Effective Schools in Arab Educational Systems: An Analysis of TIMSS 2003

Oliver Neuschmidt, IEA Data Processing and Research Center, Hamburg/ Germany,

oliver.neuschmidt@iea-dpc.de

Juliane Hencke, IEA Data Processing and Research Center, Hamburg/ Germany,

juliane.hencke@iea-dpc.de

Leslie Rutkowski, IEA Data Processing and Research Center, Hamburg/ Germany,

leslie.rutkowski@iea-dpc.de

David Rutkowski, IEA Data Processing and Research Center, Hamburg/ Germany,

david.rutkowski@iea-dpc.de

Abstract

Like in other regions of the world, in the Arab region researchers are increasingly interested in detecting the key factors that make a school successful in order to raise the performance of low-achieving schools in their educational systems.

The present study used data from the 3rd cycle of the Trends in International Mathematics and Science Study (TIMSS 2003) in order to look at school level factors influencing mathematics achievement in Arabic educational systems participating in TIMSS. Although a common regional pattern emerged and parental support, shortage of school resources and certain kinds of negative student behavior seemed to be associated with mathematics effectiveness in nearly all of the educational systems, the characteristics and importance of the indicated factors was quite different. While in all educational systems questions concerning resources and technology seem to be associated with effectiveness in mathematics, especially in Morocco and the Palestinian National Authority student behavior even played a bigger role.

Keywords: *effective schools, Arabic educational systems, TIMSS 2003*

Introduction

School effectiveness has received considerable attention during the past years. The interest in raising the level of achievement has led the focus towards examining factors associated with high school achievement. At first glance it might seem that effective schools simply can be characterized by a high average student achievement, which is usually measured by the success rates in examinations or in the test results of certain subjects such as mathematics or reading literacy. Regardless of the ruler used to measure student achievement, it remains the fact that achievement varies within and across schools.

There are several reasons given to explain the variation in the average school achievement.

First of all, the student achievement often depends on the student background. It is comprehensible, that higher achievement is expected for those kinds of schools where the major part of students is coming from affluent homes, having parents that care about their children's education and having any economical, political and attitudinal support needed.

Secondly, schools providing more and better school resources, such as space, computer equipment, and libraries are expected to favor high school achievement. Additionally, good structured and competent teachers as well as the overall school management will play an important role.

Seen from this perspective, "A school is effective to the extent that it "adds value" by realizing the potential of the student body through efficient organization and effective instruction." (Martin, Mullis, Gregory, Hoyle, Shen 2000).

In order to analyze these school specific "value added" effects being associated with achievement, studies of school effectiveness need to attempt disentangling the organizational and instructional school practices from the effects of the student's home environment such as the socioeconomic status and the parental support.

One of the earliest operationalizations of this process was described by Dyer (1970). According to Postlethwaite and Ross (1992) "He proposed that a School Effectiveness Index should be constructed as a score based on the difference between the school's actual average achievement and the score that would be predicted from a knowledge of student characteristics and ‚hard to change' conditions surrounding the school."

One of the earliest attempts at the international level in identifying some of the indicators concerning schools and their operation that can be associated with a kind of 'school effectiveness' in the sense described above has been undertaken by Postlethwaite and Ross (1992) in their report about "Effective schools in reading: Implications for educational planners". This report focused on the primary education level (mainly 9-years old) of the Reading Literacy study which was conducted by the International Association of the Evaluation of Educational Achievement (IEA) between 1989 and 1992 among 32 educational systems. This report described major groups of indicators discriminating between more effective and less effective schools in the participating countries (Student activities at home/ School context/ School characteristics/ School resources/ School initiatives/ school management and development/ Teacher characteristics/ Classroom activities/Teacher activities/ Teacher methods).

A different approach was undertaken by Martin, Mullis, Gregory, Hoyle, and Shen (2000) in their effectiveness report. This report focused on the outcomes of the middle school year evaluation of the Third International Mathematics and Science Study (TIMSS) conducted in the years 1994 and 1995 in altogether 34 educational systems. The reports sought to identify

variables from the TIMSS background questionnaire that discriminated well between high-and low-performing schools. Variables being characteristic of high-performing schools but not of low-performers were retained for a second set of analyses aiming to identify attributes of effective schools by making use of hierarchical linear modeling techniques.

The authors found, that besides indicators of socioeconomic status (book ownership, study aids, possessions in the home, parental education, and time spent working in the home), also factors more directly related to the schools were distinguishing between high- and low-achieving schools, but less uniformly between the different participating educational systems. The following factors were listed as important in this context: school size and location, school social climate, student attitude to science and mathematics, as well as instructional activities in science and mathematics.

Mainly based on the two reports mentioned above and restricted to mathematics achievement, the current study tries to identify factors from the school background questionnaire discriminating well between more effective and less effective schools in the Arabic region.

This study resulted from different seminars held in the Arabic region and is meant as a first step in helping policy makers in this region in identifying areas of concern and action. This study seeks to identify school background indicators associated with school effectiveness in terms of mathematics achievement in the Arab region. The following research questions were addressed:

- Which indicators associated with school effectiveness in terms of mathematics achievement discriminate significantly between more effective and less effective schools in the participating Arabic TIMSS 2003 educational systems?

- Are the identified indicators country-specific, or do we find consistent patterns across the region?

To address these questions, a number of methodological research issues arose in this study including: what is the best possible background index that can be created from the data at hand? Also, how to identify those variables discriminating clearly between the most effective and the least effective schools in the sense described above?

Methodology

Data

TIMSS, the Trends in International Mathematics and Science Study, 2003 is the third cycle in a series of studies assessing students' mathematics and science performance. It was conducted on a four-year cycle, the first round of TIMSS was in 1995 and the second in 1999. As the earlier cycles, TIMSS 2003 was carried out by the International Association for the Evaluation of Educational Achievement (IEA).

More specifically TIMSS 2003 assessed trends in the performance of students in the fields of mathematics and science in two grade levels (4th and 8th grade). Additionally to the survey of students' achievement in mathematics and science, the students, their teachers and their school principals, were asked about the learning conditions in mathematics and science in order to establish the effect of the home and school environments on their performance in these areas.

Sampling for TIMSS 2003 was conducted at two levels – school and classroom. For complete details on the sampling design see the "TIMSS 2003 Technical Report Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades" (Martin, Mullis, Chrostowski, 2004).

The current study focused on 8th grade level and mathematics achievement only. Approximately 50 educational systems participated in this target grade. Table 1 lists all Arabic educational systems that participated in TIMSS 2003.

<div align="center">[Take in Table 1 about here]</div>

As for Syria the specified sampling criteria were not fulfilled, Syrian data were discarded from the analysis.

Measures

For our analysis, a home background measure was created basing on selected home background variables for the student (discussed in detail below). Additionally all school background variables were used for exploratory analysis (also discussed later in detail), which sought to associate effectiveness with school attributes.

Methods

To answer our main research question, several steps were taken.

1 – Developing home background measures

A literature review was completed to include Lamb & Fullarton (2002), Dronkers & Róbert (2003), Woessmann (2003), Postlethwaite, Ross (1992), Martin et al. (2000), Kyriakides, Campbell, & Gagatsis (2000), Baker, Goesling and LeTendre (2002), Van den Broeck, Opdenakker, and Van Damme (2005).

Based on the review of this literature, the following variables were identified as possible measures of student background:

- Home possessions: book, calculator, desk, dictionary

- Mother's education

- Father's education

- Father born in country

- Mother born in country

- Sex of student

- Language spoken at home

- Family size

- Single parent family

Of the list of identified variables, the measures family size and single parent family were not applicable, because there were no questions included in the TIMSS 2003 student questionnaire. Furthermore, we examined a high association between mother and father born in country ($t = 0.583$, p<0.001), so we decided to use only one of the two measures. Instead of using mother's and father's education as single measures, we made use of the combined variable containing the highest level of parent's education. This variable was available in all data sets and was developed by the TIMSS & PIRLS International Study Center at Boston College. In addition, we attempted to use language spoken at home as a home background measure; however, Saudi Arabia had 100% of their students answering that they speak the language of the test at home. Additionally, this variable did a poor job of accounting for the variance and was pulled from the final model.

Throughout the process of developing the home background measures we ran several models using different variables looking for the best model based on parsimony and explained variance. However, other student variables did not explain much variance, had too much missing data, and/or were not relevant for the educational systems included.

The final model we decided on included:

- Books at home: coded 1 '0 – 10 books' to 5 'more than 200 books';

- Sex of student: coded 1 'girl', 2 'boy';

- Father born in the country: coded 1 'yes', 2 'no';

- Highest level of parent's education: coded 1 'finish university or equivalent or higher' to 5 'no more than primary schooling';

- Home possessions: book, calculator, desk, dictionary: coded 1 'yes', 2 'no'.

This model accounted most for the home background of the students. Depending on the educational system on average about 13% of the variance on student level could be explained with the model used. The educational system with the lowest variance explained is Morocco (4.2%), the educational system with the highest variance explained is Jordan (18%).

During the selection of the home background indicators a problem with missing data was faced: We found that when including parents' education in the model the missing data rate was nearly 20% in some educational systems. Therefore we opted to use the SAS 9.1 (2003) multiple imputation procedure (PROC MI) to impute missing values for cases in the TIMSS

2003 data set as an alternative to listwise deletion. We cautiously chose to use multiple imputations, particularly given the nature of the TIMSS 2003 data and the pattern of missingness in the data. While multiple imputation procedures assume that data are missing at random (MAR), Collins, Schafer and Kam (2001) demonstrated that incorrectly assuming MAR has only a minor impact on estimates and standard errors. Additionally, the imputation model assumes that data are distributed normally. While this is a safe assumption for the response variables (mathematics achievement), the student background variables were either binary (gender) or at best, ordinal (categories representing number of books in the home). Simulation studies indicate that parameter estimates based on multiply imputed categorical data has better coverage and less bias than estimates resulting from complete case analysis (Allison, 2005). Finally, given the large sample size for each educational system, we were fairly confident that our results would be robust.

The process of multiple imputation required three related steps. First, a pre-specified number of data sets were created, such that each data set represents a different imputed value (plausible value) for each of the missing values. The number of data sets typically ranges in number from three to 10; however, for the current analysis we chose five, which is consistent with the IEA protocol for imputation. The second step included separately and identically analyzing each of the five data sets. Finally, the parameter estimates from the five analyses were combined to arrive at a single set of parameter estimates and standard errors. All three steps were conducted within the SAS environment; however, only the combined parameter estimates are reported.

To impute missing data in the TIMSS 2003 data set, we chose for the imputation model all variables that we wanted to include as predictors and response variables in the multiple regression model. Variables were chosen according to these criteria in part as an attempt to ensure that the imputer's model was the same as the analyst's model. We reasoned that variables used to measure home background should also be included in an imputation model since these variables are related and may increase the possibility of capturing the missing mechanism, thereby reasonably allowing for an MAR assumption.

2 – Identifying effective schools

The multiple regression based on the final model of home background measures provided the OLS regression predictors for each of the effects. This regression was done with weighted data applying the jackknifing replication method to accommodate the complex sampling design of the TIMSS 2003 data. The predictors were used to calculate a predicted student score considering the home background of each student. This predicted student score was compared to the five mathematics achievement scores and the differences between each of the five plausible values and the predicted student score were calculated. The mean of these five differences provided information for each student whether s/he achieved better or worse

results than expected given the specific home background of that student.

The residuals for each student were averaged and ranked by school in each educational system. In a last step the schools in each educational system were divided into three groups according to their rank position, which resulted in a variable indicating whether

- a school reached a better result than expected considering the home background of the students enrolled in this school;

- a school reached a worse result than expected considering the home background of the students enrolled in this school;

- a school reached the result expected considering the home background of the students enrolled in this school;

The first group of schools was called more effective schools; the second group of schools was called less effective schools. The middle group was not of much interest for our further analysis.

3 – Identifying variables associated with school effectiveness

The next step was to identify those school background variables that showed a significant association with school effectiveness. For all categorical background variables we ran the procedure crosstabs in SPSS. We selected variables having a Cramer's Phi greater than 0.10 for further investigation. For those variables we then looked at the adjusted standardized residuals in order to find an appropriate cut point for dichotomization. For example, ordered response options with negative residuals were combined into one group, while the remaining response options were similarly combined into another group. For the actual dichotomization, a value of 100 was assigned to those groups of response options with the clearest residual pattern, such as a positive school condition or school recourse or some combination of these features. At the same time we ran correlations for non-categorical variables.

This step was done for each educational system independently as we assumed that the set of variables being significantly associated with school achievement could be quite different between the eight Arabic educational systems.

4 – T-Tests

After the dichotomization of the highly associated variables, we calculated the percent of students attending each of the two school groups. Thereby the percentages were calculated using weighted data and applying the jackknife procedures as required by the complex sampling design. Finally, we ran t-tests in order to see whether the percentages are significantly different between effective and less effective schools.

[Take in Table 2 about here]

Finding and Discussion

Achievement differences between less effective and more effective third of schools

It is expected that indicators associated with school effectiveness in our sense are likely to discriminate between more and less effective schools best in those educational systems where the overall gap between the both groups of schools is the biggest. Therefore we would expect more variables showing significant proportion differences in our subsequent analysis.

Table 3 presents the average educational system achievement in mathematics, the mean achievement for the less effective third and the more effective third, and the difference between both groups. It can be seen clearly that the group differences vary a lot between the Arab educational systems ranging from 53 points in Bahrain and Morocco up to 103 score points in Egypt.

Although it might be expected that group differences are generally lower in educational systems showing a low overall achievement, this pattern does not hold for most of the educational systems displayed. We expect that homogeneity between schools will be a more important factor. In addition, we expect a higher group difference for those educational systems where the student composition between schools is quite different (for example where large differences between rural and urban conditions exist).

[Take in Table 3 about here]

Characteristics of less effective and more effective schools across educational systems

After screening the variables for association, performing the dichomization process and testing the proportion differences for significances (please refer to the methods section for more details), we were able to group the variables found to be associated with effectiveness into sensible categories to facilitate interpretation.

The resulting groups were constructed according to the structure of the school background questionnaire; however, the last category (Resources and Technology) was divided into two components and analyzed separately. A few indices calculated from the questionnaire variables were categorized according to the origin of their source variable(s).

- *School Characteristics*: This category contains questions one to seven of the school questionnaire. These variables describe the school and its environment in general, such as the school enrollment and location, affluence, and the native language of students.

- *Role as principal*: This category contains questions eight and nine of the school questionnaire, asking about the principals' experience and the percentage of time spent on different activities

- *Parental involvement*: This category consists of question 10 of the school questionnaire, which evaluates the principals' expectation of parental involvement.

- *Mathematics and science instruction*: Included here are questions 11 to 17 of the school questionnaire, which indicate allotted instructional time for mathematics and science and the organization of the mathematics and science instruction (grouping of students, enrichment and remedial courses, etc.)

- *Teacher characteristics and teaching practices*: The variables stem from questions 18 through 21 of the school questionnaire and provide information about filling teacher vacancies, teachers' professional development, and evaluation of teacher practices.

- *Student behavior*: These 13 variables from question 22 of the school questionnaire provide information about behavioral problems occurring among students in terms of how often the behavior occurs and how severe the problems are.

- *Resources*: Options of question 23 of the school questionnaire indicate the degree to which the school's capacity to provide instruction is affected by a shortage or inadequacy of material, school buildings, and computers, etc.

- *Technology*: Consisting of question 25 and 26 of the school questionnaire, this category informs about number of computers, Internet access, and assistance to teachers for the use of information and communication technology.

Figure 1 gives an overview of the number and category of school background variables that significantly discriminate between more effective and less effective schools. From altogether 117 variables and indices in the eight different categories, 84 different variables discriminated in at least one of the educational systems. It can be seen that the overall number of items discriminating clearly between less effective and more effective schools varies a good deal among the Arabic educational systems.

[Take in Figure 1 about here]

For instance, in Bahrain 39 school variables show significant differences; however, only five variables show significant differences in Saudi Arabia. The major reason for the high number of variables with discriminating power in Bahrain is assumed to be the fact that Bahrain is a small educational system where all schools were included in the TIMSS test. As such, the standard errors are quite small due to large sample size and even small differences in group percentages are significant.

School characteristics

Variables of the category 'School characteristics' discriminate clearly between more and less effective schools in all educational systems except Morocco. From the 19 discriminating variables in this section, 13 variables discriminated between more and less effective schools in Lebanon and 12 in Bahrain.

A particularly powerful variable, economic status of the students, was significant in all educational systems except the Palestinian National Authority and Morocco. In these educational systems, more effective schools tend to have lower percentages of students coming from economically disadvantaged homes (significances in five educational systems) and/or with a higher percentage of students coming from economically affluent homes (significances in four educational systems).

Additionally, in half of the educational systems (Bahrain, Egypt, Lebanon, and Tunisia) effective schools tend to have higher parental support for student achievement.

Role as principal
In Bahrain only one variable (question 9c: Percent spent on supervising and evaluating teachers and other staff) discriminated between the less and more effective group of schools. Here, more effective schools spent about 10% less time in supervising and evaluating teachers and other staff (35% versus 25%).

Parental involvement
Parental involvement in general seems to be important in a majority of educational systems (Bahrain, Egypt, Jordan, Lebanon, and Tunisia) with three out five possible variables in this group being significant in Tunisia.

In five educational systems, parents attended special events, such as science fairs, concerts, or sporting events more often in effective schools. Except in Jordan, this variable shows the same pattern as the 'parental support' question from the school characteristics section. Both variables indicate a positive home context with engaged parents showing interest in school and trying to help their children learn.

Mathematics and science instruction
Variables of the category math and science instruction distinguish significantly in five educational systems (Bahrain, Jordan, Lebanon, Palestinian National Authority, and Tunisia). From ten variables in this category, five were significant discriminators in at least one of the participating educational systems, four of them in Lebanon.

In half of the educational systems of the Arab region (Bahrain, Jordan, Lebanon, and Tunisia), total instructional time differentiated between less effective and more effective schools. In those educational systems, the more effective schools spent more time on instruction compared to the less effective group of schools.

Teacher characteristics and teaching practices

This category consisted of 24 background variables and indices. Overall, 14 variables showed significant differences in at least one of the participating educational systems. Variables of the 'Teacher characteristics' category played a role in all educational systems except Saudi Arabia. In Lebanon alone, six teacher variables discriminated between more effective and less effective schools, followed by five variables in Bahrain.

It is notable that the pattern of variables discriminating between less effective and more effective schools varies among participating educational systems and most variables are only significant in one or two educational systems. In three educational systems (Bahrain, Morocco, and Tunisia) more effective schools tend to invest more in the 'professional development supporting implementation of national or regional curriculum'.

Student behavior
Of the 27 possible variables, 22 showed significant discrimination in the Arabic educational systems. In Bahrain, eight behavioral variables discriminated between more effective and less effective schools, followed by seven variables in the Palestinian National Authority and Tunisia.

Looking at the content of single variables, we only found a quite heterogeneous pattern between educational systems with the "frequency of profanity being a problem behavior" tending to be a bigger problem in less effective schools in half of the educational systems (Bahrain, Morocco, Palestinian National Authority, Tunisia) followed by "skipping class" and "intimidation of students" in three of the educational systems each.

Resources
Of the 21 possible variables in this category, 16 variables significantly discriminated at least one educational system. Resource problems in general seem to be an issue in all the participating educational systems. However, resource types vary across educational systems. In Bahrain, seven resource-specific variables discriminated between more and less effective, followed by five variables in Egypt and Tunisia.

Interestingly, a shortage in science laboratory equipment was significant in five of the educational systems (Bahrain, Lebanon, Morocco, Saudi Arabia, and Tunisia), followed by budget for supplies and instructional space in three educational systems each.

Technology
All four technology variables show significant differences in at least one of the educational systems. In Lebanon, all four variables were significant. Technology issues discriminate between effective schools in five educational systems (Bahrain, Jordan, Lebanon, and Palestinian National Authority, Saudi Arabia).

Most important seems to be access to the Internet, where more effective schools reported a higher rate of computers with Internet access in four educational systems (Bahrain, Jordan,

Lebanon, and Palestinian National Authority).

Characteristics of less effective and more effective schools within each educational system

In this section of the paper we summarize the key factors that discriminate significantly between less and more effective educational systems for each of the eight Arabic educational systems individually. Figures 2 to 14 illustrate the individual educational system results. Here we provide a general discussion.

[Take in Figures 2 – 15 about here]

Bahrain

Bahrain is the educational system where the most variables (39) showed significant differences between less and more effective schools compared to the other Arabic educational systems. Of the variables discriminating significantly between less and more effective schools, variables of category "School characteristics" appear most often. Furthermore, Bahrain has the most variables of category "Student behavior" (8) and "Resources" (7) in comparison to the other seven educational systems. The three largest differences can be found for parental support for student achievement, percentage of students coming from disadvantaged homes and for the shortage of buildings and grounds.

Interestingly, Bahrain is the only educational system where the role of the principal seems to play a role when comparing less and more effective schools. Furthermore, the frequency of professional development seems to differ between less and more affective schools: principals of less effective schools report that teachers are sent more often to professional developments concerning school improvement and curriculum implementation.

Additionally, more effective schools seem to be more open for instruction, their principals spend less time in supervising and evaluating the teachers, and they are smaller in terms of student enrollment compared to less effective schools.

Egypt

In Egypt, variables of the category "Resources" discriminate most often between less and more effective schools. Less effective schools are more often affected by a shortage of resources than more effective schools on a total of 5 items. The biggest differences between both groups of schools can be found in the percentage of students coming from economically affluent homes, the parental support for student achievement, the shortage of teachers, and the index of good school and classroom attendance. Also, behavioral issues play a role when comparing less and more effective schools. Especially skipping classes or arriving late at school discriminate between both groups of school. In contrast to Bahrain, principals of more effective schools reported that their teachers receive more often professional development for improving their teaching skills, and the use of computer technologies.

Jordan

Variables of the category "School characteristics" and "Resources" discriminate most often in Jordan. However, the three variables with the biggest proportion differences between less and more effective schools are behavioral issues of students, such as skipping classes and intimidating or verbally abusing other students. Besides this, less effective schools are more often affected by shortages of recourses such as shortage of budget for supplies, teachers, instructional materials, heating, cooling, lighting systems. Additionally, parental involvement plays a bigger role at more effective schools, such as schools expecting parents to attend special events and to ensure the completion of homework, as well as parents' involvement in school activities. Variables such as the percentage of students coming from economically affluent homes as well as the number of computers in the school having internet access and the amount of instructional time per day as well as the school's location show significantly different proportions between less and more effective schools. All these variables can be summarized under category "School resources".

Lebanon

Lebanon is the educational system with the second highest number of discriminating variables (34) after Bahrain. Variables of the category "School characteristics" appear most often among those that discriminate between less and more effective schools. With 13 variables in this category, Lebanon has the most variables of this category compared to the other Arabic educational systems. However, also the number of variables in categories "Teacher characteristics and teaching practices" (6), "Mathematics and Science Instruction" (4) and "Technology" (4) is the highest in Lebanon.

The three biggest proportion differences in Lebanon include whether schools have higher grades (years) available or not, how many computers have internet access and whether principals thinks that students should do well in school.

Interestingly two variables, which usually do not discriminate between the two school groups in other educational systems, seem to play a role in Lebanon. This is that the observation by external persons to evaluate mathematics teachers and the observation by principal/ senior staff to evaluate mathematics teachers happens more often in less than more effective schools.

However, similarly to other educational systems the number of instructional weeks per school year is slightly higher in more effective schools. The same is true for the number of school days per year. Furthermore the number of computers available for educational purposes is higher in Lebanon's more effective schools.

In contrast to the findings in Bahrain, the number of students enrolled in 8th grade as well as in all grades is higher in more effective than in less effective schools. It also should be noted that it was more often reported in less effective schools that students violate the dress code never or rarely in comparison to more effective schools. Furthermore principals of less effective

schools reported more often that students are grouped according to their ability in mathematics and science instructions compared to their more effective counterparts.

Morocco

Morocco has the second fewest number of discriminating variables (8) after Saudi Arabia. Of the variables discriminating between less and more effective schools, variables of category "Student behavior" appear most often (4 out of 8 discriminating variables).

How often principals reported teachers receive professional development in curriculum implementation, student behavioral issues such as intimidating and verbally abusing other students, committing profanity, or disturbing in classrooms are the variables discriminating the most between less and more effective schools in Morocco.

It should be noticed, that also in Morocco there are shortage questions working in an unexpected direction: The percentage of students having principals suffering from a shortage of audio-visual resources for science, budget for supplies and science laboratory materials is higher in the more effective group of schools.

Palestinian National Authority

Seven out of 13 variables discriminating between less and more effective schools in the Palestinian National Authority belong to category "Student behavior". In agreement with this, the three variables with the biggest proportion differences are all related to student behavioral issues: classroom disturbance, students' absenteeism and arriving late at school. In addition, three more student behavioral issues play a role.

It is interesting to note that principals in more effective schools reported more often that teachers are more satisfied with their job. Additionally they also reported more often that teachers receive more professional development to improve their content knowledge compared to their counterparts in less effective schools.

Again we found an unexpected result in terms of being affected by a shortage of something: less effective schools reported more often that they are not affected by a shortage of computers for mathematics instructions compared to their more effective counterparts.

Saudi Arabia

Saudi Arabia has the fewest number of discriminating variables (5). Most of these variables belong to categories "School characteristics" and "Resources". Shortage of instructional space, percentage of students coming from economically disadvantaged homes and students regard for school property are the three variables differentiating the most between less and more effective schools.

Also more effective schools have more computers available for educational purposes than less effective schools.

Tunisia

Most variables of the ones discriminating significantly between less and more effective schools can be summarized in category "Student behavior". In general the variables discriminating between less and more effective schools in Tunisia vary a lot in their content.

There is a higher percentage of more effective schools that reported that they have below 26% of students from economically disadvantages homes, that they have no or a minor problem with students committing vandalism, and where schools expect that parents attend special events at school. These are the three variables with the biggest proportion differences between both groups of schools.

Moreover many variables concern student behavioral issues and recourses, but also school characteristics, such as characterization of students desire to do well in school, teachers expectations for student achievement, and parental support for student achievement.

Conclusion and Implications

This paper was an attempt to identify key factors that can be used to increase the level of success in less effective schools in respect to their student mathematics achievement. The focus was set on eight Arabic educational systems, as it resulted from a number of seminars held in the Arabic region, where answering this questions was of major importance for participants and policy makers in their educational systems.

More specifically, we looked at school background indicators that are associated with school effectiveness in terms of mathematics achievement in the Arab region and whether the identified factors were educational system-specific or whether consistent patterns across the region were identified.

We used multiple regressions as one approach to identify groups of less and more effective schools in each educational system. Cramer's V was used to scan the school background questionnaire for variables being associated with school effectiveness. Variables showing significant associations were dichotomized according to their adjusted standardized residuals and the percentages for less and more effective schools were calculated and tested for significance. In conjunction with this approach we applied a combination of the methods used in earlier studies (Martin et. all, 2000 and Postlethwaite and Ross, 1992).

According to the results, the variables identified as discriminating between less and more effective schools were grouped into eight categories according to the structure of the school background questionnaires. The categories identified were: school characteristics, role as principal, parental involvement, mathematics and science instruction, teacher characteristics and teaching practices, student behavior, resource, and technology. In all eight categories variables were identified that discriminated between less and more effective schools.

In general there was no clear pattern that could be identified on a regional or sub-regional level. In some educational systems many variables (25 to 39 variables) discriminated between both groups of schools, such as Bahrain, Lebanon, and Tunisia, whereas in other educational systems such as Saudi Arabia or Morocco (5 to 8 variables) only a small number of factors could be identified. Also the magnitude of the differences in the proportions varied a lot from educational system to educational system. However, concerning the content of the variables identified certain similarities could be found between the educational systems. For example socio-economic factors such as parental support and the percentage of students coming from economically disadvantaged or affluent homes played a major role in most of the Arabic educational systems. Similarly factors concerning school recourses and technology seem to be associated with effectiveness in mathematics in all educational systems. For example, principals of students attending less effective schools tended more often to report that their school is suffering from a shortage of schools recourses and certain kinds of negative student behaviors in nearly all educational systems. However, the characteristics and importance of the identified factors differed between the educational systems examined. According to this, especially in Morocco and the Palestinian National Authority student behavior played an even bigger role compared to the other Arabic educational systems.

Areas for further research

The approach used in this paper represents a first step in our analysis. Plans for further analysis include accounting for the hierarchical structure of the data and applying multilevel models in order to identify factors on school level explaining the variance between the schools within a educational system after controlling the home background using the variables identified in this paper. Further, we plan to include teacher level variables in later analyses to gain an understanding of effective teachers.

Limitations

A common limitation when using large scale assessment data such as TIMSS is the observational, cross-sectional nature of the data. As such, we are unable to make causal inferences about factors associated with effectiveness. Second, as noted above, this is a limited and exploratory analysis of a robust data set. Further, given our approach of regional selection of variables associated with effectiveness, it may be that other, country specific variables may have been inadvertently eliminated before tests of significance were performed. However, given the vast numbers of possible variables for each educational system, we reasoned that this was an effective, yet economic approach to variable reduction.

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Table 1: Overview of Arabic educational systems

Educational systems (including acronyms)	
Bahrain (BHR)	Palestinian National Authority (PSE)
Egypt (EGY)	Saudi Arabia (SAU)
Jordan (JOR)	Syria (SYR)
Lebanon (LBN)	Tunisia (TUN)
Morocco (MAR)	

Table 2: Overview of steps and methods

Step	Task	Method	Description
Develop home background measures	Identify Home Background Indicators	Multiple regressions (OLS) using weighted data and jackknifing procedure	Comparing variance explained by the model ran
Identify effective schools	Calculate OLS predictors	Multiple regressions (OLS) using weighted data and jackknifing procedure	
	Define effective school indicator	- Calculate average difference between predicted student score accounting for home background and actual student scores; - Calculate average of residuals within each school with one educational system; - Rank average residuals and divide into three group	
Identify variables associated with school effectiveness	Identify variables with association	SPSS Crosstabs – Cramer's V	Identify variables with high association according to Cramer's V > .10
	Dichotomize significant variables	Adjusted standardized residuals	Identify cut off points for dichotomization and recode variables to 0 and 100
	Calculate percentages for effective and less effective schools	Percentages using weighted data and jackknife procedure	

Step	Task	Method	Description
T-Tests	Checking for significant differences	T-Test	

Table 3: Overview mathematics achievement differences between less effective and more effective schools in Arabic educational systems

Countries	Average mathematics achievement		Average mathematics achievement less effective schools		Average mathematics achievement more effective schools		Difference between less and more effective schools	
Bahrain	401	(1.7)	379	(3.6)	431	(2.4)	53	(4.4)
Egypt	406	(3.5)	355	(4.2)	458	(3.6)	103	(4.9)
Jordan	424	(4.1)	381	(4.7)	471	(5.7)	90	(7.5)
Lebanon	433	(3.1)	385	(3.3)	485	(3.7)	100	(4.9)
1 ‡ Morocco	387	(2.5)	361	(2.7)	414	(3.2)	53	(4.4)
Palestine	390	(3.1)	350	(3.8)	434	(4.2)	84	(5.6)
Saudi Arabia	332	(4.6)	294	(6.3)	369	(4.5)	74	(7.4)
Tunisia	410	(2.2)	385	(2.0)	440	(3.5)	55	(4.0)
Arabic Average	398	(1.1)	361	(1.4)	438	(1.4)	76	(2.0)

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

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

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

Figure 1: Number of questions in each category discriminating between less and more effective schools in Arabic educational systems

Figure 2: Bahrain: Proportions in less and more effective schools (cont.)

Question Number	Description	Description of less vs. more effective category	Bahrain		Difference (Absolute Value)	Difference	
			Less effective schools	More effective schools		Less effective	More effective
(1) SCQ2-07E	Parental support to student achievement:	very low; low vs. very high; high; medium	42 (0.3)	100 (0.0)	58 (0.3)		■■■■■■
(1) SCQ2-06AA	Percentage of students from an economic disadvantaged background:	> 50% vs. ≤ 50%	43 (0.3)	91 (0.1)	48 (0.3)		■■■■■
(7) SCQ2-23C	Affected by shortage of buildings and grounds:	a lot; some vs. none; a little	14 (0.3)	61 (0.2)	47 (0.3)		■■■■■
(6) SCQ2-22BL	Severity of students verbally abusing teachers:	serious; minor problem vs. no problem	37 (0.4)	81 (0.1)	44 (0.4)		■■■■
(6) SCQ2-22BK	Severity of students injuring other students:	serious; minor problem vs. no problem	38 (0.4)	81 (0.2)	43 (0.4)		■■■■
(7) SCQ2-23Q	Affected by shortage of audio-visual resources for science:	a lot; some; a little vs. none	5 (0.2)	41 (0.3)	36 (0.4)		■■■
(6) SCQ2-22AA	Frequency of students arriving late to school:	never; monthly; weekly; daily vs. rarely	10 (0.1)	44 (0.3)	34 (0.3)		■■■
(5) SCQ2-19B	Usage of incentives to recruit science teachers:	yes vs. no	9 (0.3)	43 (0.3)	34 (0.4)		■■■
(5) SCQ2-19A	Usage of incentives to recruit mathematics teachers:	yes vs. no	9 (0.3)	43 (0.3)	34 (0.4)		■■■
(1) SCQ2-06AB	Percentage of students from an economic affluent background:	≤ 10% vs. > 10%	25 (0.3)	55 (0.3)	31 (0.4)		■■■
(4) SCQ2-11C	Instruction time in a full day:	≤ 5 hours vs. > 5 hours	55 (0.3)	83 (0.1)	28 (0.3)		■■
(7) SCQ2-23N	Affected by shortage of software for science:	a lot; some; a little vs. none	17 (0.3)	41 (0.3)	24 (0.4)		■■
(1) SCQ2-07F	Parental involvement in school activities:	very low; low; medium; very high vs. high	0 (0.0)	24 (0.1)	24 (0.1)		■■
(8) SCQ2-24B	Number of computers with access to internet in 8th grade:	none; some vs. all; most	4 (0.1)	27 (0.3)	23 (0.3)		■■
(7) DERIVED	Index of availability of school resources for mathematics instruction:	low; medium vs. high	5 (0.2)	28 (0.3)	23 (0.4)		■■
(1) SCQ2-04	Students absent from school:	≥ 5% vs. < 5%	76 (0.2)	98 (0.3)	23 (0.4)		■■
(7) DERIVED	Index of availability of school resources for science instruction:	low; medium vs. high	9 (0.3)	31 (0.3)	23 (0.4)		■■

60 40 20 0 20 40 60

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

*   For creation of indices refer to TIMSS 2003 Supplement 3

**   Full-time teacher; library media specialist; teacher with informal leadership; principal, another school administrator

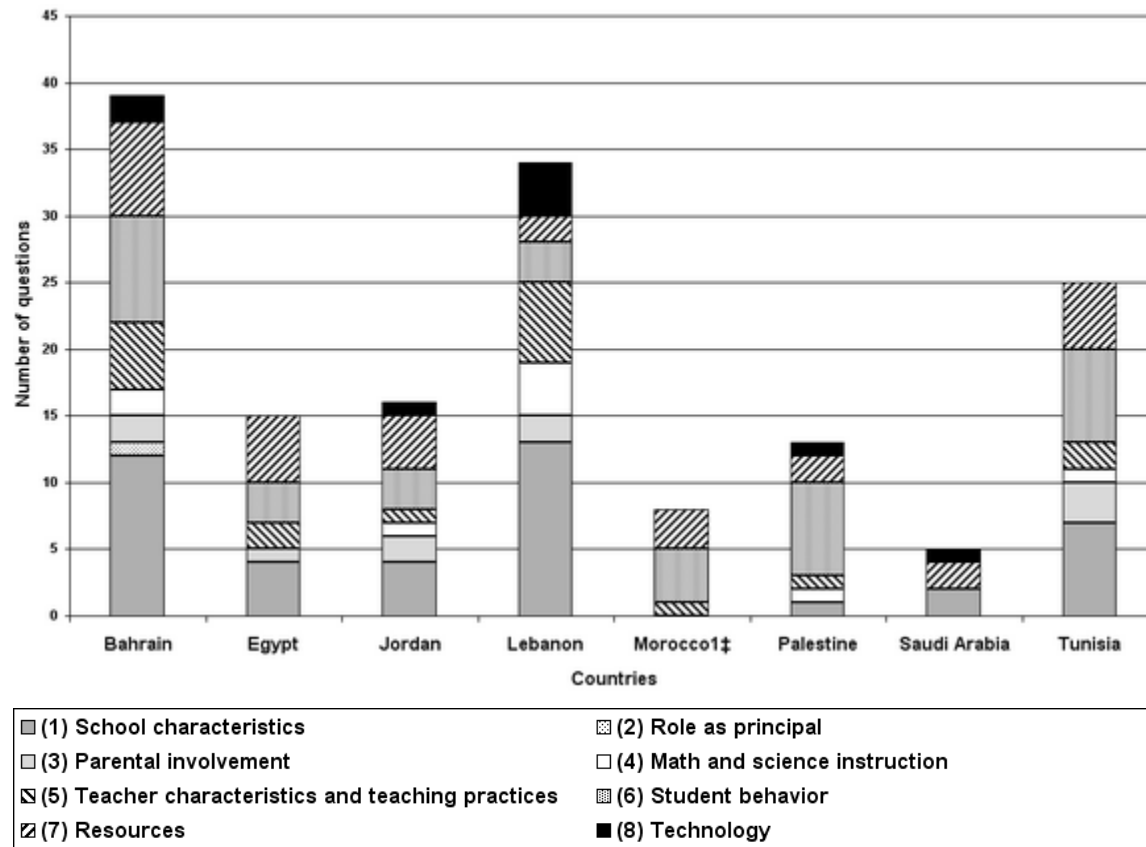■ Difference statistically significant   □ Difference not statistically significant

Figure 3: Bahrain: Proportions in less and more effective schools

Question Number	Description	Description of less vs. more effective category	Bahrain Less effective schools	Bahrain More effective schools	Difference (Absolute Value)	Difference
(6) SCQ2-22AK	Frequency of students injuring other students:	rarely; monthly; weekly; daily vs. never	43 (0.3)	65 (0.3)	21 (0.4)	More effective
(1) SCQ2-01A	Lowest grade level in school:	kindergarten to 7; 10 to 13 vs. 8; 9	30 (0.4)	49 (0.3)	19 (0.4)	More effective
(1) SCQ2-03	Number of people in city or school area:	> 500 000; 3 001 to 100 000 vs. 100 001 to 500 000; < 3 000	2 (0.0)	20 (0.3)	18 (0.3)	More effective
(1) SCQ2-07G	Students' regard for school property:	very low; low vs. very high; high; medium	83 (0.3)	100 (0.0)	17 (0.3)	More effective
(6) SCQ2-22AH	Frequency of students committing vandalism:	monthly; weekly; daily vs. never; rarely	79 (0.2)	95 (0.2)	17 (0.3)	More effective
(6) SCQ2-22AC	Frequency of students skipping classes:	monthly; weekly; daily vs. never; rarely	79 (0.2)	95 (0.2)	16 (0.3)	More effective
(7) SCQ2-23L	Affected by shortage of science laboratory materials:	a lot; some; a little vs. none	16 (0.3)	29 (0.2)	13 (0.3)	More effective
(3) SCQ2-10A	School expects parents to attend special events:	no vs. yes	87 (0.2)	94 (0.1)	7 (0.2)	More effective
(6) SCQ2-22AG	Frequency of students committing profanity:	monthly; weekly; daily vs. never; rarely	82 (0.3)	84 (0.2)	3 (0.3)	More effective
(3) SCQ2-10E	School expects parents to serve on school committees:	no vs. yes	23 (0.2)	19 (0.3)	4 (0.4)	Less effective
(5) SCQ2-18C	Difficulty to fill vacancies for computer sciences:	very difficult; somewhat difficult vs. no vacancies; easy to fill	88 (0.3)	78 (0.3)	10 (0.4)	Less effective
(6) SCQ2-22AI	Frequency of students committing theft:	rarely; monthly; weekly; daily vs. never	26 (0.3)	12 (0.3)	14 (0.4)	Less effective
(8) SCQ2-25B	Description of person who helps teachers use information technologies:	certain person descriptions** vs. principal, another school administrator; other	19 (0.3)	3 (0.0)	16 (0.3)	Less effective
(1) SCQ2-05A	Students still enrolled after one year:	< 89% vs. ≥ 90%	100 (0.0)	84 (0.1)	16 (0.1)	Less effective
(1) SCQ2-07C	Characterization of teachers success of implementing the curriculum:	very low; low; medium; high vs. very high	20 (0.2)	2 (0.1)	18 (0.3)	Less effective
(7) SCQ2-23J	Affected by shortage of math library materials:	a lot; some vs. none; a little	85 (0.1)	63 (0.3)	23 (0.3)	Less effective
(5) SCQ2-20B	Teachers in professional development in school improvement:	never; 1 to 5 times vs. 6 to more than 10 times	43 (0.3)	16 (0.2)	27 (0.3)	Less effective
(5) SCQ2-20A	Teachers in professional development in curriculum implementation:	never; 1 to 2 times vs. 3 to more than 10 times	85 (0.1)	45 (0.3)	40 (0.3)	Less effective

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
*   For creation of indices refer to TIMSS 2003 Supplement 3
**   Full-time teacher; library media specialist; teacher with informal leadership; principal, another school administrator

60 40 20 0 20 40 60
■ Difference statistically significant   □ Difference not statistically significant

Figure 4: Bahrain: Proportions in less and more effective schools: Continuous variables

Question Number	Description		Bahrain				Difference (Absolute Value)	
			Less effective schools		More effective schools			
(4) Derived	Number of hours of school per year:	in hours	842	(0.6)	942	(0.3)	99	(0.7)
(2) SCQ2-09C	Time spend by principal on supervising and evaluating teachers:	in %	35	(0.1)	25	(0.1)	10	(0.1)
(1) SCQ2-02B	Total school enrolment in 8th grade:	in number of students	244	(0.6)	168	(0.6)	75	(0.8)
(1) SCQ2-02A	Total school enrolment in all grades:	in number of students	822	(0.9)	654	(1.1)	168	(1.4)
( )	Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.							
*	For creation of indices refer to TIMSS 2003 Supplement 3							

Figure 5: Egypt: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Egypt Less effective schools	Egypt More effective schools	Difference (Absolute Value)	Difference Less effective	Difference More effective
(1) SCQ2-06AB	Percentage of students from an economic affluent background:	< 26% vs. ≥ 26%	6 (3.8)	36 (6.5)	30 (8.4)		████
(1) SCQ2-07E	Parental support to student achievement:	very low; low vs. very high; high; medium	54 (7.0)	84 (5.4)	29 (9.7)		████
(7) SCQ2-23R	Affected by shortage of teachers:	a lot; some; a little vs. none	32 (7.1)	59 (6.3)	27 (8.6)		███
(6) DERIVED	Index of good school and class attendance:	high; low vs. medium	27 (6.2)	54 (6.8)	27 (8.7)		███
(5) SCQ2-20D	Teachers professional development in improving teaching skills:	never; 1 to 10 times vs. > 10 times	35 (6.9)	62 (6.3)	26 (9.5)		███
(6) SCQ2-22BA	Severity of students late to school:	no problem; serious problem vs. minor problem	18 (5.2)	44 (6.7)	26 (8.3)		███
(7) SCQ2-23E	Affected by shortage of instructional space:	a lot; some vs. none; a little	43 (8.0)	68 (6.1)	25 (9.8)		███
(7) SCQ2-23C	Affected by shortage of buildings and grounds:	a lot; some; a little vs. none	33 (7.1)	55 (6.5)	22 (9.3)		██
(7) SCQ2-23S	Affected by shortage of computer support staff:	a lot; some; a little vs. none	27 (6.0)	49 (6.1)	22 (8.0)		██
(7) SCQ2-23F	Affected by shortage of special equipment for handicapped students:	a lot; some; a little vs. none	59 (6.7)	79 (5.8)	20 (8.2)		██
(6) SCQ2-22AC	Frequency of students skipping classes:	daily; weekly; monthly; rarely vs. never	33 (7.1)	53 (6.2)	20 (9.7)		██
(5) SCQ2-20E	Teachers professional development in use of communication technologies:	never; 1 to 2 times; 6 to 10 times vs. 3 to 5 times; > 10 times	59 (7.7)	78 (5.5)	20 (9.9)		██
(1) SCQ2-06AA	Percentage of students from an economic disadvantaged background:	> 10% vs. ≤ 10%	7 (3.9)	26 (6.0)	18 (6.9)		██
(3) SCQ2-10A	School expects parents to attend special events:	no vs. yes	71 (6.2)	87 (5.0)	15 (7.7)		█
(1) SCQ2-01B	Highest grade level in school:	kindergarten to 11 vs. 12; 13	0 (0.0)	11 (5.2)	11 (5.2)		█

40 20 0 20 40

( )   Standard errors appear in parentheses.
Because results are rounded to the nearest whole number, some totals may appear inconsistent.
*   For creation of indices refer to TIMSS 2003 Supplement 3

■ Difference statistically significant   □ Difference not statistically significant

Figure 6: Jordan: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Jordan		Difference (Absolute Value)	Difference	
			Less effective schools	More effective schools		Less effective	More effective
(6) SCQ2-22AC	Frequency of students skipping classes:	daily; weekly; monthly; rarely vs. never	21 (6.1)	69 (6.6)	48 (9.5)		
(6) SCQ2-22BC	Severity of students skipping classes:	serious; minor problem vs. no problem	37 (7.3)	73 (6.9)	36 (10.4)		
(6) SCQ2-22AL	Frequency of students intimidating or verbally abusing teachers:	daily; weekly; monthly; rarely vs. never	53 (7.4)	89 (5.4)	35 (9.5)		
(7) SCQ2-23B	Affected by shortage of budget for supplies:	a lot; some; a little vs. none	27 (6.9)	59 (7.7)	33 (9.8)		
(1) SCQ2-03	Number of people in city or school area:	50 001 to 500 000 people; ≤ 15 000 people vs. > 500 000; 15 001 to 50 000 people	23 (6.2)	55 (7.9)	32 (9.9)		
(1) SCQ2-07H	Characterization of students desire to do well in school:	very low; low; medium vs. very high; high	46 (7.7)	78 (6.5)	32 (9.8)		
(1) SCQ2-06AB	Percentage of students from an economic affluent background:	< 11% vs. ≥ 11%	11 (4.4)	40 (8.5)	29 (9.7)		
(4) SCQ2-11C	Instruction time in a full day:	≤ 5 hours vs. > 5 hours	16 (5.8)	45 (8.2)	29 (10.0)		
(3) SCQ2-10D	School expects parents to ensure students complete homework:	no vs. yes	62 (7.6)	91 (4.3)	29 (8.6)		
(5) SCQ2-17A	School offers enrichment science:	no vs. yes	48 (7.6)	73 (6.1)	26 (9.3)		
(1) SCQ2-07F	Parental involvement in school activities:	very low; low; medium vs. very high; high	9 (4.2)	33 (7.4)	24 (8.8)		
(7) SCQ2-23R	Affected by shortage of teachers:	a lot; some; a little vs. none	11 (4.5)	35 (8.3)	24 (9.8)		
(7) SCQ2-23A	Affected by shortage of instructional materials:	a lot vs. none; a little; some	53 (8.2)	76 (6.7)	23 (10.9)		
(8) SCQ2-24B	Number of computers with access to internet in 8th grade:	none vs. all; most; some	10 (4.8)	32 (8.6)	22 (10.2)		
(7) SCQ2-23D	Affected by shortage of heating, cooling, lighting systems:	a lot; some; a little vs. none	12 (5.3)	33 (7.8)	21 (9.4)		
(3) SCQ2-10A	School expects parents to attend special events:	no vs. yes	84 (5.9)	99 (1.5)	15 (6.1)		

60 40 20 0 20 40 60

■ Difference statistically significant   ☐ Difference not statistically significant

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

Figure 7: Lebanon: Proportions in less and more effective schools (cont.)

Question Number	Description	Description of more effective category	Lebanon Less effective schools	Lebanon More effective schools	Difference (Absolute Value)	Difference Less effective / More effective
(1) SCQ2-01B	Highest grade level in school:	kindergarten to 9 vs. 10 to 13	11 (4.2)	75 (6.8)	64 (8.0)	███
(8) SCQ2-24B	Number of computers with access to internet in 8th grade:	none vs. all; most; some	9 (4.6)	72 (7.0)	64 (8.6)	███
(1) SCQ2-07H	Characterization of students desire to do well in school:	very low; low; medium vs. very high; high	27 (7.1)	78 (6.1)	52 (8.9)	██
(4) SCQ2-11C	Instruction time in a full day:	< 6 hours vs. ≥ 6 hours	22 (12.3)	68 (10.4)	46 (16.0)	██
(1) SCQ2-07C	Characterization of teachers success of implementing the curriculum:	very low; low; medium vs. very high; high	48 (7.8)	93 (3.6)	44 (8.2)	██
(1) SCQ2-07F	Parental involvement in school activities:	very low; low vs. very high; high; medium	36 (7.6)	79 (5.4)	43 (9.5)	██
(1) SCQ2-07D	Characterization of teachers expectations for student achievement:	very low; low; medium vs. very high; high	19 (6.0)	62 (6.9)	43 (9.6)	██
(8) SCQ2-25A	Help for teachers to use information technologies for teaching:	no vs. yes	43 (8.6)	85 (5.7)	42 (10.6)	██
(3) SCQ2-10D	School expects parents to ensure students complete homework:	no vs. yes	56 (7.9)	96 (2.6)	40 (8.7)	██
(8) SCQ2-25B	Description of person who helps teachers use information technologies:	certain person descriptions** vs. teacher with coordinator title; district-level coordinator; other person	36 (16.9)	76 (7.7)	40 (18.5)	██
(3) SCQ2-10A	School expects parents to attend special events:	no vs. yes	54 (8.1)	89 (4.7)	35 (9.3)	██
(1) SCQ2-07G	Students' regard for school property:	very low; low; medium vs. very high; high	28 (7.4)	63 (5.9)	35 (9.8)	██
(1) SCQ2-06AA	Percentage of students from an economic disadvantaged background:	< 11%; > 50% vs. 11% - 50%	13 (5.2)	45 (6.6)	32 (8.1)	██
(1) SCQ2-07B	Characterization of teachers understanding of school curricular goals:	very low; low; medium vs. very high; high	57 (8.2)	89 (3.5)	32 (8.9)	██
(6) SCQ2-22BA	Severity of students late to school:	serious; minor problem vs. no problem	46 (9.4)	78 (6.0)	32 (11.2)	██
(1) SCQ2-07E	Parental support to student achievement:	very low; low vs. very high; high; medium	49 (8.2)	78 (6.3)	30 (10.4)	██
(1) SCQ2-07A	Characterization of teachers job satisfaction:	very low; low; medium vs. very high; high	63 (7.4)	92 (3.5)	29 (7.8)	██

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

* For creation of indices refer to TIMSS 2003 Supplement 3

** Full-time teacher; library media specialist; teacher with informal leadership; principal, another school administrator

80 60 40 20 0 20 40 60 80

■ Difference statistically significant   □ Difference not statistically significant

Figure 8: Lebanon: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Lebanon		Difference (Absolute Value)	Difference	
			Less effective schools	More effective schools		Less effective	More effective
(1) SCQ2-05B	Percentage of students enrolled after beginning of school year:	> 20% vs. ≤ 20%	66 (7.6)	94 (3.3)	27 (8.4)		■
(7) DERIVED	Index of good school and class attendance:	low; medium vs. high	46 (8.6)	73 (6.4)	27 (11.2)		■
(7) SCQ2-23L	Affected by shortage of science laboratory materials:	a lot; some; a little vs. none	16 (5.8)	40 (6.6)	24 (9.0)		■
(5) DERIVED	Index of principals' perception of school climate:	low; medium vs. high	6 (3.2)	29 (7.0)	23 (7.8)		■
(5) SCQ2-20E	Teachers professional development in use of communication technologies:	never vs. 1 to more than 10 times	55 (8.1)	78 (6.0)	23 (10.3)		■
(7) SCQ2-23I	Affected by shortage of calculators for math instructions:	a lot; some; a little vs. none	31 (7.6)	53 (7.0)	23 (10.3)		■
(5) SCQ2-18A	Difficulty to fill vacancies for mathematics:	very difficult; somewhat difficult; easy to fill vacancies vs. no vacancies	16 (5.0)	38 (7.3)	22 (9.2)		■
(6) SCQ2-22AD	Frequency of students violating dress code:	daily; weekly; monthly vs. never; rarely	97 (2.2)	78 (5.5)	19 (5.8)	■	
(5) SCQ2-16	Grouping of 8th grade students by ability in science:	no vs. yes	41 (7.9)	10 (4.4)	31 (8.9)	■	
(5) SCQ2-21BB	Observation by external persons to evaluate math teachers:	no vs. yes	72 (6.9)	38 (6.9)	34 (10.3)	■	
(5) SCQ2-21AB	Observation by principal or senior staff to evaluate math teachers:	no vs. yes	78 (6.4)	43 (7.2)	34 (10.0)	■	
(4) SCQ2-13	Grouping of 8th grade students by ability in mathematics:	no vs. yes	44 (7.9)	9 (4.1)	35 (8.9)	■	

80 60 40 20 0 20 40 60 80

( )	Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
*	For creation of indices refer to TIMSS 2003 Supplement 3
**	Full-time teacher; library media specialist; teacher with informal leadership; principal, another school administrator

■ Difference statistically significant   □ Difference not statistically significant

Figure 9: Lebanon: Proportions in less and more effective schools: Continuous variables

Question Number	Description		Lebanon Less effective schools		Lebanon More effective schools		Difference (Absolute Value)	
(4) DERIVED	Number of weeks of school per year:	in weeks	31	(0.5)	34	(0.5)	2	(0.7)
(4) SCQ2-11A	Number of days school is open for 8th grade education:	in days	159	(2.4)	167	(2.0)	9	(3.1)
(7) SCQ2-24A	Number of computers for educational purpose in 8th grade:	in number of computers	9	(2.6)	25	(2.4)	16	(3.6)
(1) SCQ2-02B	Total school enrolment in 8th grade:	in number of students	55	(5.3)	93	(5.6)	38	(8.1)
(1) SCQ2-02A	Total school enrolment in all grades:	in number of students	456	(40.7)	1220	(120.6)	765	(128.7)

( )	Standard errors appear in parentheses.
	Because results are rounded to the nearest whole number, some totals may appear inconsistent.
*	For creation of indices refer to TIMSS 2003 Supplement 3

Figure 10: Morocco: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Morocco[1][‡] Less effective schools	More effective schools	Difference (Absolute Value)	Difference Less effective	More effective
(5) SCQ2-20A	Teachers in professional development in curriculum implementation:	1 to 2 times; ≥ 6 times vs. never; 3 to 5 times	48 (10.5)	93 (7.1)	45 (12.8)		▬▬▬
(6) SCQ2-22BJ	Severity of students intimidating or verbally abusing other students:	serious; minor problem vs. no problem	13 (7.0)	52 (11.8)	39 (12.5)		▬▬▬
(6) SCQ2-22AG	Frequency of students committing profanity:	daily; weekly; monthly vs. never; rarely	61 (10.8)	90 (6.4)	28 (12.7)		▬▬
(6) SCQ2-22BE	Severity of students disturbance in classrooms:	serious; minor problem vs. no problem	27 (6.5)	55 (10.6)	28 (11.4)		▬▬
(6) SCQ2-22AJ	Frequency of students intimidating or verbally abusing other students:	daily; weekly; monthly vs. never; rarely	67 (9.8)	92 (6.5)	25 (11.9)		▬▬
(7) SCQ2-23Q	Affected by shortage of audio-visual resources for science:	a lot; some vs. none; a little	52 (9.1)	26 (5.9)	26 (10.4)	▬▬	
(7) SCQ2-23B	Affected by shortage of budget for supplies:	a lot; some; a little vs. none	58 (11.6)	23 (10.2)	35 (15.3)	▬▬▬	
(7) SCQ2-23L	Affected by shortage of science laboratory materials:	a lot; some vs. none; a little	63 (9.3)	26 (9.1)	37 (12.0)	▬▬▬	

60 40 20 0 20 40 60

■ Difference statistically significant   □ Difference not statistically significant

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

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

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
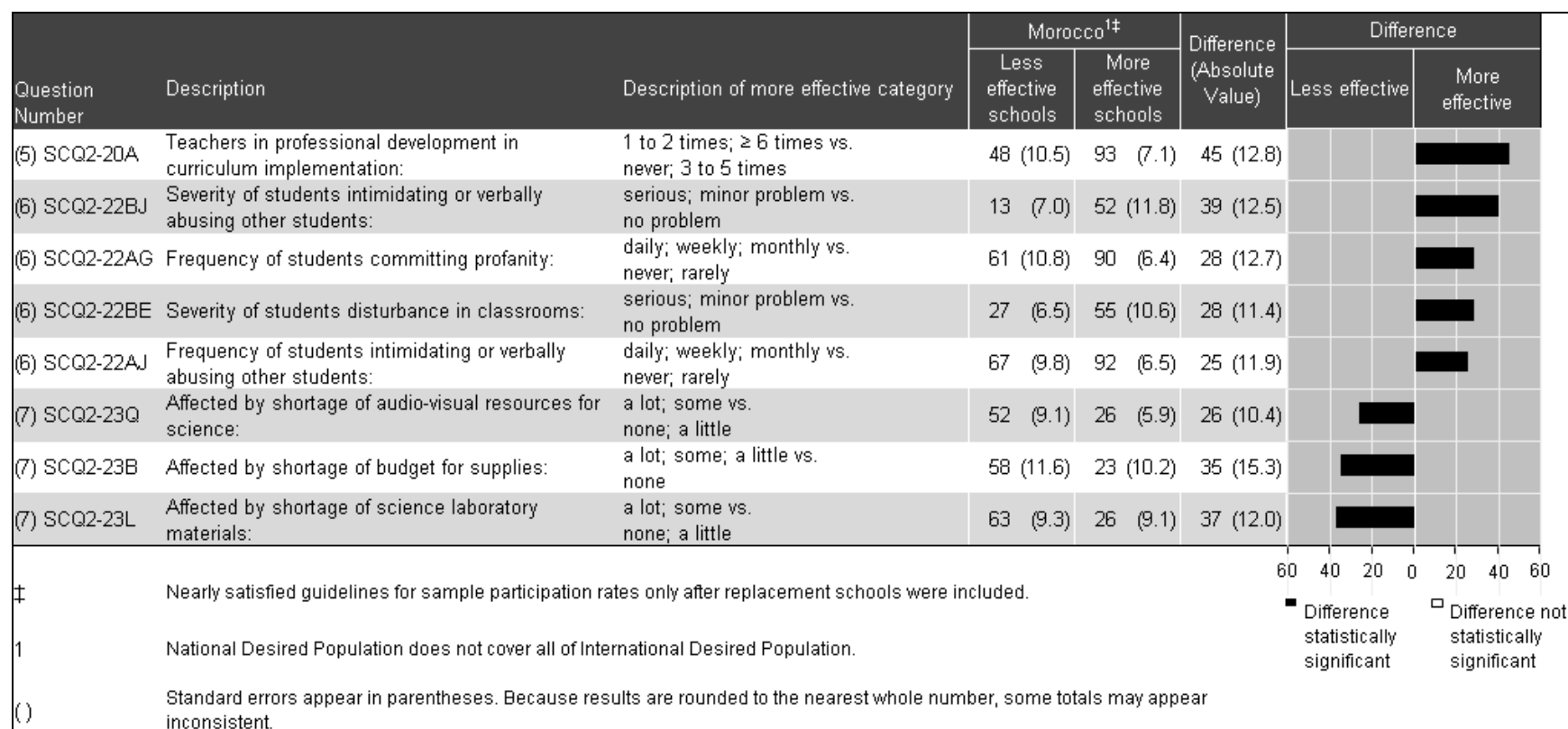
Figure 11: Palestinian National Authority: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Palestine		Difference (Absolute Value)	Difference		
			Less effective schools	More effective schools		Less effective	More effective	
(6) SCQ2-22AE	Frequency of students disturbance in classrooms:	daily; weekly; monthly vs. never; rarely	35 (7.6)	73 (6.4)	38 (9.6)		▇▇▇▇	
(6) SCQ2-22AB	Frequency of students absenteeism:	daily; weekly; monthly vs. never; rarely	60 (6.7)	87 (5.2)	28 (8.0)		▇▇▇	
(6) SCQ2-22AA	Frequency of students arriving late to school:	daily; weekly; monthly vs. never; rarely	48 (8.4)	74 (6.5)	26 (10.4)		▇▇▇	
(5) SCQ2-20C	Teachers professional development in improving content knowledge:	never; 1 to 2 times vs. 3 to more than 10 times	48 (7.7)	69 (6.8)	21 (10.5)		▇▇	
(7) SCQ2-23E	Affected by shortage of instructional space:	a lot; some; a little vs. none	18 (6.7)	38 (7.1)	20 (9.2)		▇▇	
(6) SCQ2-22AG	Frequency of students committing profanity:	daily; weekly vs. never; rarely; monthly	81 (6.1)	98 (2.2)	17 (6.4)		▇▇	
(1) SCQ2-07A	Characterization of teachers job satisfaction:	high; medium; low; very low vs. very high	2 (2.1)	16 (5.5)	14 (5.9)		▇▇	
(4) SCQ2-14B	School offers remedial mathematics:	no vs. yes	79 (5.2)	93 (3.5)	14 (6.1)		▇▇	
(6) SCQ2-22AI	Frequency of students committing theft:	daily; weekly; monthly vs. rarely; never	85 (3.6)	98 (2.0)	13 (4.1)		▇	
(6) SCQ2-22AJ	Frequency of students intimidating or verbally abusing other students:	daily; weekly; monthly; rarely vs. never	6 (3.5)	19 (5.4)	13 (6.5)		▇	
(6) SCQ2-22AH	Frequency of students committing vandalism:	daily; weekly vs. monthly; rarely; never	89 (4.7)	99 (1.4)	10 (4.9)		▇	
(8) SCQ2-24B	Number of computers with access to internet in 8th grade:	none vs. all; most; some	0 (0.0)	10 (4.8)	10 (4.8)		▇	
(7) SCQ2-23G	Affected by shortage of computers for math instructions:	a lot; some; a little vs. none	37 (6.0)	21 (5.8)	16 (8.2)	▇		
( )	Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.							

40 20 0 20 40

■ Difference statistically significant   □ Difference not statistically significant

Figure 12: Saudi Arabia: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Saudi Arabia		Difference (Absolute Value)	Difference	
			Less effective schools	More effective schools		Less effective	More effective
(7) SCQ2-23E	Affected by shortage of instructional space:	a lot; some vs. none; a little	30 (8.3)	62 (8.4)	31 (13.1)		▬▬▬
(1) SCQ2-06AA	Percentage of students from an economic disadvantaged background:	> 25% vs. ≤ 25%	40 (9.5)	64 (7.8)	24 (12.0)		▬▬
(1) SCQ2-07G	Students' regard for school property:	very low; low vs. very high; high; medium	76 (8.6)	95 (2.9)	19 (9.3)		▬▬
(7) SCQ2-23L	Affected by shortage of science laboratory materials:	a lot; some; a little vs. none	6 (3.4)	23 (7.4)	17 (7.2)		▬
					40 20 0 20 40		
( )	Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.				■ Difference statistically significant		□ Difference not statistically significant

Figure 13: Saudi Arabia: Proportions in less and more effective schools: Continuous variables

Question Number	Description	Saudi Arabia		Difference (Absolute Value)
		Less effective schools	More effective schools	
(8) SCQ2-24A	Number of computers for educational purpose in 8th grade: in number of computers	3 (1.2)	11 (1.8)	8 (2.4)
( )	Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.			

Figure 14: Tunisia: Proportions in less and more effective schools (cont.)

Question Number	Description	Description of more effective category	Tunisia		Difference (Absolute Value)	Difference	
			Less effective schools	More effective schools		Less effective	More effective
(1) SCQ2-06AA	Percentage of students from an economic disadvantaged background:	≥ 26% vs. < 26%	6 (3.6)	44 (6.9)	38 (7.4)		▬▬▬▬
(6) SCQ2-22BH	Severity of students committing vandalism:	serious problem vs. no problem; minor problem	36 (7.4)	69 (7.3)	33 (10.4)		▬▬▬
(3) SCQ2-10A	School expects parents to attend special events:	no vs. yes	44 (6.8)	76 (5.9)	32 (8.4)		▬▬▬
(7) SCQ2-23L	Affected by shortage of science laboratory materials:	a lot vs. none; a little; some	54 (8.6)	85 (6.3)	31 (11.2)		▬▬▬
(5) DERIVED	Index of principals' perception of school climate:	low vs. high; medium	17 (5.6)	47 (6.7)	30 (8.3)		▬▬▬
(1) SCQ2-07H	Characterization of students desire to do well in school:	very high; low; very low vs. high; medium	14 (4.9)	44 (5.9)	30 (7.3)		▬▬▬
(6) SCQ2-22BM	Severity of students physically injuring teachers or staff:	serious problem vs. no problem; minor problem	44 (7.3)	73 (6.6)	29 (9.9)		▬▬
(7) SCQ2-23B	Affected by shortage of budget for supplies:	a lot; some; a little vs. none	24 (6.4)	51 (7.1)	27 (9.5)		▬▬
(1) SCQ2-07D	Characterization of teachers expectations for student achievement:	very high; very low vs. high; medium; low	26 (6.5)	52 (5.9)	26 (9.1)		▬▬
(6) SCQ2-22BD	Severity of students violating dress code:	serious; minor problem vs. no problem	42 (7.0)	68 (6.5)	26 (10.0)		▬▬
(7) SCQ2-23O	Affected by shortage of calculators for sciences instructions:	a lot; some; a little vs. none	26 (6.6)	52 (7.7)	26 (9.8)		▬▬
(1) SCQ2-06AB	Percentage of students from an economic affluent background:	< 26% vs. ≥ 26%	5 (3.5)	30 (7.3)	25 (8.0)		▬▬
(7) SCQ2-23A	Affected by shortage of instructional materials:	a lot; some vs. none; a little	43 (7.3)	68 (6.8)	25 (10.5)		▬▬
(6) SCQ2-22BI	Severity of students committing theft:	serious problem vs. no problem; minor problem	46 (7.9)	71 (7.5)	25 (11.0)		▬▬
(1) SCQ2-03	Number of people in city or school area:	< 15 001 people vs. ≥ 15 001 people	56 (7.0)	78 (5.4)	22 (9.2)		▬▬
(3) SCQ2-10C	School expects parents to volunteer for projects, programs, trips:	no vs. yes	23 (6.2)	45 (7.3)	22 (9.2)		▬▬
(3) SCQ2-10D	School expects parents to ensure students complete homework:	no vs. yes	31 (6.5)	53 (7.3)	22 (8.9)		▬▬

( )   Standard errors appear in parentheses.
Because results are rounded to the nearest whole number, some totals may appear inconsistent.
*   For creation of indices refer to TIMSS 2003 Supplement 3

40   20   0   20   40

■ Difference statistically significant   □ Difference not statistically significant

Figure 15: Tunisia: Proportions in less and more effective schools

Question Number	Description	Description of more effective category	Tunisia		Difference (Absolute Value)	Difference	
			Less effective schools	More effective schools		Less effective	More effective
(6) SCQ2-22AB	Frequency of students absenteeism:	daily; weekly; monthly vs. never; rarely	33 (6.5)	55 (7.9)	22 (10.0)		
(5) SCQ2-20A	Teachers in professional development in curriculum implementation:	never; 6 to more than 10 times vs. 1 to 5 times	38 (7.9)	59 (6.9)	21 (9.8)		
(6) SCQ2-22AJ	Frequency of students intimidating or verbally abusing other students:	daily; weekly; monthly vs. never; rarely	61 (6.7)	80 (5.8)	20 (9.0)		
(6) SCQ2-22AG	Frequency of students committing profanity:	daily; weekly; monthly vs. never; rarely	67 (6.1)	85 (5.3)	17 (8.4)		
(7) SCQ2-23F	Affected by shortage of special equipment for handicapped students:	a lot vs. none; a little; some	73 (6.7)	90 (4.3)	17 (8.1)		
(1) SCQ2-07E	Parental support to student achievement:	very low; low; medium vs. very high; high	13 (5.1)	29 (5.1)	16 (7.3)		
(4) SCQ2-11C	Instruction time in a full day:	≤ 6 hours vs. > 6 hours	0 (0.0)	10 (4.5)	10 (4.5)		
(1) SCQ2-07A	Characterization of teachers job satisfaction:	very low; low; medium; high vs. very high	0 (0.0)	8 (2.6)	8 (2.6)		

( ) Standard errors appear in parentheses.
Because results are rounded to the nearest whole number, some totals may appear inconsistent.
* For creation of indices refer to TIMSS 2003 Supplement 3

■ Difference statistically significant   □ Difference not statistically significant