with models and procedures of how to conduct these) in teacher training courses.

The findings relating to teacher training in the mathematics curriculum also suggest the need for revision and updating of training practices, but in this case for the UNRWA sector only. Here, the changes needed could be drawn from the positive experience within the government sector in this area of training. The findings presented in this chapter suggest that teacher training programs in assessment and evaluation in the UNRWA sector also need to be evaluated, with the program in the government sector possibly adopted for use. In terms of teacher job satisfaction, however, UNRWA schools could provide a model for reform within government schools. The results of this present study suggest that the government sector needs to increase its efforts to develop the teaching profession and improve teaching conditions.

The issue of homework assignments needs to be studied and evaluated in the UNRWA sector in terms of the nature and amount of these assignments and ways in which teachers can appropriately check and assess their students' homework. In the government schools, the seemingly non-realistic expectations that teachers have of their students' achievement need to be studied in greater detail to identify the reasons behind these perceptions. Other factors that could be studied in this context include the extent and nature of a teacher's teaching experience and the number of years he or she has spent teaching in the same school.

In general, the eight variables analyzed in this chapter did not provide sufficiently strong explanations of the difference in mathematics achievement between students in the government and UNRWA sectors. As a consequence, similar analyses to the ones reported in this chapter should be undertaken, and these should focus on other teacher variables, such as teacher pre-service training along with student background variables and school environment variables to identify those factors that may explain the difference in mathematics achievement between students in schools run by Palestine's two educational supervisory authorities.

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Useful websites

MoEHE (Ministry of Education and Higher Education): www.moehe.gov.ps.

The Palestinian Central Bureau of Statistics: www.pcbs.gov.ps.

The Palestinian Curriculum Development Center: www.pcdc.edu.ps.

The Palestinian Economic Policy Research Institute: http://www.pal-econ.org/index.php?lang=in.

CHAPTER 9

Tunisia: Analysis of the relationship between instructional practices and achievement in mathematics

Imène Ghedamsi, Samira Helanoui, Leila Kamoun, and Hikma Smida

9.1 EXECUTIVE SUMMARY

The analyses reported in this chapter drew on TIMSS 2003 data for Tunisia and were conceptualized within a model of factors influencing teaching practices originally proposed by Ernest (1988) that included different approaches to teaching and learning as well as the classroom context within which teaching and learning occurs. The concepts in the model were operationalized through a number of questions from the TIMSS background questionnaire for mathematics teachers in Grades 4 and 8.

The results showed that Grade 4 Tunisian students whose teachers engaged in the following activities or held the following attitudes showed significantly higher mathematics performance than Grade 4 Tunisian students whose teachers did not engage in these activities or who did not share these views:

- Devoted up to and including 27% of mathematics lesson time in a typical week to reviewing homework; and
- Had high or very high expectations of student performance.

Grade 8 students whose teachers engaged in the following activities or held the following attitudes showed higher mathematics performance than Grade 8 students whose teachers did not engage in these activities or who did not share these views:

- Asked students to use calculators to do routine computations in about half the mathematics lessons;
- Devoted 28% and more of mathematics lesson time in a typical week to reviewing homework;
- Considered lack of textbooks for students not to be a factor limiting mathematics instruction; and
- Had high expectations of student performance.

9.2 INTRODUCTION

Educationists generally agree that students' levels of achievement in mathematics are strongly related to their teachers' practices, specifically those concerning the pedagogical approaches and strategies that they employ to facilitate the process of teaching and learning mathematics. According to Ernest (1988), good models of teaching and learning mathematics depend fundamentally on two aspects. The first is the teacher's conception of mathematics, the components of which are beliefs, concepts, meaning, rules, mental images, and preferences (Thompson, 1992). The second aspect is the social context of the teaching situation.

Ernest (1988), in line with work by Thompson (1984), also identified three views of the nature of mathematics commonly evident in the teaching of mathematics. The first—the instrumental view—holds that mathematics is an accumulation of isolated facts, rules, and skills to be used. The second view, termed the Platonist view, considers mathematics to be a unified body of knowledge. The third view—problem-solving—sees mathematics as a field of human creation and production. According to Ernest, these three views determine different approaches to teaching and learning mathematics.

The first view leads the teacher to adopt a traditional approach to teaching based on the transmission of knowledge and emphasizing mastery of computation skills and the memorization of isolated rules and procedures. A teacher holding this view can be considered an instructor. The second view leads the teacher to adopt a conceptual approach based on the meaning of the mathematics concepts and the relationships between them. This approach emphasizes explanation of concepts. A teacher holding this view can be considered an explainer. The third view leads the teacher to adopt a constructivist approach, which involves providing his or her students with opportunities to explore and investigate different situations and to develop reasoning, thinking, and problem-solving skills. A teacher who holds the third view can be considered a facilitator.

An instructor model of teaching is likely to be associated with a strict following of a textbook, while a facilitator model is likely to see the teacher exercise some degree of autonomy in relation to use of the textbook. Students taught under a constructivist approach are considered to have better opportunities than students taught under the other two views to develop a sound understanding of mathematics concepts and to exercise greater autonomy in problem-solving.

In addition to articulating and discussing these different approaches to teaching and learning, Ernest (1988) identified the social context as a central factor within the model of teaching and learning. More precisely, he argued that teachers' expectations, students' motivations, the mathematics texts, and/or other instructional materials form part of the model because of the constraints and the opportunities they provide. Ernest's model is presented in diagrammatic form in Figure 9.1.

How these factors ultimately relate to student outcomes is, of course, the important consideration here, and it was this matter that was the focus of the present study. Specifically, Ernest's model was used to examine how approaches to teaching and learning adopted by the Tunisian Grade 4 and Grade 8 mathematics teachers who participated in TIMSS 2003 as well as the classroom context linked to students' achievement in mathematics. The following research questions were proposed:

- How do the views of teaching and learning reflected in the teachers' practices relate to the mathematics achievement of Tunisian students?
- How does the classroom context relate to the mathematics achievement of Tunisian students?

9.3 METHOD

In order to answer the above two questions, information obtained in response to the background questionnaire for the mathematics teachers of Tunisian students who participated at Grade 4 and Grade 8 in the TIMSS 2003 assessment was used. More precisely, responses to questions concerning the classroom context or the approach toward teaching and learning adopted by teachers were used as the independent variables. Tables 9.1 and 9.2 provide details of the variables from the TIMSS data files that were used as indicators of the various concepts in the models proposed by Ernest (1988).

The five plausible values of mathematics achievement were used as the dependent variables by the IEA IDB Analyzer©. Numerical independent

Figure 9.1: Ernest's (1988) Model of Factors Influencing Mathematics Teachers' Practices

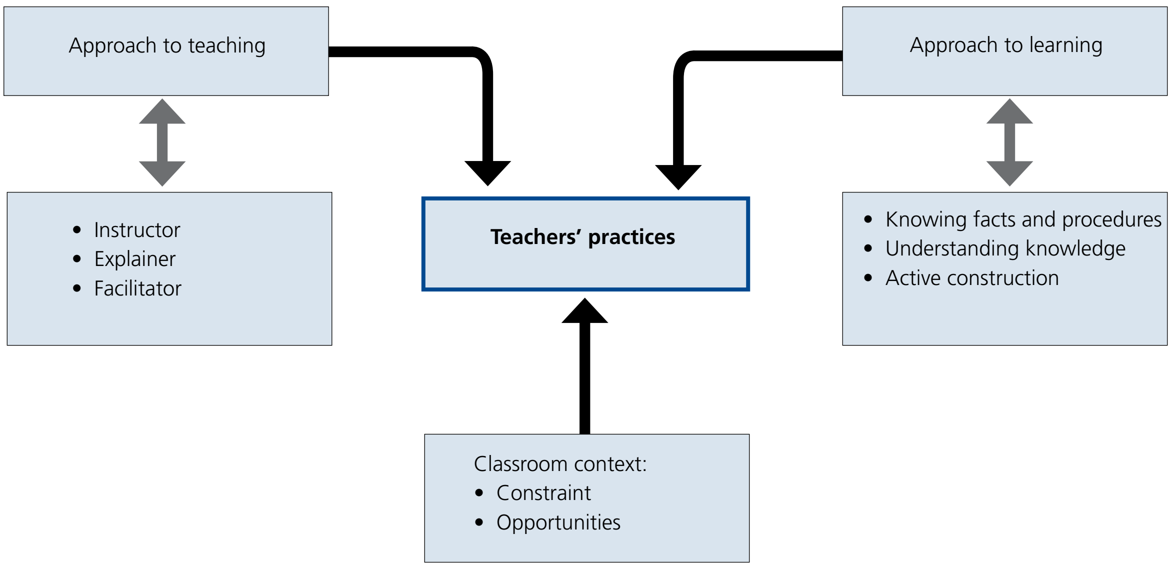


Table 9.1: Approaches to Teaching and Learning: Variables Used as Indicators

Approach to teaching	Independent Variables (TIMSS 2003 variable name Population A/B)	Approach to learning
Instructor Grades 4/8	Occurrence of lessons where students use calculator to do routine computations (ATBMCALR/BTBMCALR)	Knowing facts and procedures
Instructor Grades 4/8	Percentage of time spent by students on listening to lecture-style presentation (ATBMPTLS/BTBMPTLS recoded into ATBMPTLS1/BTBMPTLS1)	Knowing facts and procedures
Explainer Grades 4/8	Percentage of time spent by students on reviewing homework (ATBMPTRH/ BTBMPTRH recoded into ATBMPTRH1/BTBMPTRH1)	Understanding of knowledge
Explainer Grades 4/8	Percentage of time spent by students listening to teachers re-teach and clarify (ATBMPTRT/BTBMPTRT recoded into ATBMPTRT1/BTMPTRT1)	Understanding of knowledge
Explainer Grade 8	Occurrence of lessons where students use calculator to explore number concepts (BTBMCALE)	Understanding of knowledge
Facilitator Grades 4/8	Percentage of time spent working on problems with guidance (ATBMPTYG/BTBMPTYG recoded into ATBMPTYG/BTBMPTYG1)	Active construction of knowledge and skills
Facilitator Grades 4/8	Percentage of time spent by students working on problems on own (ATBMPTOO/BTBMPTOO recoded into ATBMPTOO1/ BTBMPTOO1)	Active construction of knowledge and skills
Facilitator Grades 4/8	Occurrence of lessons where students use calculator to solve complex problems (ATBMBCALS/BTBMBCALS)	Active construction of knowledge and skills
Facilitator Grade 8	Occurrence of lessons where students work on problems (BTBMASWS)	Active construction of knowledge and skills
Facilitator Grade 8	Occurrence of lessons where students relate what they learn in mathematics to daily life (BTBMASDL)	Active construction of knowledge and skills
Facilitator Grade 8	Occurrence of lessons where students decide on own procedures for solving complex problems (BTBMASCP)	Active construction of knowledge and skills

Table 9.2: Classroom Context: Concepts, Teachers' Practices, and Indicators

Concepts	Teachers' practices	Indicators
Classroom structure	Opportunities for the active construction of knowledge	Does student achievement differ depending on how much emphasis is placed on working in small groups (ATBMASSG/ BTBMASSG)?
		How are class size (ATBMSTDQ1/BTDSTUD1) and student achievement related?
Use of textbooks	Opportunities for autonomy	Do significant differences in student achievement emerge for different uses of textbooks in teaching mathematics (ATBMTXBU/BTBMTXBU)?
		Are missing textbooks for students (as a factor limiting mathematics instruction) (BTBGLTI0) linked to student achievement?
Classroom climate	Constraints on an active construction of knowledge	Is lack of student interest (BTBGLTO4) a factor limiting mathematics instruction?
		How are teachers' perceptions of school teachers' expectations (ATBGCHES/BTBGCHES) related to student achievement?

variables were recoded as follows:

1. At Grade 4:
   - Number of students in the class at Grade 4 (ATBMSTDQ recoded into ATBMSTDQ1): 14–34 into "1" and 35–43 into "2", with all other values set to missing.
   - Percentage of time teacher spends on lecture-style instruction (ATBMPTLS recoded into ATBMPTLS1): 0–10 into "1", 11–27 into "2", and 28–50 into "3", with all other values set to missing.
   - Percentage of time teacher spends reviewing homework (ATBMPTRH recoded into ATBMPTRH1): 0–18 into "1", 19–27 into "2", and 28–70 into "3", with all other values set to missing.
   - Percentage of time teacher spends re-teaching concepts (ATBMPTRT recoded into ATBMPTRT1): 0–10 into "1", 11–25 into "2", and 26–50 into "3", with all other values set to missing.
   - Percentage of time teacher has students work on problems set by the teacher (ATBMPTYG recoded into ATBMPTYG1): 0–15 into "1", 16–25 into "2", and 26–75 into "3", with all other values set to missing.
   - Percentage of time teacher has students decide on their own procedure for working on problems (ATBMPTOO recoded into ATBMPTOO1): 0–18 into "1", 19–27 into "2", and 28–56 into "3", with all other values set to missing.
2. At Grade 8:
   - Number of students in the class at Grade 8 (BTBMSTUD recoded into BTBMSTUD1): 35–42 into "1" and 35–42 into "2", with all other values set to missing.
   - Percentage of time teacher has students listen to lecture-style presentations (BTBMPTLS recoded into BTBMPTLS1): 0–10 into "1", 11–27 into "2", and 28–55 into "3", with all other values set to missing.
   - Percentage of time teacher spends reviewing homework (BTBMPTRH recoded into BTBMPTRH1): 0–18 into "1", 19–27 into "2", and 28–50 into "3", with all other values set to missing.
   - Percentage of time teacher spends re-teaching concepts (BTBMPTRT recoded into BTBPTRT1): 3–10 into "1", 11–25 into "2", and 26–60 into "3", with all other values set to missing.
   - Percentage of time teacher has students work on problems set by the teacher (BTBMPTYG recoded into BTBMPTYG1): 0–15 into "1", 16–25 into "2", and 26–50 into "3", with all other values set to missing.
   - Percentage of time teacher has students decide on their own procedure for working on problems (BTBMPTOO): 0–18 into "1", 19–27 into "2", and 28–61 into "3", with all other values set to missing.

9.4 RESULTS

The results of the analysis are summarized in Figures 9.2a–d, 9.3a–e, 9.4a–i, 9.5a–d, 9.6a–c and 9.7a–c. The figures illustrate, for each variable, the mean mathematics achievement for each response category for that variable, first for Grade 4 (if the question was asked at that level), and then for Grade 8.

Thus, for example, the variable asking Grade 8 teachers about the frequency with which their students used calculators for routine computations (BTBMCALR, Figure 9.2b) had four response categories, namely "every or almost every lesson," "about half the lessons," "some lessons," and "never," which constitute the labels on the x-axis. On the y-axis, the mean achievement in mathematics of students taught by teachers indicating a certain frequency of use is given. For the given example, the results show that students taught by teachers who stated that they used calculators for routine calculations in about half the lessons showed the highest level of mathematics achievement, with a score of 431.86, as indicated by the circle with a standard error of 6.20, which is represented by the lines leading from the circle and ending in two whiskers. In contrast, students whose teachers reported that they used calculators for routine calculations only in some lessons or never showed lower achievement in mathematics, with a respective mean of 404.28 (SE 5.14) and 403.87 (SE 4.79).

A *t*-test of the differences in mean scores revealed that students whose teachers reported using calculators for routine computations in about half the lessons scored at a significantly higher level than students of teachers who used calculators for this purpose less frequently. However, the differences between the mean achievement scores for any of these three groups and the mean score for students taught by teachers who reported using calculators for routine computations every or almost every lesson (422.12, SE 9.85) were not significant.

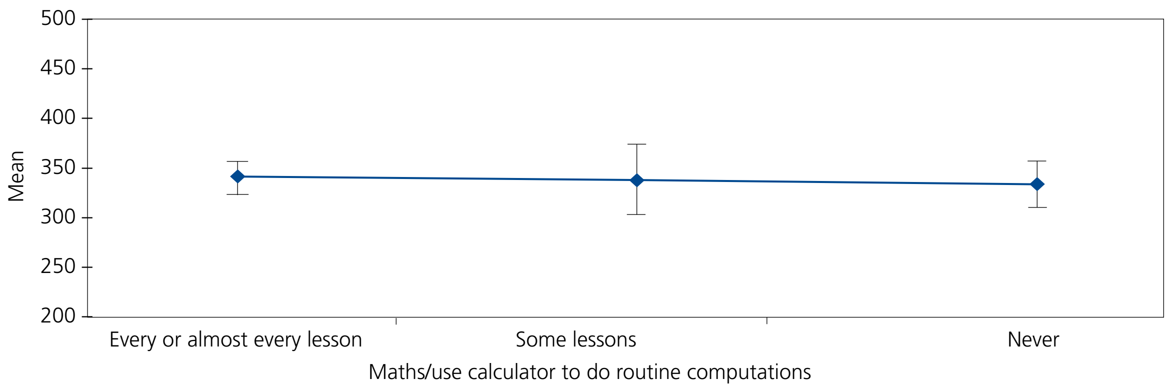
Having completed this description of the general information content of the illustrations, we now turn to a discussion of the results for the variables within each approach. We first look at the instructor approach, and then at the variables related to the explainer approach. This is followed by a look at the variables used as indicators of the facilitator approach. We conclude by presenting the results of the analysis relating to the variables measuring classroom context.

Student achievement and the instructor approach to teaching and learning mathematics

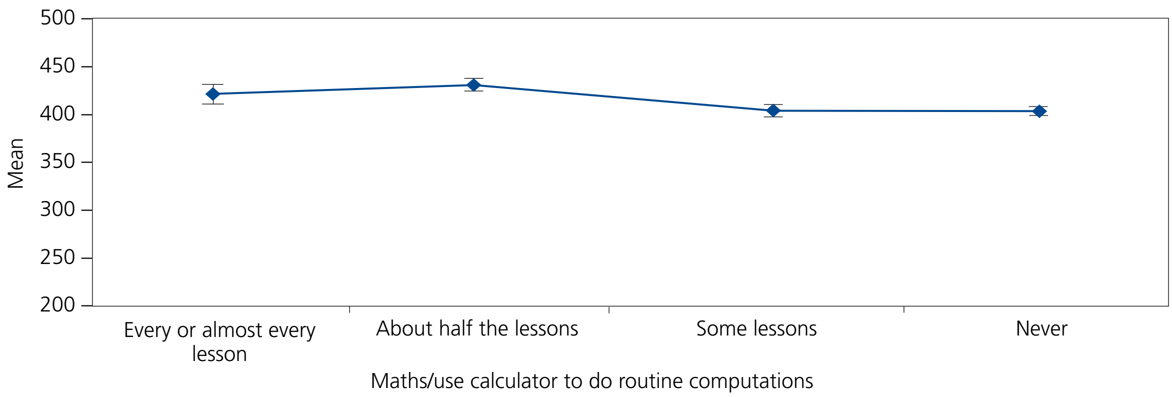
Of the four variables related to this first approach to teaching and learning mathematics in Grade 4 and Grade 8, only one presented a significant difference in student achievement. This variable concerned the following question for Grade 8: "How often are calculators used in class to do routine computations?" In Grade 8, students whose mathematics teachers asked them to use calculators to do routine computations in about half the lessons performed at a significantly higher level than those Grade 8 students whose teachers never asked them to engage in this activity or to engage in it in some lessons (see Figure 9.2b). This finding seems to support previous findings which indicate that giving students more opportunities to use calculators to perform routine computations at secondary school level leads to higher achievement, providing that this activity does not happen all the time.

Figure 9.2: Mean Mathematics Achievement of Students Relative to Instuctor Approach

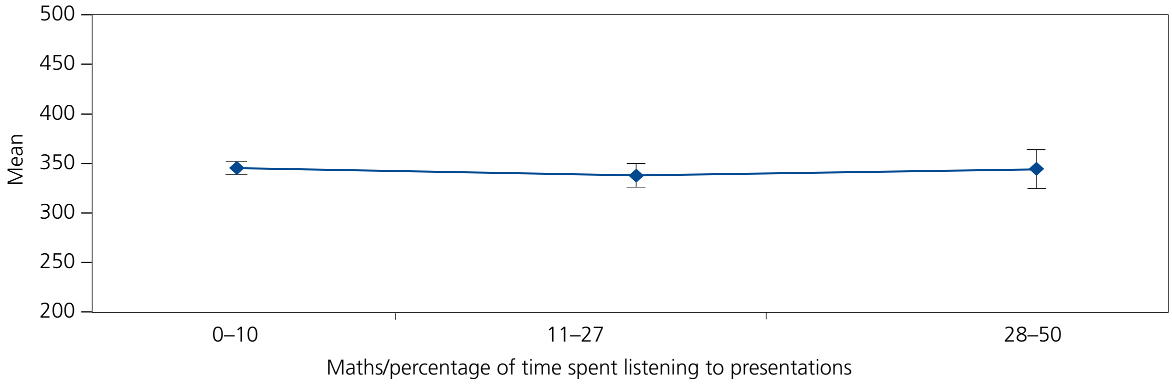
a. Mean mathematics achievement by ATBMCALR (Grade 4)



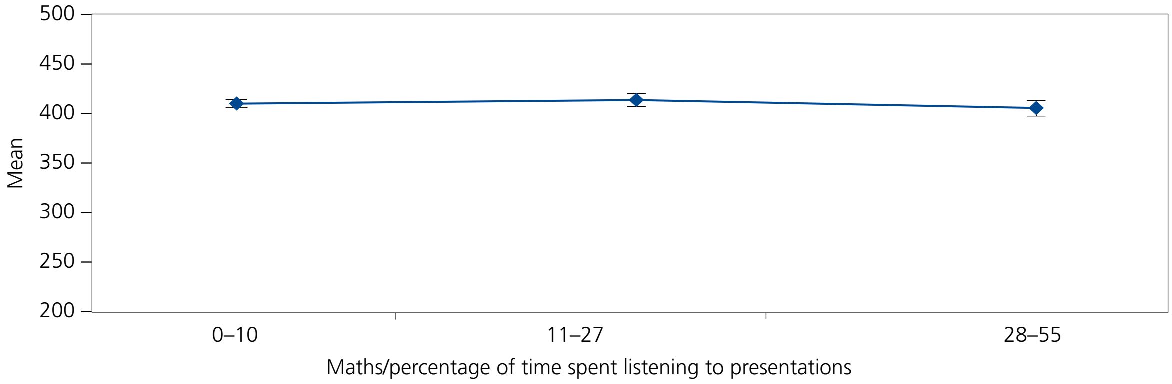
b. Mean mathematics achievement by BTBMCALR (Grade 8)



c. Mean mathematics achievement by ATBMPTLS1 (Grade 4)



d. Mean mathematics achievement by BTBMPTLS1 (Grade 8)



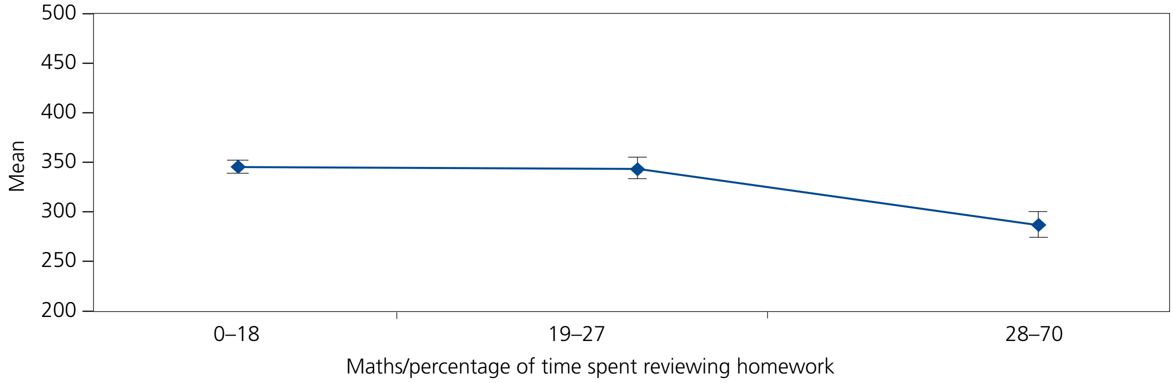
Student achievement and the explainer approach to teaching and learning mathematics

In Grade 8, only one of three variables measuring the second approach to teaching and learning presented a significant difference in terms of student achievement. This variable concerned the question, "How frequently is homework reviewed in mathematics lessons?" Grade 8 students whose teachers devoted 28% or more of time in a typical week of mathematics lessons to reviewing homework performed at a higher level than the other two groups, with the difference between the "28% or more of time" students and those students whose teachers devoted up to 18% of the time being significant (see Figure 9.3a). This finding seems to reflect the fact that, in Tunisia at this grade level, a large number of new concepts are introduced and that the time allowed to teach mathematics is insufficient. Hence, homework provides students with additional opportunities to improve their mastery of computation skills and their understanding of the concepts.

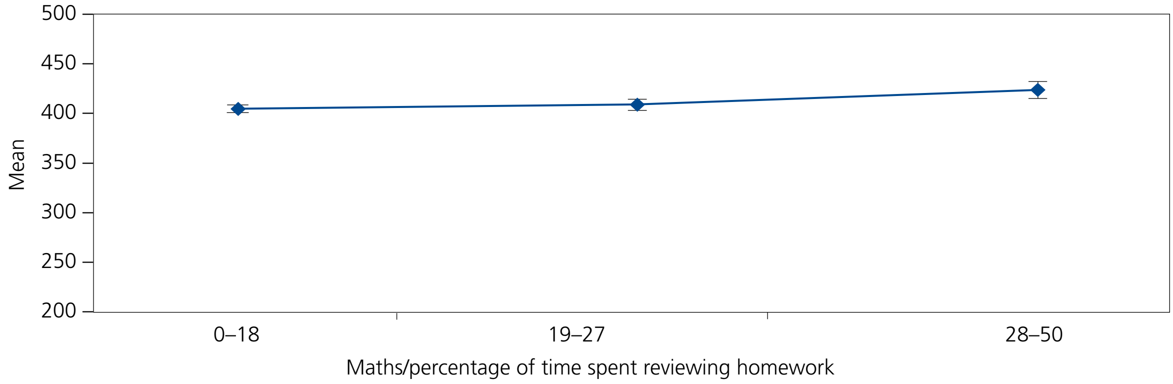
In Grade 4, both variables used to measure the second approach to teaching and learning presented significant differences in terms of student achievement. These variables concerned the two questions: "How frequently is homework reviewed in mathematics lessons?" and "How frequently do students listen to teachers re-teaching?" The Grade 4 students whose teachers devoted 28% or more of class time to reviewing homework in a typical week performed at a lower level than those students whose teachers devoted less time to this activity (see Figure 9.3b). In addition, students whose teachers devoted between 11 and 25% of time in a typical week to having the students listen to them re-teach concepts performed at a lower level than those students whose teachers devoted either more or less time to this activity. Thus, the evidence suggests that in Grade 4 (see Figure 9.3c), in contrast to Grade 8, too much reviewing of homework can limit opportunity for other learning activities that require teachers to help students understand the concepts. It also appears that there is a need to limit time spent on re-teaching concepts, given that the highest achievement was reported for students of teachers who reported spending up to and including 10% of mathematics lesson-time in a typical week on this activity.

Figure 9.3: Mean Mathematics Achievement of Students Relative to Explainer Approach

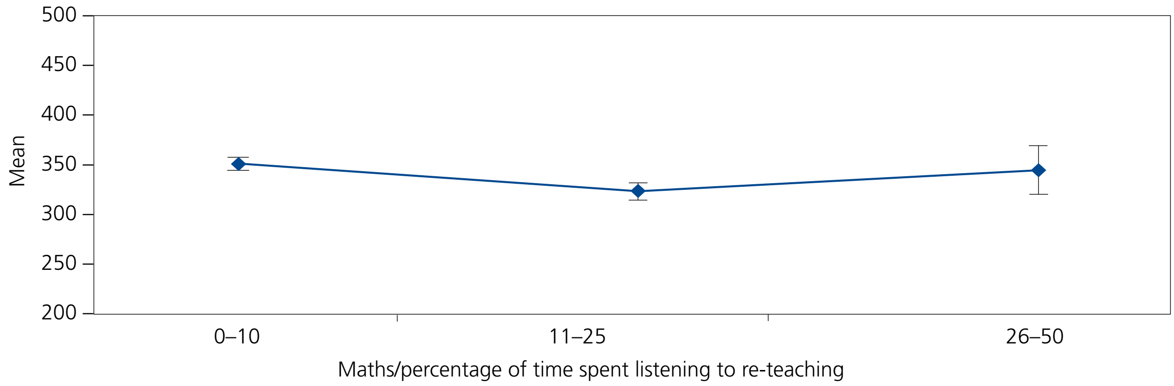
a. Mean mathematics achievement by ATBMPTRH1 (Grade 4)



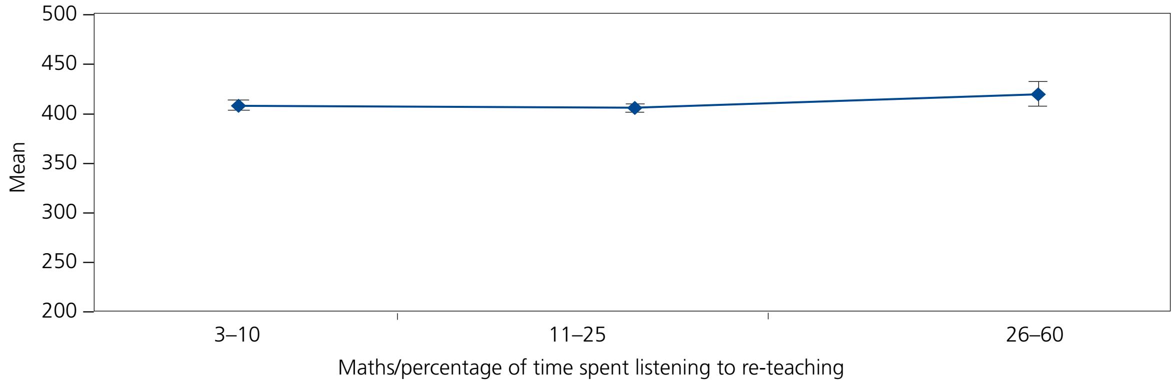
b. Mean mathematics achievement by BTBMPTRH1 (Grade 8)



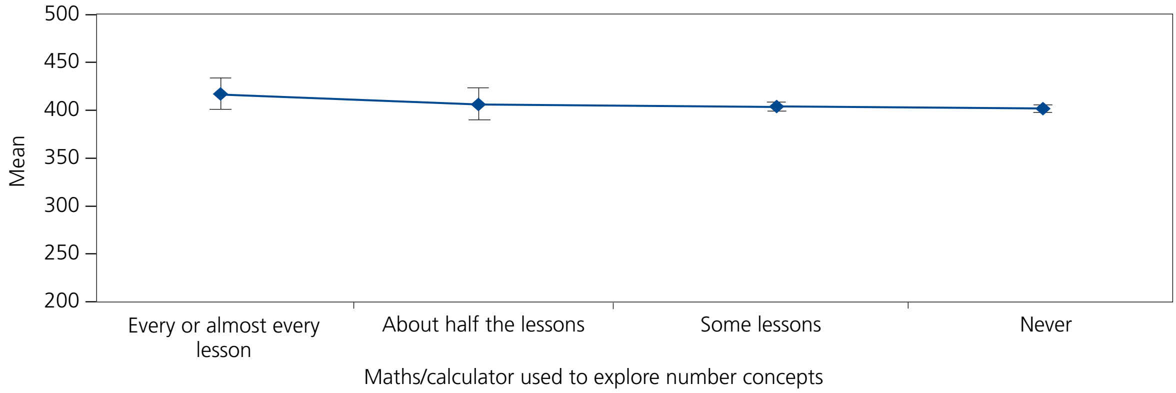
c. Mean mathematics achievement by ATBMPTRT1 (Grade 4)



d. Mean mathematics achievement by BTBMPTRT1 (Grade 8)



e. Mean mathematics achievement by BTBMCALE (Grade 8)

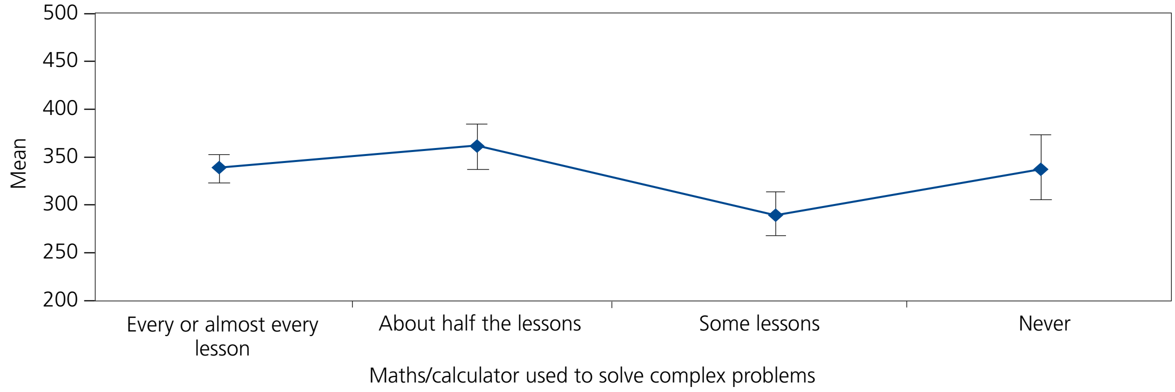


Student achievement and the facilitator approach to teaching and learning mathematics

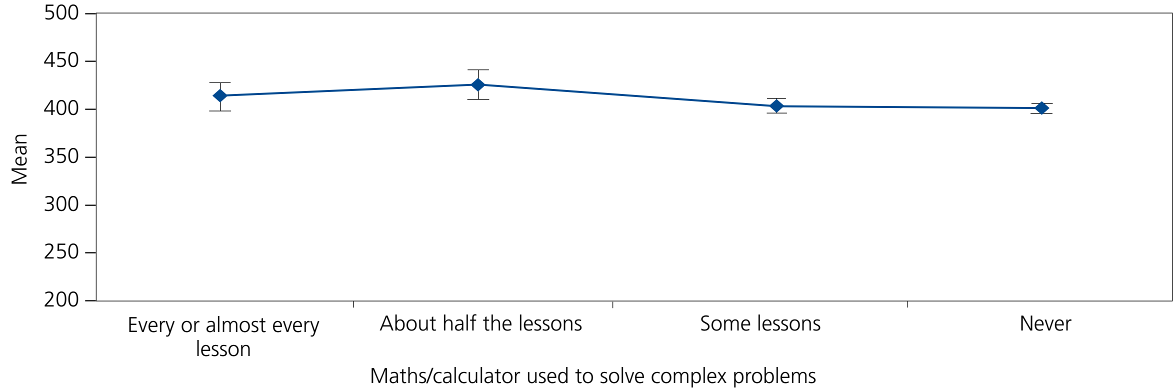
In contrast to the theoretical model developed above, few empirical differences in terms of mathematics achievement emerged with respect to the instructional techniques associated with the facilitator approach to teaching and learning. Of the total nine variables under review—three at Grade 4 and six at Grade 8—none showed a significant difference at Grade 8 and two showed a significant difference at Grade 4 (Figure 9.4a–i). Here, the significant difference in student achievement emerged for the variable measuring the frequency of calculator use for complex problems. Students whose teachers asked them to use calculators to solve complex problems during half the lessons across a typical week performed at a higher level than students in the other three groups and significantly better than students of teachers who reported such use in only some lessons. Significant differences in student achievement were also found for the variable measuring how often students work on problems on their own. Students whose teachers asked them to work on their own between 28 to 56% of their time performed at a significantly higher level than students with teachers reporting to do the same only 0 to 18% and 19 to 27% of their time. However, no systematic differences in mathematics achievement emerged for teachers in Grade 4 or Grade 8 who reported different frequencies of encouraging students to relate mathematics content to daily life.

Figure 9.4: Mean Mathematics Achievement of Students Relative to Facilitator Approach

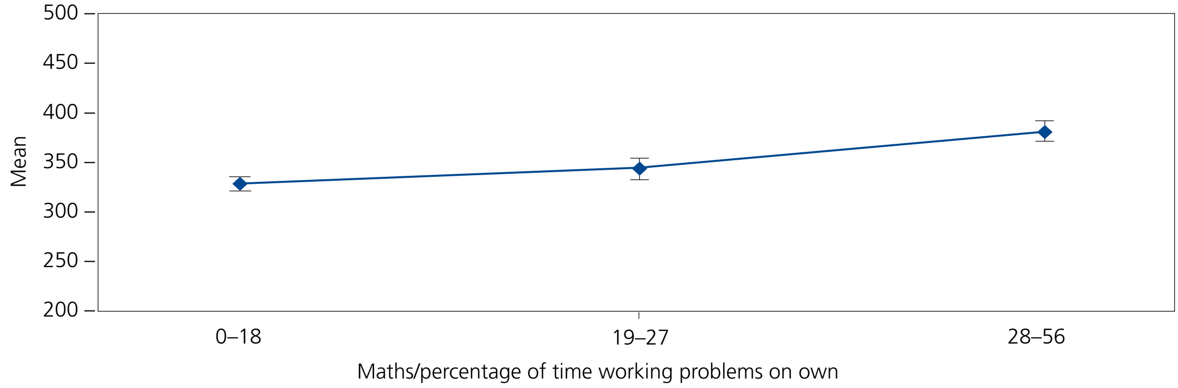
a. Mean mathematics achievement by ATBMCALS (Grade 4)



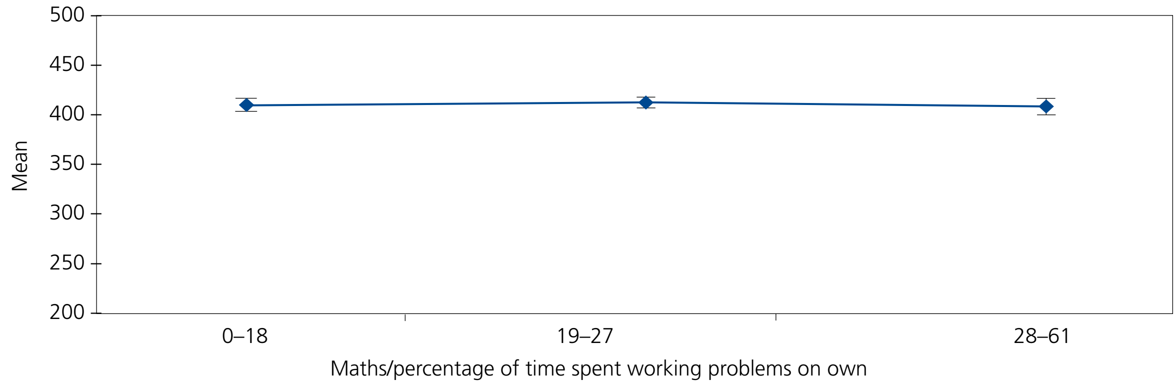
b. Mean mathematics achievement by BTBMCALS (Grade 8)



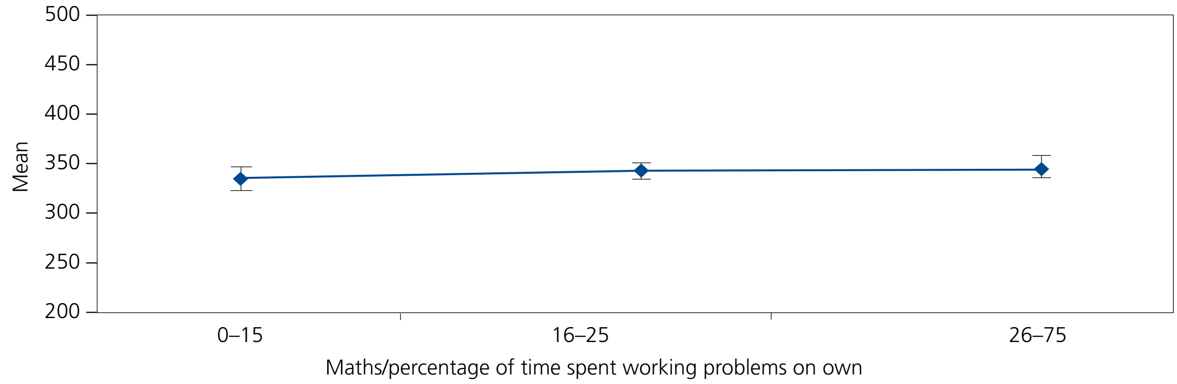
c. Mean mathematics achievement by ATBMPTOO1 (Grade 4)



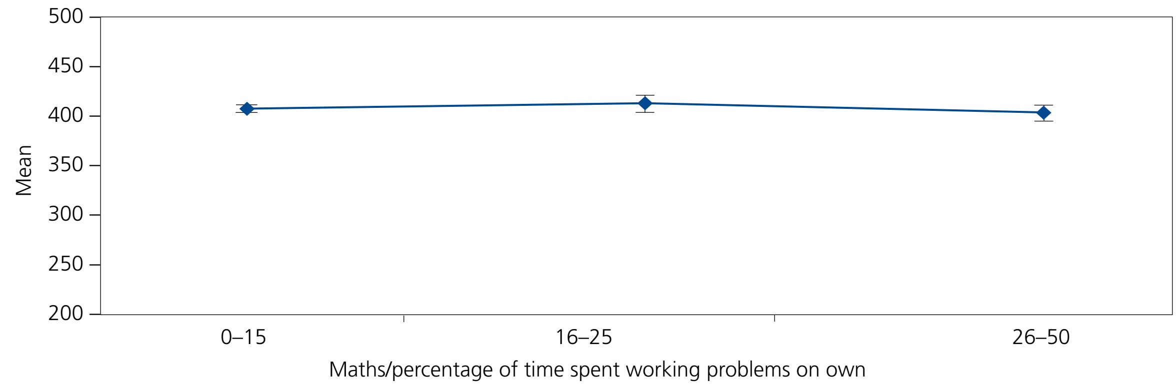
d. Mean mathematics achievement by BTBMPTOO1 (Grade 8)



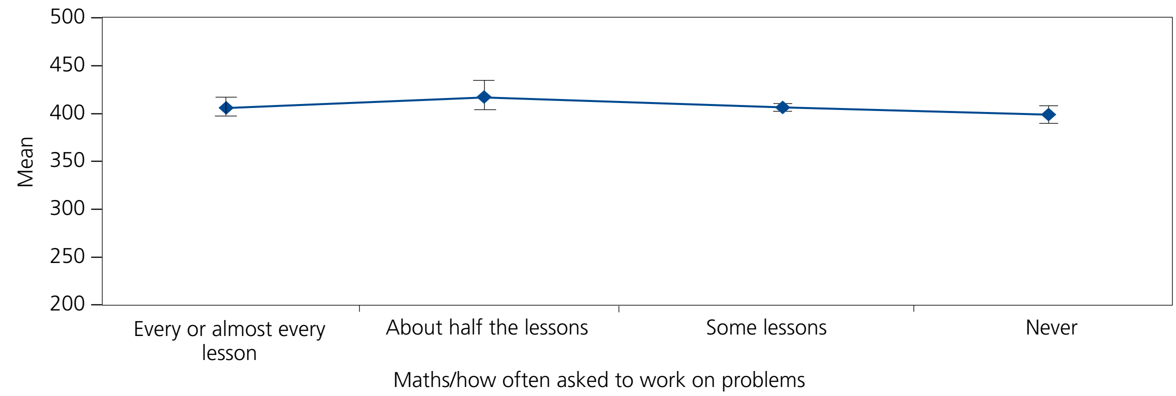
e. Mean mathematics achievement by ATBMPTYG1 (Grade 4)



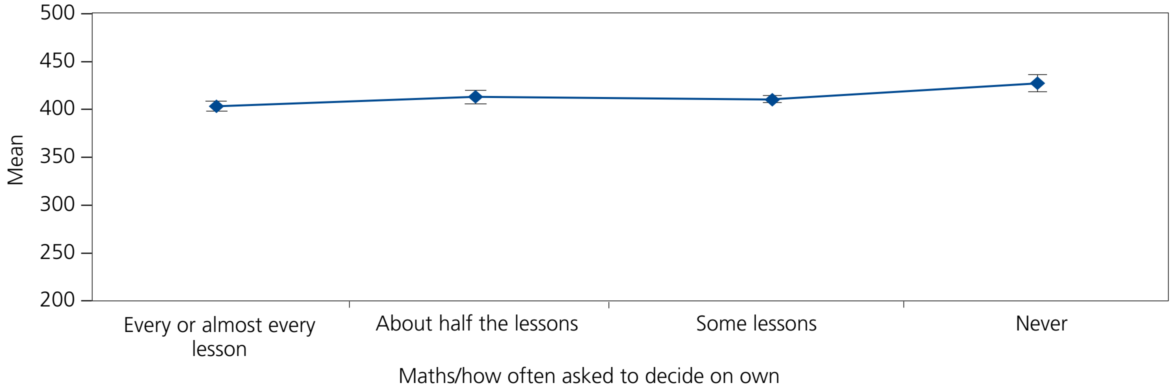
f. Mean mathematics achievement by BTBMPTYG1 (Grade 8)



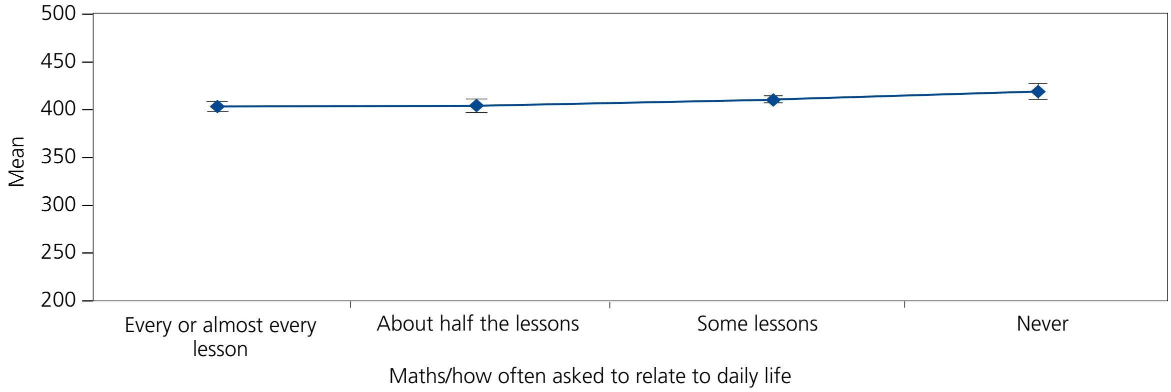
g. Mean mathematics achievement by BTBMASWS (Grade 8)



h. Mean mathematics achievement by BTBMASCP (Grade 8)



i. Mean mathematics achievement by BTBMADSL (Grade 8)



Student achievement and classroom context

In this section, the results of the analysis examining the relationship between classroom context and student achievement are presented. To this end, results concerning classroom structure are given first, followed by the results regarding the use of textbooks. Finally, findings relating to classroom climate are discussed.

Student achievement and claassroom structure

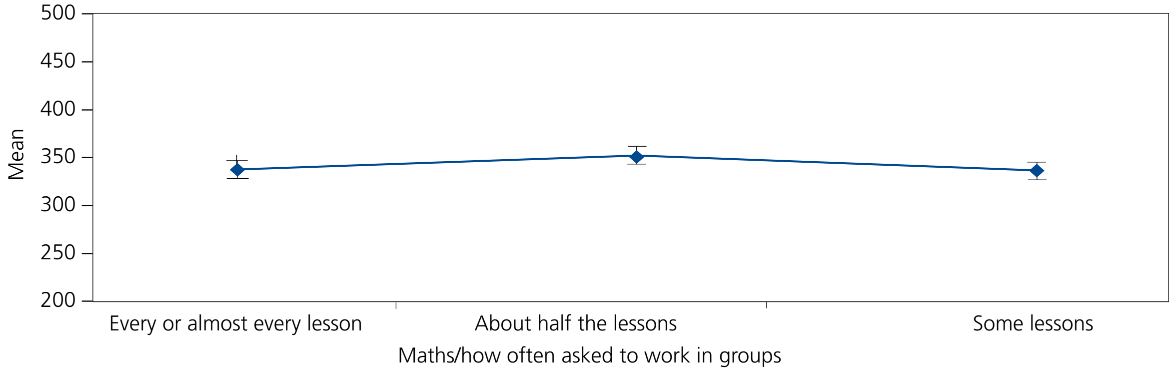
As is evident from Figure 9.5a–b, neither the Grade 4 nor the Grade 8 data showed any significant differences in mathematics achievement concerning the classroom structure as operationalized by the question, "How much emphasis is given to working in small groups?"

This result, which is contrary to the hypothesized beneficial effect of actively constructing knowledge together with peers, may be explained by the fact that having students work in small groups is only useful if the activities given are relevant and lead students to discuss the strategies to adopt or the solutions to propose. If small-group work is not well designed, this work arrangement might take away precious instructional time from other more beneficial classroom activities.

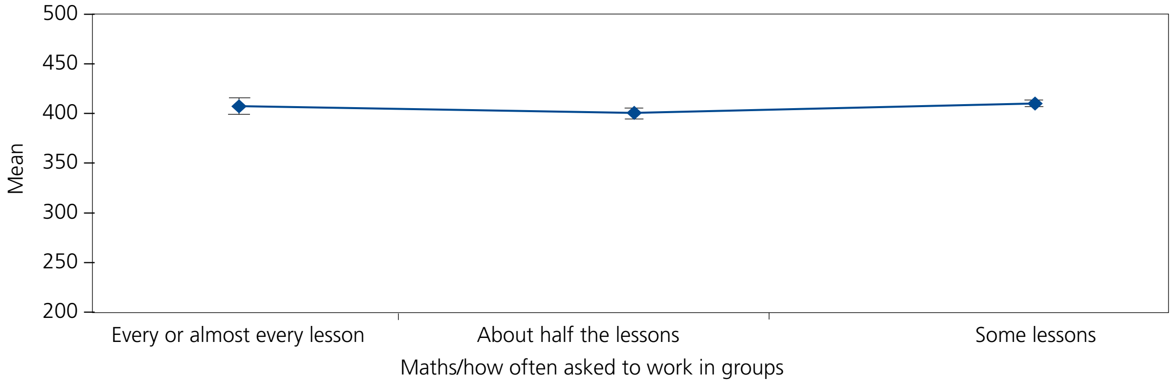
As regards the second variable measuring classroom structure, namely class size, again no significant differences in mathematics achievement emerged for the Grade 4 or Grade 8 data (see Figure 9.5c–d). The fact that the achievement is slightly, albeit not significantly, higher for the larger group size is probably because students with greater learning difficulties tend to be taught in smaller classes.

Figure 9.5: Mean Mathematics Achievement of Students Relative to Classroom Context

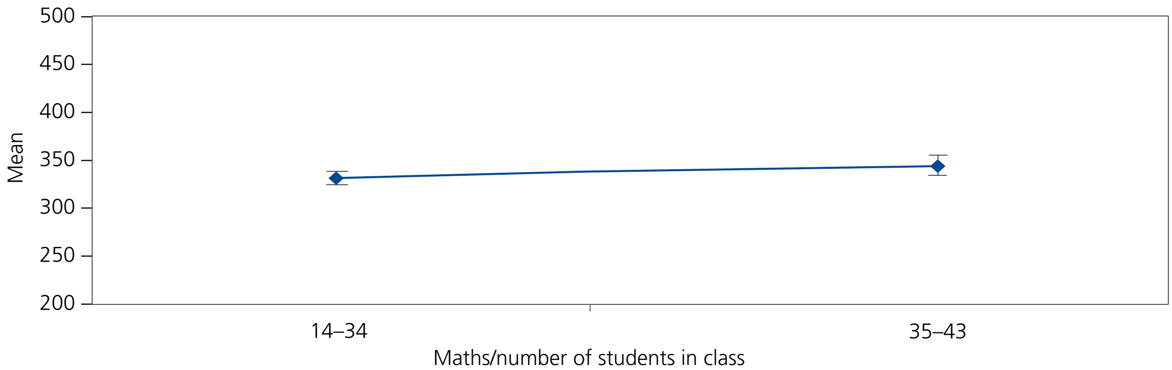
a. Mean mathematics achievement by ATBMASSG (Grade 4)



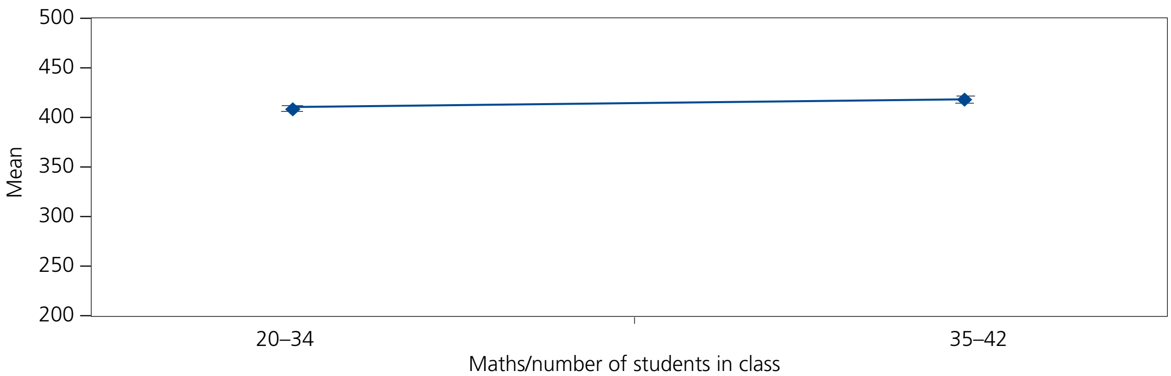
a. Mean mathematics achievement by BTBMASSG (Grade 8)



c. Mean mathematics achievement by ATBMSTDQ1 (Grade 4)



d. Mean mathematics achievement by BTDSTUD1 (Grade 8)



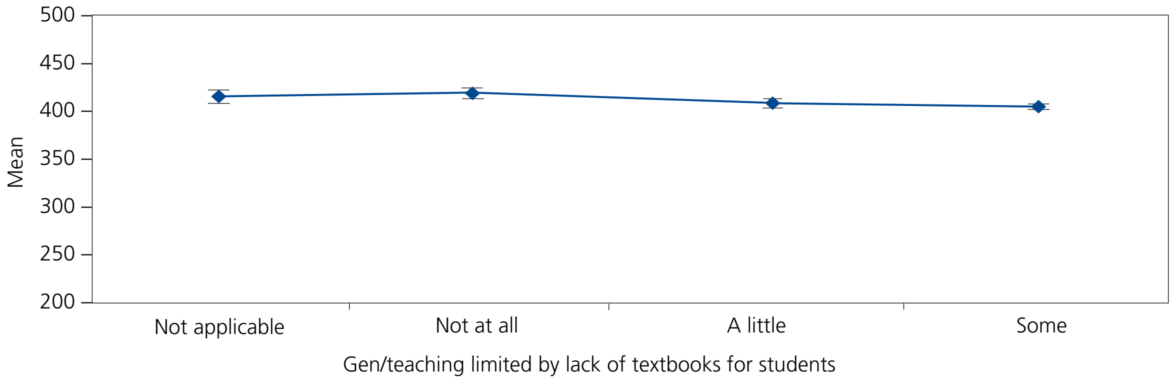
Student achievement and use of textbooks

In Grade 8, one variable relating to textbooks showed a significant difference in terms of student achievement. This variable concerned the extent to which teachers regarded the shortage of textbooks for students a factor limiting mathematics instruction. As is apparent from Figure 9.6a, the Grade 8 students whose teachers reported that a lack of textbooks for students was not a factor limiting mathematics instruction performed at a slightly higher level than teachers who reported that this factor limited their teaching a little. These students also performed at a significantly higher level than those students whose teachers reported that this lack was a constraining factor to some extent.

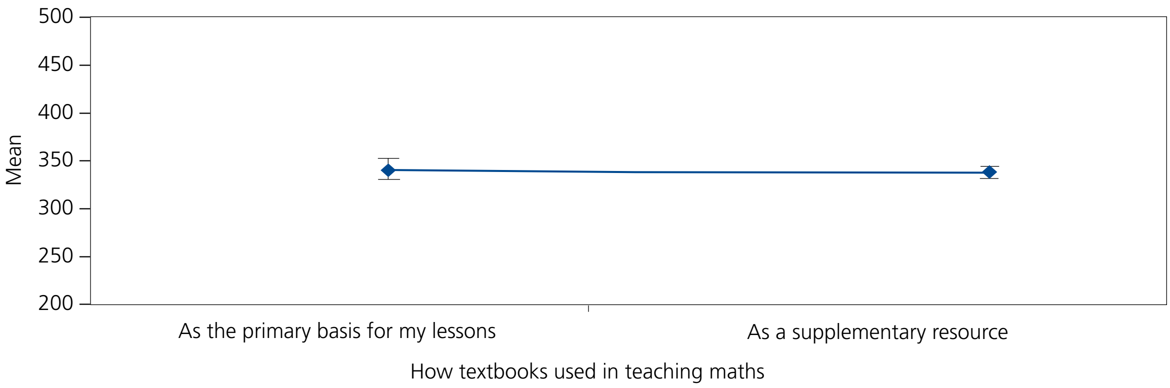
The other variable relating to textbook use showed no significant differences at either Grade 4 or Grade 8 (see Figure 9.6b–c). Thus, students did not perform at a higher or lower level in mathematics depending on whether their teachers used textbooks as the primary basis for their lessons or as a supplementary resource.

Figure 9.6: Mean Mathematics Achievement of Students Relative to Use of Textbooks

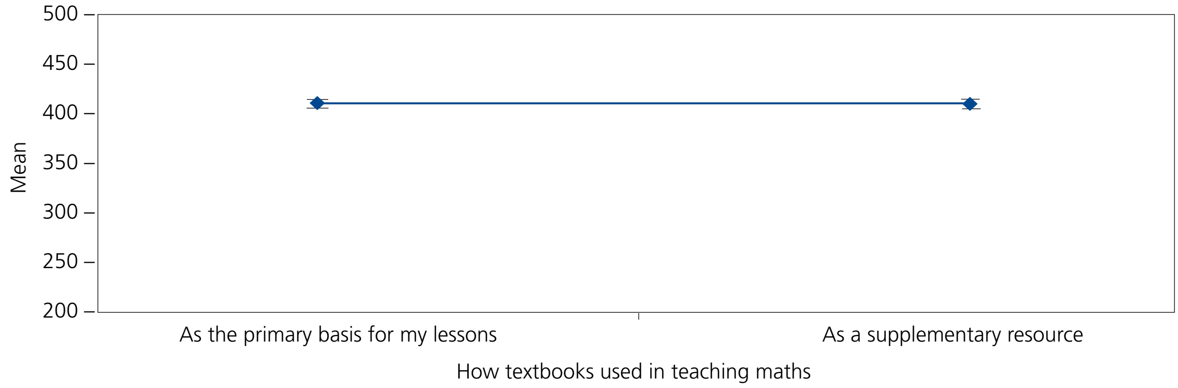
a. Mean mathematics achievement by BTBGLT10 (Grade 8)



b. Mean mathematics achievement by ATBMTXBU (Grade 4)



c. Mean mathematics achievement by BTBMTXBU (Grade 8)

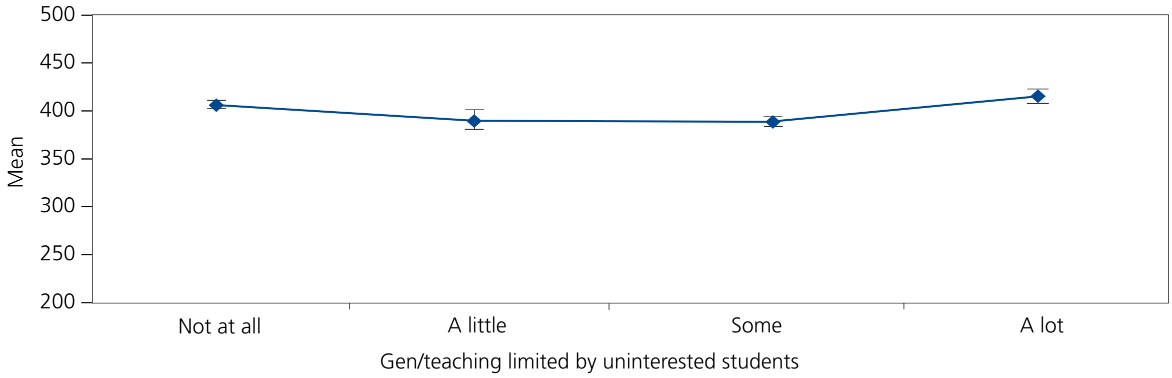


Student achievement and classroom climate

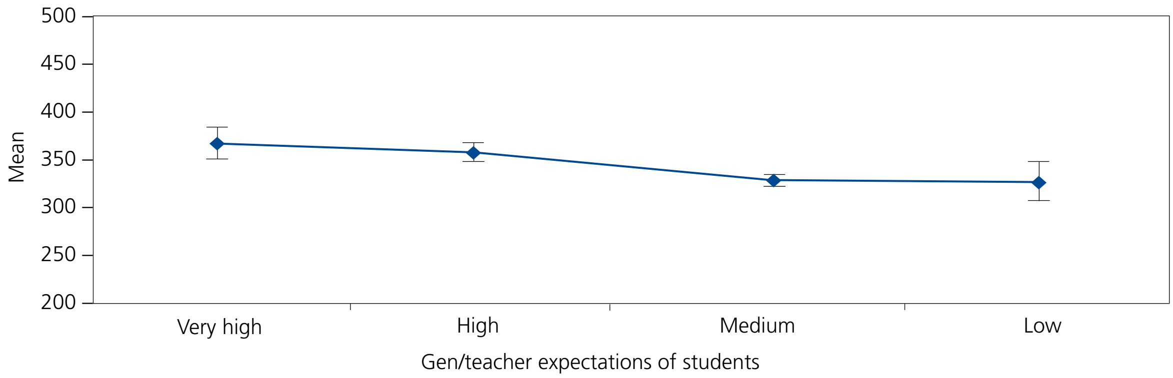
For the three variables used as indicators of classroom climate, significant differences in terms of student achievement were recorded, although not necessarily in the expected direction. Grade 8 students whose teachers reported that uninterested students limited mathematics instruction a lot performed at a significantly higher level than those students whose teachers reported that this factor limited instruction only a little or to some extent (see Figure 9.7a). This question was not asked at Grade 4, so it is not known if the same relationship existed at this earlier age. In both Grades 4 and 8, students whose teachers reported that their expectations of student achievement were high or very high performed at a higher level than those whose teachers reported lower levels of expectation (see Figures 9.7b–c). This result supports the hypothesis that a high level of teacher expectation is important for high achievement.

Figure 9.7: Mean Mathematics Achievement of Students Relative to Classroom Climate

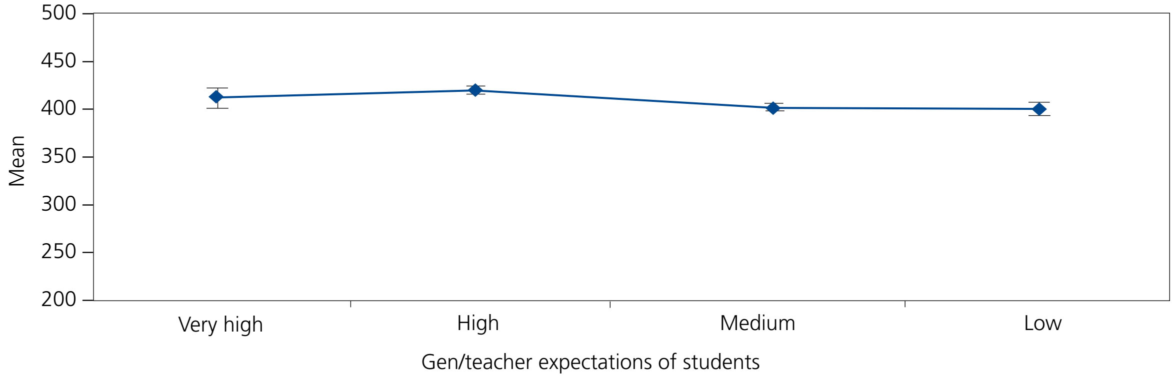
a. Mean mathematics achievement by BTBGLT04 (Grade 8)



b. Mean mathematics achievement by ATBGCHES (Grade 4)



c. Mean mathematics achievement by BTBGCHES (Grade 8)



9.6 CONCLUSION

The analyses in this chapter aimed to examine if the mathematics achievement of Grade 4 and Grade 8 Tunisian students who participated in TIMSS 2003 significantly differed depending on a number of selected variables. The variables considered were those proposed within a larger model of factors influencing teaching practices. Some results supported the hypothesized relationships. These included achievement differences relative to the use of calculators for routine computations and complex problems, amount of time spent on reviewing homework and re-teaching concepts, and teachers' expectations. In regard to the other instructional variables (listening to presentations, using calculators to explore concepts, amount of time spent working on problems, relating mathematical concepts to daily life, and allowing students to decide on their own way of solving problems), the hypothesized relationships with achievement did not emerge.

Essentially, some interesting results emerged from the bi-variate analyses reported here, and it would be useful to explore the way in which the factors considered in this report might operate indirectly, through other variables, to ultimately influence student outcomes. For this purpose, we would need to apply more complex analytical techniques, such as structural equation modeling or hierarchical linear models, to the available data.

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Thompson, A. G. (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educational Studies in Mathematics, 5*(2), 105–127.

Thompson, A. G. (1992). Teachers´ beliefs and conceptions: A synthesis of the research. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (pp. 127–146). New York: MacMillan.

CHAPTER 10

Yemen: A preliminary inquiry into the relationship between students' age and mathematics and science performance across eight Arabic countries

Tawfiq Ahmad Al-Mekhlafy

10.1 EXECUTIVE SUMMARY

The Trends in International Mathematics and Science Study (TIMSS) defines its target population as follows: "… all students enrolled in the upper of the two adjacent grades that contain[s] the largest proportion of 13-year-old students at the time of testing" (Martin, Mullis, & Chrostowski, 2004, p. 4). As a consequence, students in the obtained samples are of different ages. The width of the age range depends on the circumstances and policies of the respective national systems of education. Thus, for example, education systems differ as to whether they promote students from one grade to the next higher grade automatically or whether they base the decision on the results of end-of-year examinations. Systems also differ in how strictly they mandate age of first enrolment and the number of times a student may repeat a grade.

Many developing countries participate in TIMSS, and the number of Arab participant countries is increasing. Eight Arabic countries had valid TIMSS 2003 data at the Grade 8 level. For nearly all developing countries, the goal of universal education is yet to be achieved. At the same time, age of actual school entry differs within each country but the practice of grade repetition tends to be commonplace. The analyses presented in this chapter examine the relationship between age-related factors and performance in several ways. The chapter begins by describing policies related to age of school entry and grade promotion. This information is followed by an analysis of the mathematics and science performance between students in the youngest, middle, and oldest age brackets in each country, and then by regression analyses of the extent to which any differences found were significant. In a final step, the same analyses are repeated for a somewhat different subdivision of students wherein students were grouped according to whether their age was appropriate for the grade they were in—that is, whether they were "too young" or "too old" in terms of the age one would expect them to be in that grade.

The main results to emerge from these various analyses were as follows:

- The eight Arabic countries under review differed in their policies regarding the extent to which they accepted enrolment of children older than the specified school-entry age.
- In most of the eight Arabic countries, students were allowed to repeat a grade once or twice.
- Age had a substantial effect on mathematics and science performance of eighth graders in mathematics and science in seven of the eight Arabic countries under review.
- The effect was negative in that the older children performed at a lower level than the younger children.

It is acknowledged that other factors such as school location or student ability could account for some of the age-based differences that emerged from the analyses. For example, evidence from developing countries shows that students in rural areas frequently start school at a later age. In Yemen, according to the TIMSS 2003 international database, for example, the mean age of urban fourth graders was 10.68 years while the mean age of rural fourth graders was 11.06 years. This is usually explained by policymakers as being due to households holding children, particularly girls, back from timely enrolment in order for these children to assist with the family business or chores and/or to wait until the children have grown up enough to travel long distances to schools. In addition, children who are perceived as being "slower" are frequently held at home a little longer. The current analyses endeavored to obtain some initial insights into the bivariate relationship between age and performance in the eight Arabic countries that participated in TIMSS 2003 and for which samples adhered to the pre-defined international guidelines.

10.2 INTRODUCTION

Researchers conducting large-scale international comparative studies of formal education have to decide whether to define their target populations in terms of age or grade. When studies base their samples on age, grade becomes a variable because students of the same age can be spread across a number of grades. When samples are based on grade, age becomes a variable because within any one grade students can be either younger or older. In both cases, the variation stems from the students' age of enrolment and their rate of progress in school. Age of enrolment and rate of progress, in turn, are not merely a result of the individual student's circumstances in the home or his or her developmental capabilities but also a consequence of an education system's policies on how strictly the age of entry into the system is enforced and whether promotion from one grade to the next higher grade is automatic or based on some measure of student performance.

While it might be claimed that age-based samples are fairer because they exclude aspects of development or maturity that are often argued to impact on performance, they tend to be more disruptive to normal school activities during the testing process. This is because students from different grades and classes have to be gathered to complete the tests. Grade-based samples, in contrast, are more considerate of the school routine and take the view that performance in school subjects is mainly a result of the time spent in school, thereby making it fairer to test students after the same number of years of exposure to formal schooling. However, a grade-based definition of target populations results in students of different ages entering a sample, giving rise to arguments that differential performance is at least partly due to age.

Because TIMSS defines its target population in terms of grade, this study investigated the extent to which differences in student performance in the TIMSS mathematics and science tests depended on age. While, from a maturational viewpoint, one could argue that older students are likely to perform at a higher level than younger children because of having had more time to grow and learn and because they are ready for more complex mental activities, evidence from most international comparative studies (see, for example, Elley, 1992; Keeves, 1992; Postlethwaite, 2004) shows otherwise. In nearly all participating countries, older children perform at a lower level than younger children in the same grade. The explanation put forward by these authors is that it is the less able students who are held back home longer than their peers and hence either enter school later or repeat grades in order to re-attempt learning of the same material. In both scenarios, students of lower ability will be older than their fellow students in the same grade. This situation, in turn, leads to older students in the same grade showing lower performance.

These considerations led to the following overarching research question: What effect did student age have on student performance in science and mathematics in TIMSS 2003? More specifically, the hypotheses put forward were that:

1. Age would have no effect on students' performance in the TIMSS 2003 tests.
2. Age would have no significant effect on students' average achievement in the TIMSS 2003 tests in the eight Arabic countries.

10.3 METHOD

As a first, descriptive step, information was collated on the policies regarding enrolment age and grade promotion for the eight Arabic countries in the analyses. The IEA IDB Analyzer© was then used for the following analyses:

- Merging the TIMSS 2003 international database files for the eight Arabic countries.
- Grouping students' ages within each country into three categories, namely the youngest third, the middle third, and the oldest third.
- Undertaking regression analyses to examine whether differences in performance between the three age groups were significant, with the first analysis focusing on science and the second on mathematics.
- Re-grouping students somewhat differently by categorizing them into three groups:
    a. Grade 8 "appropriate age," that is, those students of an age equal to their age when they first enrolled in school plus eight years (thus, eight grades);

b. Younger than "appropriate;" and

c. Older than "appropriate."

Specifically, the "age-appropriate" group contained those students 12 years and 9 months (12.9) of age through to 14.0 years of age (for Morocco, 13.9 through 15.0 years). The younger and the older students were those whose age was under 12.9 years and more than 14.0 years, respectively.

- Undertaking regression analyses to examine if differences in performance between the "age-appropriate," the "younger than appropriate," and the "older than appropriate" groups were significant.

10.4 RESULTS

Country characteristics, including age

The eight countries varied in their gross national income, secondary net enrolment rate, and other characteristics. Table 10.1 presents selected characteristics of each country compiled from related TIMSS 2003 reports. Table 10.2 details the age distribution of the TIMSS student populations in these countries.

As is apparent from the tables, there were more similarities across the countries than differences. Net enrolment rates in secondary school (NER) ranged from 35.7% in Morocco to 87% in Bahrain. In addition, variation in the ages of eighth graders within each country was also evident in Table 10.2. Both factors that could contribute to variation of student ages within a single grade, that is, the acceptance of a range of ages for school entry as well as grade repetition, were present in seven of the eight Arabic education systems. The exception—Bahrain—allowed for grade repetition but not for late enrolment. Table 10.1 also shows that differences existed between the countries in the extent to which the authorities permitted children to enroll in school late or to repeat a grade.

Only small differences were apparent in the mean age across the countries, except for Morocco, as shown in Table 10.2. Moroccan students begin school about one year later than students in the other countries. The difference in age ranges in the samples was nonetheless quite large, with the smallest range reported for Jordan (5.7 years) and the greatest range reported in Saudi Arabia (8.5 years). When the distribution of ages in each country was split into three categories, that is, the youngest, the middle, and the oldest category, different age ranges were evident within each category in each country (Table 10.3). In general, the greatest age range was apparent for the oldest third of the students, with Morocco again being the exception, as it reported the greatest age range for the youngest age group.

The two hypotheses relating to the study's research question regarding the size and significance of possible differences in performance depending on student age were tested using regression and correlation analyses of the science and mathematics data sets. The following presentation and discussion of results addresses the two subjects separately, although some comparison is made between the two subjects whenever the context of the discussion warrants it.

As can be seen from Table 10.4, the regression analysis for science did not support either of the two hypotheses. Differences depending on age emerged and were significant in all countries, except in Jordan, where the effect was negligible. The effect, moreover, was negative: as the average age of the student group increased, the average achievement score decreased.

This result contradicts the maturational viewpoint that older students perform at a higher level than younger students. Instead, it seems that other factors influence the performance of older students, with these students doing less well than the younger students in an age-banded category. One such factor might be that students who are perceived by their parents as bright enter school earlier. These academically able students are therefore relatively young in Grade 8 and perform at a higher level than their fellow students. Another factor could be grade repetition for slower learners. This means that grade repeaters are older than their fellow students and that, in reality, the repetition did not work because the scores of the repeaters are still lower than the scores of their fellow students who were attempting the content of the class for the first time.

In addition to the direction of the effect, the magnitude of the effect was relatively large. Thus, the effect of age on students' science achievement

Table 10.1: Selected Characteristcs of each Arabic Country

Country	Policy on age of entry to school	Practice on age of first entry to school	Policy on Grade 8 repetition	School years to Grade 8	Gross national income ($US)	Secondary net enrolment rate (%)
Bahrain	6	6	Students can repeat the grade once. Those not passing the examination more than once divert to "evening schools."	8	10,500	87
Egypt	6 or 7	6 or 7	Students can repeat the grade twice.	8	1,470	80.8
Jordan	5, 6, 7	Children as old as 10 can be enrolled.	Students can repeat the grade once.	8	1,760	79.9
Lebanon	6 or 7	6 or 7		8	3,990	–
1‡ Morocco	7	7 or 8	Students can repeat the grade twice.	8	1,170	35.7
Palest. Nat'l Auth.	6	Older children can be enrolled in "some special cases".	Students of lowest 5% scores can repeat the grade. The rest are promoted.	8	–	83.8
Saudi Arabia	6	Children as old as 9 can be enrolled.	Students can repeat the grade twice. Those not passing the examination more than twice divert to "evening schools."	8	8,530	52.7
Tunisia	6	5.5 or 6	If student's age within grade's appropriate age, he/she can repeat the grade twice. Otherwise, he/she can continue in private schools.	8	1,990	64.5

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

Table 10.2: Summary Statistics Relating to Age of Students Participating in TIMSS in the Eight Arabic Countries

Country	Student *N*	Total student weight	Mean of age	Mean (s.e.)	Range	Minimum	Maximum	Std. dev.
Bahrain	4.191	10.52	14.07	0.01	7.75	11.00	18.75	0.82
Egypt	7.054	1355.61	14.44	0.02	8.08	10.50	18.58	0.98
Jordan	4.487	96.26	13.92	0.01	5.67	11.75	17.42	0.41
Lebanon	3.787	57.39	14.57	0.04	7.58	10.83	18.42	1.21
1 ‡ Morocco	2.756	192.63	15.20	0.04	8.42	10.58	19.00	1.19
Palest. Nat'l Auth.	5.356	64.85	14.13	0.02	8.00	10.33	18.33	0.85
Saudi Arabia	4.228	322.31	14.06	0.05	8.50	10.42	18.92	1.28
Tunisia	4.927	183.31	14.81	0.03	6.00	12.50	18.50	1.16

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

Table 10.3: Summary Statistics for the Three Age Groupings within each Arabic Country

Country	Three age groups	Student *N*	Total student weight	Mean	Mean (s.e.)	Percent of students	Percent (s.e.)	Range	Std. dev.
Bahrain	Youngest	1,315	3,174	13.38	0.01	30.17	0.75	2.58	0.24
	Middle	1,500	3,831	13.86	0	36.42	0.71	0.42	0.14
	Oldest	1,376	3,515	14.91	0.03	33.41	0.73	4.58	0.88
	Total	**4,191**	**10,521**	**14.07**	**0.01**	**100**		**7.75**	**0.82**
Egypt	Youngest	2,266	390,831	13.55	0.01	28.83	0.98	3.33	0.40
	Middle	2,374	461,912	14.15	0	34.07	0.78	0.50	0.16
	Oldest	2,414	502869	15.40	0.03	37.10	1.21	4.08	0.89
	Total	**7,054**	**1,355,612**	**14.44**	**0.02**	**100**		**8.08**	**0.98**
Jordan	Youngest	1,489	31,627	13.52	0	32.86	0.73	1.92	0.12
	Middle	1,446	31,144	13.88	0	32.35	0.89	0.25	0.09
	Oldest	1,552	33,488	14.33	0.01	34.79	0.80	3.33	0.38
	Total	**4,487**	**96,259**	**13.92**	**0.01**	**100**		**5.67**	**0.41**
Lebanon	Youngest	1,332	19,229	13.48	0.01	33.51	1.24	3.00	0.34
	Middle	1,220	17,917	14.19	0.01	31.22	0.90	0.75	0.22
	Oldest	1,235	20,240	15.94	0.04	35.27	1.40	3.67	0.93
	Total	**3,787**	**57,386**	**14.57**	**0.04**	**100**		**7.58**	**1.21**
1 ‡ Morocco	Youngest	890	63,575	14.01	0.03	33.00	1.58	4.00	0.63
	Middle	945	66,236	15.05	0.01	34.39	1.26	0.83	0.25
	Oldest	921	62,816	16.56	0.03	32.61	1.33	3.42	0.75
	Total	**2,756**	**192,627**	**15.20**	**0.04**	**100**		**8.42**	**1.19**
Palest. Nat'l. Auth.	Youngest	1,929	22,793	13.48	0.01	35.15	0.93	3.42	0.38
	Middle	1,662	20,670	13.97	0	31.88	1.05	0.25	0.08
	Oldest	1,765	21,384	14.97	0.04	32.98	0.84	4.17	0.91
	Total	**5,356**	**64,848**	**14.13**	**0.02**	**100**		**8.00**	**0.85**
Saudi Arabia	Youngest	1,389	103,673	12.91	0.01	32.17	1.70	2.92	0.40
	Middle	1,425	104,139	13.71	0.01	32.31	0.84	0.67	0.21
	Oldest	1,414	114,501	15.42	0.05	35.52	1.79	4.75	1.12
	Total	**4,228**	**322,314**	**14.06**	**0.05**	**100**		**8.50**	**1.28**
Tunisia	Youngest	1,662	62,056	13.65	0.01	33.73	1.19	1.50	0.25
	Middle	1,578	58,849	14.56	0.01	31.99	0.73	1.08	0.36
	Oldest	1,687	63,057	16.19	0.02	34.28	0.94	3.25	0.67
	Total	**4,927**	**183,962**	**14.81**	**0.03**	**100**		**6.00**	**1.16**

Notes:

1 National Desired Population does not cover all of International Desired Population

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

Table 10.4: Effect of Age on Students' Science Achievement

	Country	Average scale score	Effect	*t*-test
	Bahrain	460.33	-21.18	-11.99
	Egypt	455.33	-31.24	-12.37
	Jordan	474.98	-0.08	-0.04
	Lebanon	432.26	-38.08	-14.65
1 ‡	Morocco	414.11	-16.30	-7.30
	Palest. Nat'l.Auth.	456.92	-21.97	-12.92
	Saudi Arabia	422.28	-23.14	-7.73
	Tunisia	420.35	-16.72	-10.49

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

ranged from -16.30 in Morocco to -38.08 in Lebanon. Jordan was the only country not to have a significant effect in terms of science performance decreasing with increasing age.

Because the regression in Table 10.4 involved a single measure indicating student age, I assumed the measure could be "hiding" details that would indicate the actual location of the effect. I accordingly used descriptive information on the variable "age" in each country to split the sample into thirds, which I labeled "younger," "middle," and "oldest" age group. I then conducted tests to ascertain if any differences in the performance levels of these three age groups were significant and thereby reveal the "location" of the effect. The breakdown in Table 10.5 shows the details of the age effect. The descriptive statistics show the highest scores for the youngest group, followed by the scores of the middle group; the lowest performance was recorded for the oldest group. The oldest group performed at a significantly lower level in science than did the middle and the youngest groups in all countries, except Jordan. Specifically, these significant differences ranged from a 14-point difference between the higher scoring oldest group and the lower scoring middle group in Tunisia (Table 10.5, column "Difference 3–2") to a 76-point difference between the higher scoring youngest group and the lower scoring oldest group in Lebanon (Table 10.5, column "Difference 3–1").

The differences between the middle group and the oldest group were, in general, smaller, ranging from a non-significant difference of 1 point in favor of the youngest group compared with the middle group in Bahrain to a significant difference of 19 points in Tunisia, again in favor of the youngest group.

The breakdown also explains why Jordan did not show an overall regression effect. The second (middle) group outscored the youngest group and the oldest group by virtually the same amount—17 score points. Essentially, the two differences cancelled out the effect.

The pattern for mathematics evident in Table 10.6 is similar to the pattern for science (Table 10.4). We can see here that the three countries with the largest age effect for science—Lebanon, Egypt, and Saudi Arabia—also had the largest age effect for mathematics, although their rank positions were not the same. Palestine was in the middle of the ranking. The two countries with the smallest effect of age on achievement in mathematics were Bahrain, Morocco and Tunisia, while Jordan again showed no significant effect of age on performance.

The size of the effect was larger in science than in mathematics in Egypt and Lebanon, and it was about the same in Bahrain and Palestine. In Morocco, Saudi Arabia, and Tunisia, the effect of age on performance was larger in mathematics than in science.

As with the science results, the extent of the differences between the three age groups in terms of mathematics performance was subjected to tests of statistical significance. Table 10.7 shows the results of this analysis. The difference in performance between the youngest age group and the oldest age

Table 10.5: Difference in Science Achievement between Three Age Groups in Each Arabic Country

Country	Average scale score of youngest group (1)		Average scale score of middle group (2)		Average scale score of oldest group (3)		Difference 3–1 (absolute value)			Difference 3–2 (absolute value)			Difference 2–1 (absolute value)		
Bahrain	453	(2.7)	452	(2.3)	411	(2.6)	42	(3.5)	▲	41	(3.0)	▲	1	(3.1)	
Egypt	446	(4.4)	439	(4.3)	386	(5.0)	60	(5.1)	▲	54	(4.2)	▲	7	(4.7)	
Jordan	469	(4.8)	487	(4.4)	469	(4.3)	0	(4.3)		17	(4.3)	▲	17	(3.7)	▲
Lebanon	424	(4.9)	412	(4.4)	348	(4.9)	76	(5.1)	▲	64	(5.0)	▲	12	(4.3)	▲
1 ‡ Morocco	413	(3.1)	400	(3.4)	381	(4.1)	33	(4.5)	▲	19	(3.8)	▲	14	(4.0)	▲
Palest. Nat'l. Auth.	451	(3.7)	448	(3.5)	407	(3.9)	44	(3.4)	▲	41	(3.3)	▲	3	(3.5)	
Saudi Arabia	417	(4.1)	410	(3.6)	371	(5.5)	46	(5.9)	▲	38	(4.9)	▲	8	(3.9)	
Tunisia	421	(2.9)	402	(2.2)	388	(2.3)	33	(3.2)	▲	14	(2.0)	▲	19	(2.8)	▲

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

group was considerably larger than the difference in performance between the youngest and the middle age groups in all countries except Jordan, where the differences favored the younger age group.

Four countries showed a significant difference in science achievement between the youngest group and the middle group (see Table 10.5), whereas six countries showed a significant difference between these two groups in the subject area of mathematics (see Table 10.7). In science, the youngest group performed at a significantly higher level than the middle group in Lebanon, Morocco, and Tunisia. In Jordan, however, the middle group outperformed the youngest group in science.

These results led to the two null hypotheses being rejected. Thus, age-related differences were evident in the performance of the Arabian students who participated in TIMSS 2003, and these differences were significant. While the age-related differences were similar across all countries under review, one result contradicted this general pattern. In contrast to the other Arabic countries, where the youngest group performed at a higher level than both the middle group and the oldest group, in Jordan the middle group outperformed both the younger and older groups in mathematics as well as in science.

Table 10.6: Effect of Age on Students' Mathematics Achievement

Country	Average scale score	Effect	*t*-test
Bahrain	424.83	-22.74	-14.05
Egypt	438.34	-29.41	-15.60
Jordan	426.88	-2.45	-1.16
Lebanon	460.69	-27.25	-14.93
1 ‡ Morocco	405.77	-18.30	-7.96
Palest. Nat'l. Auth.	411.89	-21.84	-12.97
Saudi Arabia	363.22	-29.86	-8.51
Tunisia	431.36	-20.91	-11.60

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

Table 10.7: Difference in Mathematics Achievement for the Three Age Groupings within each Arabic Country

	Country	Average scale score of youngest group (1)		Average scale score of middle group (2)		Average scale score of oldest group (3)		Difference 3–1 (absolute value)			Difference 3–2 (absolute value)			Difference 2–1 (absolute value)		
	Bahrain	417	(2.6)	416	(2.1)	372	(2.7)	45	(3.2)	▲	44	(3.3)	▲	1	(2.9)	
	Egypt	429	(4.1)	426	(3.7)	372	(3.9)	57	(3.8)	▲	54	(3.3)	▲	3	(3.4)	
	Jordan	422	(5.0)	435	(4.6)	417	(4.3)	5	(4.2)		18	(4.1)	▲	14	(3.6)	▲
	Lebanon	454	(3.4)	447	(3.7)	400	(3.2)	54	(3.6)	▲	47	(3.9)	▲	7	(2.8)	▲
1 ‡	Morocco	404	(3.4)	399	(3.9)	368	(3.2)	37	(4.6)	▲	23	(4.2)	▲	14	(4.1)	▲
	Palest. Nat'l. Auth.	408	(4.0)	390	(3.5)	364	(3.6)	44	(3.4)	▲	36	(3.3)	▲	8	(3.8)	▲
	Saudi Arabia	358	(5.4)	345	(4.6)	298	(5.4)	59	(6.9)	▲	46	(4.9)	▲	13	(5.9)	▲
	Tunisia	433	(3.2)	406	(2.3)	392	(2.3)	42	(3.6)	▲	15	(2.4)	▲	27	(2.9)	▲

Notes:

1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

Taking a somewhat different approach to examining the relationship between age and performance, I regrouped the students on the basis of whether they were "age appropriate" (i.e., their age was in line with what it should have been after eight years of schooling) or "age inappropriate" (i.e., either younger or older than the age-appropriate range). I did this regrouping in order to test if the poorer performance of the older children related to either grade repetition or late enrolment in school. Table 10.8 presents the results of this analysis.

The table reveals several interesting points. First, the group of students who were younger than they should have been in terms of their country's age of school entry (see Table 10.1) was relatively small in all countries, ranging from 1% of students in Jordan to 12% of students in Saudi Arabia. The group of students who were older than they should have been relative to school entry age was much larger, ranging from 35% of students in Jordan to 66% of students in Tunisia. Indeed, in Egypt, Lebanon, Morocco, and Tunisia, the number of students in the older group exceeded the number of students in the age-appropriate group. Because the numbers of children in the "younger than appropriate" group in each country were too small to warrant their inclusion in further analysis, I conducted the regression analysis for the remaining two groups only. The results for mathematics and science appear in Tables 10.9 and 10.10 respectively.

Generally, the picture presented in these two tables is similar to that for the analysis of differences based on the three categories of student age presented earlier. Those countries that showed large regression effects in the earlier analyses, that is, Egypt, Lebanon, and Saudi Arabia, maintained the largest effects here. Again, the differences were such that students who were older than expected—given the prescribed age of school entry and the fact that they were in Grade 8—performed at a significantly lower level in mathematics and science than the age-appropriate students in all countries under review.

In summary, the evidence presented here shows that students who were older within a specified grade or age cohort did not perform at a higher level as could be assumed as a result of their greater maturity. The question, of course, is why? Is this outcome a product of countries' policies regarding grade repetition? Is it a product of late enrolment in school? Or is it perhaps a consequence of both? In addition, could other factors, such as where students live or their level of ability, explain some of the differences that emerged in this bivariate analysis of the relationship between age and performance?

Another possible explanation could relate to a de-motivation factor whereby the performance of

Table 10.8: Summary Statistics for the Three Age Groupings within each Arabic Country

Country	Three age groups	Student *N*	Total student weight	Mean	Mean (s.e.)	Minimum	Maximum	Percent of students	Percent (s.e.)
Bahrain	Younger	66	146	12.54	0.05	11.00	12.83	1.39	0.19
	Appropriate	2,518	6,249	13.63	0.00	12.92	14.00	59.40	0.75
	Older	1,607	4,125	14.79	0.02	14.08	18.75	39.21	0.78
Egypt	Younger	66	14,840	11.92	0.10	10.50	12.83	1.09	0.16
	Appropriate	2,957	526,634	13.71	0.01	12.92	14.00	38.85	1.11
	Older	4,031	814,138	14.96	0.03	14.08	18.58	60.06	1.10
Jordan	Younger	4	74	12.41	0.35	11.75	12.83	0.08	0.04
	Appropriate	2,931	62,697	13.70	0.00	13.00	14.00	65.13	0.80
	Older	1,552	33,488	14.33	0.01	14.08	17.42	34.79	0.80
Lebanon	Younger	64	1,109	12.48	0.05	10.83	12.83	1.93	0.30
	Appropriate	1,633	23,550	13.64	0.01	12.92	14.00	41.04	1.39
	Older	2,090	32,727	15.31	0.04	14.08	18.42	57.03	1.44
1 ‡ Morocco	Younger	257	19,257	13.31	0.06	10.58	13.83	10.00	1.01
	Appropriate	1,121	77,151	14.54	0.01	13.92	15.00	40.05	1.24
	Older	1,378	96,220	16.11	0.03	15.08	19.00	49.95	1.49
Palestine	Younger	76	912	11.97	0.08	10.33	12.83	1.41	0.22
	Appropriate	3,204	38,809	13.71	0.01	12.92	14.00	59.85	0.92
	Older	2,076	25,126	14.84	0.03	14.08	18.33	38.75	0.91
Saudi Arabia	Younger	504	39,228	12.54	0.03	10.42	12.83	12.17	0.78
	Appropriate	2,224	161,658	13.46	0.01	12.92	14.00	50.16	1.53
	Older	1,500	121,428	15.34	0.05	14.08	18.92	37.67	1.81
Tunisia	Younger	12	452	12.67	0.04	12.50	12.83	0.25	0.08
	Appropriate	1,650	61,604	13.66	0.01	13.00	14.00	33.49	1.18
	Older	3,265	121,906	15.41	0.02	14.08	18.50	66.27	1.19

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included

Table 10.9: Effect of Age-Appropriate Status on Students' Mathematics Achievement

Country	Younger children than appropriate-age children (1)		Appropriate-age children (2)		Older children than appropriate-age children (3)		Difference 3–1 (absolute value)			Difference 3–2 (absolute value)			Difference 2–1 (absolute value)		
Bahrain	448	(12.6)	415	(2.0)	379	(2.6)	69	(12.9)	▲	36	(2.7)	▲	33	(12.7)	▲
Egypt	351	(11.9)	428	(4.0)	393	(3.6)	43	(12.2)	▲	35	(3.3)	▲	77	(12.5)	▲
Jordan	401	(96.7)	428	(4.5)	417	(4.3)	16	(96.4)		11	(3.8)	▲	28	(96.4)	
Lebanon	452	(9.5)	457	(3.3)	416	(3.1)	36	(9.5)	▲	42	(3.1)	▲	6	(10.2)	
1 ‡ Morocco	405	(6.0)	402	(2.9)	372	(3.0)	32	(6.4)	▲	29	(3.0)	▲	3	(6.2)	
Palest. Nat'l. Auth.	341	(15.4)	405	(3.2)	373	(3.4)	32	(14.9)	▲	32	(2.9)	▲	64	(14.4)	▲
Saudi Arabia	352	(7.7)	351	(4.2)	301	(5.2)	51	(8.3)	▲	51	(4.9)	▲	1	(7.1)	
Tunisia	425	(24.3)	433	(3.2)	399	(1.9)	27	(24.4)		35	(3.0)	▲	8	(24.1)	

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

Table 10.10: Effect of Age-Appropriate Status on Students' Science Achievement

Country	Younger children than appropriate-age children (1)		Appropriate-age children (2)		Older children than appropriate-age children (3)		Difference 3–1 (absolute value)			Difference 3–2 (absolute value)			Difference 2–1 (absolute value)		
Bahrain	476	(8.4)	451	(2.1)	417	(2.4)	59	(8.8)	▲	34	(2.7)	▲	25	(8.5)	▲
Egypt	362	(15.8)	445	(4.2)	407	(4.4)	44	(16.3)	▲	38	(4.2)	▲	82	(15.6)	▲
Jordan	485	(127.6)	478	(4.2)	469	(4.3)	15	(127.5)		8	(3.9)	▲	7	(127.4)	
Lebanon	419	(15.1)	426	(4.9)	370	(4.4)	49	(15.5)	▲	56	(5.0)	▲	7	(16.1)	
1 ‡ Morocco	418	(6.2)	408	(3.2)	384	(3.4)	34	(6.6)	▲	24	(4.0)	▲	10	(6.8)	
Palest. Nat'l. Auth.	375	(13.8)	450	(3.2)	418	(3.8)	43	(13.5)	▲	33	(2.9)	▲	75	(12.9)	▲
Saudi Arabia	417	(6.5)	413	(3.7)	372	(5.3)	44	(7.0)	▲	41	(5.2)	▲	4	(6.9)	
Tunisia	426	(25.9)	421	(2.9)	395	(2.0)	32	(25.5)		27	(2.8)	▲	5	(25.4)	

Notes:
1 National Desired Population does not cover all of International Desired Population
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent
▲ The difference is significant at (α=0.05)

older students is adversely affected when they are placed among younger students. Or could it be that the interaction between teachers and these older learners tends toward the negative, in terms of the former expecting relatively lower perfomance of the latter and consequently creating a self-fulfilling prophecy? Other explanations might rest on such possibilities as older eighth graders who begin their schooling at an age beyond the specified school entry age do so because they come from economically disadvantaged backgrounds. Essentially, other social, policy, psychological, and educational factors need to be investigated to examine what is behind the relationship in which older students perform at a significantly lower level than younger students in the same grade.

10.5 CONCLUSION

The following points emerged from the investigation:

1. Age had a substantial effect on the mathematics and science performance of eighth graders in seven of the eight Arabic countries under review.
2. The size of the effect differed between the countries.
3. The effect was negative—the older children did not do as well on the tests as did the younger ones. "Older," in this analysis, was operationalized in two ways: (a) in the general sense of students who were older students within a specified age bracket; and (b) older than one would expect a student to be who had completed eight years of schooling.

Some of the questions that arise from these analyses and that could be considered in further analyses are:

- Why are children in Grade 8 older than they should be?
- Are they grade repeaters?
- Did they start school later than the prescribed age of school entry?

Subsequent pedagogical questions that arise from the issue of having students of different ages within one grade might include:

- Are older children de-motivated when placed with younger classmates?
- Is there a difference in pedagogical interactions between the teacher and his or her younger and older students?
- Should age variation within a class be reduced?
- Should learners of heterogeneous ages in a single class be provided with different instructional experiences?
- How effective is grade repetition?
- What results in higher achievement—automatic promotion to the next grade or promotion based on performance?

However, before addressing pedagogical questions as refined as these, interested researchers should analyze this issue relative to other factors that might explain the relationship between age and student performance in TIMSS, such as school location (urban/rural) and student ability.

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CHAPTER 11

Conclusion

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This report is an outcome of the seminar series designed by IEA in response to a specific request for capacity-building by the World Bank. More specifically, part of the funding provided by the World Bank under the terms of the Development Grant Facility was aimed at enhancing the statistical and analytical skills of researchers involved in conducting the TIMSS and PIRLS studies in the Arabic countries of the MENA region. As such, the report represents a first effort by these researchers to undertake secondary analyses of data drawn from the complex TIMSS database in an attempt to address issues relevant to their country or to the region. The results presented in the preceding country chapters and summarized below should therefore be regarded as preliminary insights into the respective issues. In order to disentangle the complexities associated with understanding the relationship between educational outcomes and their influencing factors, further multivariate and multilevel analyses will be required.

This chapter begins with a summary of findings reported in the country analyses chapters. It continues with a brief reflection on the structure, content, and implementation of the seminar series. The chapter—and the report—concludes with an outlook that considers adapting this current seminar series for other countries or regions and the continuation of the current series in terms of training in further analytical techniques.

11.1 SUMMARY OF FINDINGS

Some of the country analysis chapters focused on questions that were of importance to the individual country. Jordan, for example, participated in TIMSS 1999 and TIMSS 2003 and used the opportunity to examine, among many other things, the extent to which performance differences in mathematics and science relative to student gender, school location, and school-governing authority had changed over time. In science, the changes were generally positive in that the scores overall and for most subgroups increased significantly between 1999 and 2003. In mathematics, in contrast, achievement was slightly lower for some subgroups in 2003 than it had been in 1999. In this subject, gender differences actually increased as a result of a decrease in the boys' performance and an increase in the girls' performance between the two occasions. While the performance gap relating to school location decreased, this was partly a result of a decrease in the performance of students in the urban schools. In terms of school authority, private and government schools performed at similar levels on the two occasions, whereas the performance of students in the UNRWA (United Nations Relief and Work Agency) schools decreased considerably between 1999 and 2003 in mathematics.

While the results presented by the Palestinian National Authority were also broken down according to different school authorities, this country's analyses, as well as those undertaken by Egypt and Tunisia, examined possible differences in achievement in terms of teachers' instructional activities, given that teachers are frequently regarded as the critical factor influencing students' performance.

More specifically, the analysis undertaken by the Palestinian National Authority focused on various factors for which data were obtained from the TIMSS teacher questionnaire. These factors included teachers' visits to one another's classrooms, in-service training, job satisfaction, teacher expectations of student performance, parental involvement in school activities, and homework assignments. Four of these factors, which were analyzed by school authority, were shown to result in significant differences in mathematics performance—three in UNRWA schools and one in government schools.

First, in UNRWA schools, students for whom teachers reported a medium level of parental involvement in school activities achieved at a significantly higher level than students with parents showing low involvement. Second, students of teachers in UNRWA schools who expected their students' performance to be medium or high performed significantly higher than those students whose teachers expected a low performance of them. Third, performance was significantly higher for students in UNRWA schools who were assigned homework half the lessons or less than half the lessons than it was for students who had homework assignments nearly every lesson. Fourth, for government schools, students taught by teachers who reported having experienced in-service training in assessment and evaluation achieved at a significantly higher level than students taught by teachers who reported not having received such in-service training.

The Egyptian analysis used data from the eight Arabic countries that met the sampling requirements in TIMSS 2003 to examine whether or not differential activities in the form of remedial works for weaker students and enrichment works for more able students led to different levels of achievement in mathematics as well as in science. With three exceptions, namely Jordan for enrichment works in mathematics and science and Palestine for remedial works in mathematics, no significant differences in performance depending on the provision of remedial or enrichment activities emerged from the analyses.

The Tunisian analysis conceptualized the investigation of teacher factors within a model that included different approaches to teaching and learning as well as the classroom context within which teaching and learning occurs. Results showed a higher level of mathematics performance for Tunisian Grade 8 students whose teachers asked them to use calculators in about half the lessons, devoted 28% or more of weekly instructional time to reviewing homework, did not regard shortage of textbooks as a factor limiting their instruction, and had high or very high expectations of student performance. Grade 4 students whose teachers reported high or very high expectations likewise performed at a higher level than students whose teachers had medium or low expectations of their students' performance. Moreover, at this grade level, students performed significantly better if their teachers devoted 28% or more of weekly instructional time to reviewing homework than students whose teachers devoted only up to and including 18% of time to this activity.

The analyses reported by Morocco and Oman focused on information obtained from students and schools in addition to that obtained from teachers and revolved around the relationship between the availability and use of computers and student achievement in mathematics. Here, four major findings emerged from the analyses of data from the Arabic countries under review. First, the Omani analysis showed that for those countries where differences were significant, students who used computers inside school performed at a higher level than students who used computers outside school. Second, for those countries where differences were significant, students from schools with many computers outperformed students from schools with few computers, except in Tunisia. Third, the importance of availability of computers in mathematics lessons was emphasized by results showing a significantly higher performance of students who had access to computers during mathematics lessons. A closer examination of the Moroccan data in regard to using computers during mathematics lessons showed all differences favoring students whose teachers reported using computers for different activities instead of not using computers. These differences were significant for students of teachers who reported using computers to practice skills or process data.

A focus on instruction was also part of the Algerian and the Tunisian analyses, but it related to one of the essential conditions in which different instructional activities can be conducted—class size. For Tunisia, the analysis found that students in larger classes performed significantly better in mathematics than did students in smaller class. No significant differences emerged in Morocco relative to class size. These results appear to contradict some of the ideas and experiences of many educational researchers and practitioners who argue that smaller classes result in higher performance.

Another school-level variable and a student-level variable were the common elements of the Algerian and the Jordanian analyses, which examined performance differences according to school location and student gender. For the three Arabic countries for which data were examined in these analyses, that is, Jordan, Morocco, and Tunisia, mixed results emerged with respect to school location. Whereas urban schools outperformed rural schools in mathematics in Jordan, semi-urban schools outperformed urban and rural schools in mathematics in Tunisia. No differences emerged relative to school location in either mathematics or science in Morocco and in science in Jordan. In terms of gender differences, male students outperformed female students in mathematics in Morocco and Tunisia, but girls performed at a significantly higher level than boys in Jordan in both mathematics and science. An investigation into whether boys or girls in Morocco and Tunisia were more affected by the educational background of their parents showed that gender differences tended to be smaller for students with more highly educated parents.

Last, but not least, the Yemeni analysis examined the relationship between students' age and performance in mathematics. Because the target populations in TIMSS were grade-based, students in the sample could be of different ages. Results of the analysis showed that older children performed at a lower level than younger children. Probable underlying causes of this relationship were thought to include the following: (a) the older students were those who were enrolled by their parents later than their peers because they were deemed not ready for school; (b) in rural areas, the older students could have been those who had been kept at home for longer because their parents needed their assistance with farm duties; and (c) some education systems had a policy of grade repetition in cases of unsatisfactory achievement. These possibilities, however, are suggestions to be investigated in future analyses.

In summary, time and resource constraints meant that the available analyses involved only bivariate relationships or examined differences in performance broken down by a maximum of two variables. However, the analyses demonstrated how data from a study such as TIMSS can start to be used for evidence-based policymaking rather than a popular but simplistic ranking of countries in terms of student performance. Finally, some interesting commonalities, differences, and unique findings emerged across the Arabic countries for which data were analyzed.

11.2 REFLECTIONS ON THE SEMINAR SERIES

The seminar series was successful in a number of ways. First, it provided a balanced combination of theoretical presentations and hands-on workshops that allowed participants to apply the theoretical knowledge. Thus, for example, participants were first shown how to calculate means, percentages, and standard errors of mathematics and science achievement and secondly how to undertake and interpret the results of computations aimed at assessing the significance or otherwise of differences between certain subgroups of interest, such as public or UNRWA schools, male and female students, or rural and urban schools. Moreover, participants were shown appropriate ways of presenting the results in tables for use in national reports or other publications of TIMSS results and for different audiences and purposes.

Likewise, as part of the seminar series, a common framework for reporting results of the analyses was developed, including the structural and editorial conventions to apply when writing-up policy-relevant research. The current report is a testimony to the successful implementation of this framework, which is particularly noteworthy given that English is the second or third language of almost all participants.

The seminar series also provided some participants and IEA staff with the opportunity to experience parts of the Arab world they had not previously visited and to see the context in which education systems operate in the countries hosting the seminars, specifically Jordan, Oman, and Tunisia. Such experiences were particularly important because they sensitized all involved to the different demands and cultural contexts in which TIMSS operates, and assisted in making future large-scale international education studies a better reflection of all the participating countries.

Although participation at the seminars was the main component of the series, work on the analyses also took place between seminars. In order to facilitate and support this work, each country was assigned to a specific IEA staff member. Communication occurred by email and telephone and included quick queries regarding the state and progress of analyses, questions about the appropriate match between research questions and analytical techniques, and in-depth discussions about the interpretation and writing-up of results.

It should be remembered that these interactions and the workshop seminars were affected by the security situation in some of the participating countries, in particular the Middle East Arabic countries. Thus, for example, it was sometimes unclear whether or not participants could attend a seminar until the last minute and work between seminars was affected by curfews or bomb threats or explosions in the vicinity of participants' workplaces. While some participants managed to produce results despite such difficult circumstances, others were unable to complete the tasks required for the production of an analysis chapter for this report.

As with any training, particularly in the context of professional and adult education, one of the major challenges was the diversity in the prior knowledge that participants brought to the various tasks. Thus, some participants had more experience in writing, others had greater knowledge of various statistical techniques, and others again were more familiar with the types of questions policymakers might ask of the TIMSS data. The seminars tried to accommodate these different levels of expertise by keeping theoretical input during plenary sessions to a minimum and providing ample opportunity for individual work and consultation between participants and IEA staff.

The evaluation sheets that participants completed at the end of each seminar showed a generally high level of satisfaction with the organization, content, and delivery of the seminars. Specific comments to the open-ended question asking participants for suggestions frequently expressed the wish to learn about more complex types of analyses. This desire is one of the issues discussed in the following section, which looks at the possible content of future training sessions of this kind.

11.3 OUTLOOK

One of the specific requests mentioned by participants was further training in the theoretical underpinnings and actual implementation of index building. Those involved in the seminars saw this area as particularly interesting, as they considered that some of the indices used for international reporting purposes, such as school resources or parental education, could be adapted to reflect more appropriately the educational context within countries and hence be more relevant in those analyses aimed at explaining differences in student achievement within a particular country.

Furthermore, it became clear that participants would benefit from acquiring the skills necessary to examine the validity of the survey and test questions, within the context of response behavior specific to the Arabic countries. A number of seminar participants questioned the accuracy of responses obtained as a consequence of, for example, teachers giving answers that they considered desirable, either socially or professionally, or response scales that left too little room for differentiating responses at the positive end. Here, further training to enable participants to undertake and interpret, for example, reliability, factor, and item response analyses directed at examining answering behavior, consistency of responses, and the conceptual equivalence of questions across countries would be desirable. Such capacity-building might improve the validity of questionnaires in the Arab region, leading to an increased acceptance of the study process and the seriousness with which respondents answer questions. In addition, participants skilled in such a way would be able to produce empirically based suggestions to improve questionnaires or develop greater confidence in ascertaining the appropriateness of the questions and response options used in TIMSS.

The Tunisian analysis in particular illustrated that, while certain parts of a complex theoretical model can be analyzed using mean comparisons and regression analysis, more sophisticated analytical multivariate and multilevel techniques are required to do justice to the complexity of the proposed model. Such techniques could also address some of the disappointment expressed by some participants regarding the low level of explanatory power of variables in their analyses. While previous experience has shown that such analyses still do not explain all the differences in student performance, the underlying models are a more accurate reflection of the complexities involved in teaching and learning mathematics and science.

Despite these concerns, the format, structure, and content of the capacity-building seminar series documented in this report can be considered a sound and tried framework that could be expanded by providing participants with training on more sophisticated multivariate and multilevel analysis techniques and adapted for use in different regions in the world.

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