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Kurdistan Regional Government
Ministry of Planning • Ministry of Education

Strategic Priorities for Improving Access to Quality Education in the Kurdistan Region—Iraq

Georges Vernez
Shelly Culbertson
Louay Constant

RAND EDUCATION

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Sponsored by the Kurdistan Regional Government

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The research described in this report was sponsored by the Kurdistan Regional Government and was conducted in RAND Education, a division of the RAND Corporation.

Library of Congress Cataloging-in-Publication Data is available for this publication.

ISBN: 978-0-8330-8410-1

Cover photo by the RAND Corporation

Published 2014 by the RAND Corporation
1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665
RAND URL: http://www.rand.org
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Preface

The Kurdistan Regional Government (KRG) launched an ambitious reform of its kindergarten through grade 12 (K–12) education system beginning in 2007. The reform was motivated, in part, by the need to modernize the system's decades-old curriculum, upgrade its school facilities, and increase the quality of instruction. Education was made compulsory through grade 9, up from grade 6; a new, more rigorous curriculum was introduced; and two languages (English and Arabic) were to be taught in addition to Kurdish beginning in primary school. The system was also restructured into two levels—basic (grades 1–9) and secondary (grades 10–12)—instead of the previous three levels (primary, intermediate, and secondary). Finally, would-be teachers would from now on be required to complete a bachelor's degree. All of these changes were implemented at the same time, with the exception of the curriculum, which was implemented incrementally.

These new policies are expected to have a major impact on future student enrollment, the number of schools needed, and the number and kind of teachers required. They also may require adjustments in instruction on the part of teachers and may encourage behavioral changes on the part of principals, teachers, parents, and students.

In this context of an education system in transition, the KRG, under the auspices of His Excellency Dr. Ali Sindi, Minister of Planning, asked the RAND Corporation to conduct a one-year study to evaluate the status of the current system, develop strategic priorities, and, within these priorities, make practical recommendations for improving access to and the quality of education in Kurdistan.

This study was conducted by RAND Education, a unit of the RAND Corporation, and was sponsored by the Kurdistan Regional Government–Iraq. The findings of this study should be of interest to the KRG's Council of Ministers and Ministry of Education, and to education administrators, principals, teachers, and all those in the general public who have an interest in improving education in the Kurdistan Region—Iraq.

The principal author of this work, Dr. Georges Vernez, may be contacted by email at vernez@rand.org or by phone at 310-393-0411, extension 6211. For more information on RAND Education, contact the Director, Dr. Darleen Opfer, who can be reached by email at dopfer@rand.org; by phone at 310-393-0411, extension 4926; or by mail at RAND Corporation, 1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138. More information about RAND is available at www.rand.org.

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Summary

In 2007, the Kurdistan Regional Government (KRG) launched an ambitious reform of its kindergarten through grade 12 (K–12) education system. It introduced a new, more rigorous curriculum, made education compulsory through grade 9 instead of grade 6, and restructured what had been three levels of schools into two: basic (grades 1–9) and secondary (grades 10–12). It also put policies in place to reduce the high rate at which students were being held back in the early grades, and instituted two national exams. Additionally, teacher training was part of the reform, and all teachers are now required to hold a bachelor's degree.

In the context of this sweeping transformation of the education system, in 2010 the KRG asked the RAND Corporation to assess the current status of the K–12 system and recommend measures to increase the access of students in the Kurdistan Region—Iraq (KRI) to education and improve educational quality. RAND's overarching goal was to build on the recently instituted reform and help the KRG move rapidly to good-quality, universal, basic education. RAND designed a one-year, multi-method study in which it analyzed school data from the Ministry of Education (MOE); analyzed data from other government sources in KRI and Iraq; interviewed a wide variety of stakeholders;[1] surveyed teachers; reviewed the new K–12 curriculum and the curriculum used in the teacher colleges; developed a model to project future student enrollment; used geographic information system (GIS) mapping to display the distribution of schools and assess the feasibility of proposed actions; and reviewed the literature on best practices and relevant education policies.

This work suggested three strategic priorities for the KRG to pursue to improve the K–12 system:

- Expand capacity to meet the rapidly growing demand for education.
- Improve the quality of instruction.
- Strengthen stakeholders' accountability and incentives.

First Strategic Priority: Expand Capacity to Meet the Rapidly Growing Demand for Education

The KRI's K–12 education system grew quickly over the past years (school years 2004–05 to 2009–10). On average, 67,000 new students enrolled annually. Growth was greater in the intermediate (7–9) and secondary (10–12) grades (averaging 4.9 percent and 13.8 percent a

[1] Including staff from the MOE and teacher colleges, school principals, teachers, and school supervisors.

year, respectively) than in the primary grades (K–6). However, although the net enrollment rate was nearly 100 percent in the primary grades, it was much lower in grades 7–9 (0.47) and grades 10–12 (0.22).

School capacity did not keep up with this rapid growth. As a result, more than half of schools in the KRI added one or more additional shifts or started sharing a building with another school. This is especially true in urban areas and in grades 7–12. Compounding the problem, schools in urban areas—both single- and double-shift alike—were often overcrowded, with an average class size of 42 students.[2]

This pressure on capacity is unlikely to let up over the next decade, and may even increase. By our projections, enrollment will grow annually by anywhere from a low of 69,000 to a high of 111,000 new students.[3] This translates into a need for the KRG to add the equivalent of between 21,400 and 34,700 new classrooms in these ten years (assuming an average class size of 35 students). Tackling the problem of overcrowding in urban schools would require an additional 5,200 new classrooms.

A growing demand for new teachers is also a significant part of the capacity problem. To meet the projected growth in enrollment, the KRG will need to hire an annual average of 4,800 to 6,900 additional teachers over the next decade. Teachers of Kurdish, mathematics, and science will be in greatest demand.

Build New Schools and Classrooms

To meet this demand for new school spaces and for reduced crowding in current schools, the KRG will need to build between 134 and 200 new 18-classroom schools every year until 2021. The capital investment required to build that many schools using traditional construction methods will range from $200 million to $300 million annually—much in excess of the KRG's current annual investment for this purpose. To reduce this investment by 15 to 30 percent, the KRG could use prefabricated schools. This would also offer the added advantage of taking only 6 to 8 months to build compared with the 18 to 24 months needed using traditional methods.

Should the KRG's capital resources be insufficient to build this many new schools, we recommend it consider four mitigating measures, mainly applicable in urban areas:

- Redistribute students from overcrowded to uncrowded schools.
- Lower the rate at which students are retained in the primary grades (1–6).
- Add a second shift to all existing single-shift schools.
- Add a second shift to all newly built schools.

These measures would reduce the number of new schools to be built by as much as 60 percent. But a need would still remain for the equivalent of 50 to 85 new 18-classroom schools annually.

In rural areas, one promising way to reduce the need for new schools is to consolidate all students in a particular catchment area into one large school rather than several small schools. Although the KRG would then need to transport students whose homes were not in walking

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[2] By contrast, class size in rural areas averages 14 students.

[3] These numbers depend on varying assumptions about birth rates, the annual increase in the number of students who complete basic education, and the speed at which gender parity is attained.

distance, economies of scale in the number of teachers and principals needed and better-quality education should compensate for the added transportation costs.

Hire New Teachers

To meet the coming demand for new basic-school teachers, the teacher colleges will have to increase their annual output of graduates (now about 1,000 per year) by four to five times (to 4,000 to 5,000). However, until they do, there is seemingly no shortage of potential teachers among the graduates of education and other academic programs at universities (including mathematics and science). The MOE can draw from these ranks to offset the shortage of needed graduates from the teacher colleges and also meet the demand for new secondary-school teachers.

Second Strategic Priority: Improve the Quality of Instruction

Basic indicators of student achievement show that students in the KRI are performing poorly. In about two-thirds of urban schools, more than 50 percent of students failed the school's assessment in 2007–08. More than two-thirds of Kurdish students have been retained at least a year by the time they reach grade 9. About a third of grade 9 students did not pass the national English, physics, and mathematics tests given in 2008–09.

Three factors are contributing to these results. First, the ability of practicing teachers to teach the new curriculum is weak due to a variety of challenges. For instance, many teachers do not have the knowledge of the subject-area content required by the new curriculum, some teachers are being compelled to teach subjects outside of their specialization, teachers receive little on-the-job training, and most teachers do not possess a bachelor's degree. In addition, new teachers are neither being sufficiently prepared in teaching methods nor given practical experience before being certified.

Second, KRI schools provide too little instructional time. Single-shift basic schools offer 693 hours of instruction per year; double-shift schools, 539 hours—both well below the Organisation for Economic Co-operation and Development (OECD) average of 794 hours. The amount of time spent in the classroom in grades 7–12 is also much less than in OECD countries. Moreover, the new curriculum was designed for more time, and teachers say they cannot cover it fully in the number of hours currently in the school day.

Third, there are relatively few opportunities for high-performing students. While there are a handful of what are called "typical" schools that offer accelerated learning,[4] this is far from enough to train the KRI's next generation of leaders.

Improve Teacher Training for Both Practicing and New Teachers

Upgrade the knowledge and expertise of practicing teachers. We recommend that the KRG establish regional training centers, possibly associated with the teacher colleges. These centers should be staffed by professional, full-time trainers who could be recruited from among the KRI's best supervisors and teachers. These recruits should be thoroughly trained on the new curriculum before beginning to train other teachers. Detailed standardized training mate-

[4] Enrollment at these schools currently amounts to about 1 percent of all students in the KRI.

rial should be developed for use in the centers to ensure that teacher training is taking place in a consistent manner across the KRI.

Initially, these training centers should focus on increasing the subject-matter knowledge of practicing teachers to cover the content of the new curriculum.[5] Training on teaching methods should eventually follow. This training should build on those methods most familiar to practicing teachers, such as lecturing (rather than the still too poorly defined student-centered methods), and should focus on the most-practical techniques for large classrooms.

A second way to better prepare practicing teachers is to develop "curriculum maps," a tool that provides teachers with step-by-step guidance on how and what to teach. These maps, which combine recommended content, suggestions for teaching methods and classroom exercises, student assessment, monitoring, and teaching plans, ensure that teachers present the curriculum in a standardized fashion.

A third way to prepare practicing teachers is to develop over time a support infrastructure that assigns expert mentors to teachers who may need them and to establish professional communities of teachers across schools to promote knowledge exchanges and better align the curriculum.

Upgrade the preparation of new teachers. The curriculum of the teacher colleges should be restructured with the assistance of an outside teacher college. The aims should be to

- increase the number of courses on teaching methods
- require one semester of experience as a teacher's aide
- require both a major and a minor specialization
- reflect more closely the content of the national basic curriculum.

In the case of university graduates recruited to become either basic or secondary teachers, they should also be required to take a course in teaching methods and acquire at least one semester of experience as a teacher's aide.

To attract highly qualified and motivated people into the teaching profession, the minimum score required on the grade 12 exit exam for assignment to the teacher career track should be raised. Students who score high on the exit exam (and would, in consequence, normally be assigned to another profession) and who express a desire to become a teacher should be allowed to enroll in a teacher college or university education program.

Increase Instructional Time

We recommend that the KRG expand the school year from the current 170 days to 190 days and lengthen the shifts in double-shift schools from the current four hours to five. These changes would bring instructional time in KRI schools in line with international standards.

Provide High-Performing Students with Broadened Learning Opportunities

High-performing students should be identified using a transparent selection process and should be tracked in separate schools, entering in either grade 7 or grade 10. The program can start small but should aim to eventually offer, over time, entry to 10 percent to 15 percent of all KRI students.

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[5] Studies have shown that knowledge of subject matter is more important for student learning than are teaching methods.

Third Strategic Priority: Strengthen Stakeholders' Accountability and Incentives

Accountability involves monitoring the performance of an education system, while incentives involve inducing education leaders, principals, teachers, and parents to behave in ways that will improve student performance. At present, the KRI has a limited system for accountability and incentives, with a number of areas that could be strengthened. For example, the current teacher evaluation system in the KRI is based on a supervisory model. The MOE maintains 830 supervisors for basic education. During three school visits a year, they both evaluate and train teachers. Yet their evaluation criteria are not specific or consistent. Many do not know a subject area sufficiently or do not spend enough time in a given school to have the knowledge they need to judge the performance of either the school or individual teachers. The fact that they are asked to perform a dual role as both evaluator *and* trainer creates a potential conflict of interest.

With regard to school principals, decisionmaking is centralized in the MOE. Principals receive no data from the Ministry that would allow them to compare their students' performance with that of students in other schools or track trends in their school's performance over time. Principals also have limited input into teacher evaluations and no say in the assignment of teachers to their schools. Indeed, their role is mainly administrative; they are not expected to be instructional leaders.

Finally, parental and public participation in the KRI education system is minimal.

Restructure the Role of Supervisors

The role of supervisors should be limited to monitoring and evaluating the performance of schools and teachers. This change should be carried out in tandem with the professionalization of teacher trainers.

Redesign the System for Evaluating Teacher Performance

The evaluation criteria should be aligned with the new curriculum. Additionally, more-objective measures, including student performance, should be used to draw conclusions about how teachers are doing in the classroom.

Increase the Role of the Principal

Currently, the principal's input into a teacher's evaluation is only worth 25 percent of the total score. We recommend raising this share to 50 percent or even 75 percent. Over time, principals should also be given more authority over the assignment, hiring, and firing of teachers.

Reward High-Performing Schools

Recognition should be used to incentivize schools to perform in accordance with high standards.

Measure Student Achievement and Progress, and Make Results Public

The KRG should continue to use the annual national exams at grades 6, 8, and 9 to measure educational progress. This information should then be made available to principals, teachers, and parents. We also recommend participation in one of the international assessments of student achievement so that the KRG can benchmark the performance of KRI students with that of students in other countries.

Involve Parents and the Public in Promoting Education

A process should be set up to enable parents and the public to consult with principals, teachers, and other key stakeholders. In this way, they can be included in decisionmaking about educational improvements.

Implementing the Recommendations

While the effort involved in implementing our recommended changes may, at first, seem daunting, all changes need not be executed at once. Our vision is that the MOE will put these recommendations into action over multiple years, partly to avoid overloading principals and teachers with too many changes at the same time and partly to manage the sheer scale of the effort that will be involved.

For manageability, we recommend that a coordinated three-pillar approach be used:

- For each primary recommendation, use task forces to make key decisions; design new policies, programs, and operational guidelines; and develop detailed implementation plans.
- Conduct the implementation in phases.
- Coordinate those parts of implementation that affect all the task forces equally.

Acknowledgments

The authors thank the KRG for supporting this research. We are especially grateful to His Excellency Dr. Ali Sindi, Minister of Planning, KRG, who provided support and guidance. Also special thanks to His Excellency Safeen M. Dizayee, Minister of Education, KRG, for providing guidance, access, and support for this effort. They both helped sharpen our analysis and recommendations.

Several individuals who also deserve special recognition are Zagros Siwaily, Director General of Development Coordination and Cooperation in the Kurdistan Regional Government's Ministry of Planning; Parzheen Abdulrahman Ali, Director of Relations in the Ministry of Education; and Dastan A. Ali, Senior Coordinator in the Ministry of Education, all of whom responded to our many requests and opened doors for us. They always did so graciously and efficiently.

We also want to thank all the directors general at the Kurdistan Regional Government Ministry of Education who took time to meet with us, shared their ideas for educational improvements, answered candidly the many questions we asked, and provided the information upon which much of this report is based.

The many dedicated Kurdistan Region—Iraq education district administrators, principals, teachers, and supervisors who shared their experiences and concerns with us deserve special recognition. So, too, do the deans of the teacher colleges and universities who freely shared information and their views about the conditions of education in the Kurdistan Region—Iraq.

We also thank Yosuif Othman Yosuif, Director General of Education Planning in the Ministry of Education, and Kafee Ahmed, Director of Statistics in the Directorate General of Education Planning, for providing detailed school data and managing a survey of teachers.

Wiryah Mahmoud, Omar S. Abit, and Bakhtyar Karim at the Ministry of Planning tirelessly provided translation and helped with logistics. We are most appreciative.

Several individuals at RAND made major contributions to the study. Titus Galama developed the forecasting model used to project student enrollment to 2021 in Chapter Three. Adrian Overton produced the geographic information system (GIS) maps that display the geographical distribution of school and other data. Constantine Samaras reviewed the experience with fabricated schools and contributed to the discussion of prefabricated schools in Chapter Three. Additionally, several RAND staff provided assistance in literature searches and data analysis: Sara Al-Dorani, Mary Fu, and Kim Yuan. We thank them all.

Lucrecia Santibañez, of RAND, and Dominic Brewer, from the University of Southern California, reviewed the manuscript, made many suggestions and raised questions that led to major improvements. We thank them. Any remaining errors are ours.

Finally, we want to thank Susan Bohandy, who helped with the organization of this report, and Louis Ramirez, who typed multiple drafts, including the final one, with professional efficiency.

Abbreviations

DG	directorate general
GIS	geographic information system
ID	Iraqi dinar
IHSES	Iraq Household Socio-Economic Survey
KRG	Kurdistan Regional Government
KRI	Kurdistan Region—Iraq
MOE	Ministry of Education
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
RFP	request for proposal
TALIS	Teaching and Learning International Survey
TIMSS	Trends in International Mathematics and Sciences Study
U.A.E.	United Arab Emirates
U.S.	United States
UK	United Kingdom
UNESCO	United Nations Educational Scientific and Cultural Organization

CHAPTER ONE

Introduction

In 2007, the Kurdistan Regional Government (KRG) launched an ambitious reform of its kindergarten through grade 12 (K–12) education system. There were several motivations for this. After years of isolation from the world under sanctions, followed by regional conflict, the Kurdistan Region—Iraq (KRI) was enjoying relative stability and new resources from energy renewals. In this new environment, there was general consensus about the need to modernize the country's education system: The education curriculum was decades old, schools were very crowded, the population was growing quickly, teachers in important subject areas such as mathematics and English were in short supply, and few students completed high school.

Wanting to bring its K–12 system up to international standards, the Ministry of Education (MOE) held a conference in 2007 inviting more than 500 local and foreign education experts to gather recommendations for education reform. The conference organizers commissioned papers and attendees drew up recommendations for changes in the KRI education system. The recommendations were submitted to the KRG Council of Ministers for approval and were adopted by the KRG Parliament.

As a result of this effort, a number of major education reforms were introduced starting in the 2008–09 school year. Education was made compulsory through grade 9, up from grade 6. A new, more rigorous curriculum was implemented across the grades. The system was restructured into two levels—basic (grades 1–9) and secondary (grades 10–12)—instead of the previous three levels: primary (grades 1–6), intermediate (grades 7–9), and secondary (grades 10–12). Teachers were required to complete higher levels of education than before; new teachers were now required to have bachelor's degrees. Policies were put in place to reduce the rate at which students had been held back in the early grades. Two new national exams were instituted.

With the exception of the new curriculum, which was introduced incrementally, all of these reforms were introduced at the same time. The extent of the change they entailed would be demanding for any K–12 education system to manage, much less one already as overburdened as Kurdistan's. For example, these new policies are expected to have a dramatic impact on the demand for education in Kurdistan, the number of schools needed, and the number and kinds of teachers required in the short to medium term.

In this context of a K–12 education system in transition, the KRG asked RAND to conduct a one-year study—first, to help evaluate the system as it currently stood, and second, to develop practical advice for fully implementing its reform and further improving access to education and the quality of instruction that students receive in the KRI. The overarching goal of this work was to build on the recently instituted reforms and help the KRI move rapidly to good-quality, universal, basic education.

Background

The KRI is a semi-autonomous region of Iraq situated in its northern part and bordering Iran to the east, Turkey to the north, and Syria to the west. Its area is similar to that of the Netherlands and Switzerland. The establishment of the KRI dates back to March 1970 when an autonomy agreement was signed between the Kurdish opposition and the Iraqi government after years of heavy fighting.

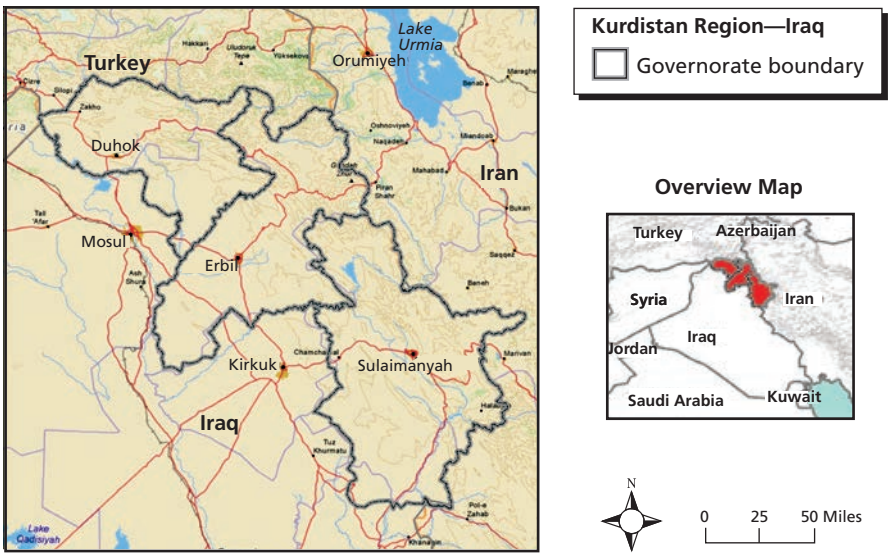
Since then, the KRI has suffered through heavy fighting with the Iraqi army. Following the 1991 uprising of the Iraqi people against Saddam Hussein, many Kurds were forced to flee the country to become refugees in bordering regions of Iran and Turkey. At the end of the First Gulf War, Iraqi forces left Kurdistan and a no-fly zone was established that facilitated the return of Kurdish refugees, leaving the region to function de facto independently. The 2003 invasion of Iraq and subsequent political changes led to the ratification of a new Constitution of Iraq in 2005 that defines Iraqi Kurdistan as a federal entity of Iraq and establishes Arabic and Kurdish as Iraq's joint official languages. Today Iraqi-Kurdistan is a parliamentary democracy with a regional assembly that consists of 111 seats.

The KRI is divided into three governorates, Duhok, Erbil, and Sulaimanyah, each with a capital city bearing its name. Each governorate is divided into districts, for a total of 31 districts; each district is divided into sub-districts. Each district and sub-district have a district center. (See Figure 1.1.)

Economy, Population, and Workforce

The KRI economy is dominated by the oil industry, agriculture, and tourism. The relative security and stability of the region have allowed the KRG to improve the region's housing, road

Figure 1.1
Current KRI's Geographical Boundaries



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and power infrastructure and upgrade its services to the population.[1] Since 2003, the stronger economy has attracted some 20,000 workers from other parts of Iraq. The KRG currently receives 17 percent of Iraqi government revenues after deductions for defense and other nationwide services.

The population of the KRI was estimated at about 3.9 million in 2007.[2] It is young, with 50 percent of the population under the age of 20. Illiteracy is relatively high. About 27 percent of the population age 20 to 29 is illiterate, and about 46 percent of the population age 30 and above is illiterate. Households are somewhat large, averaging 7.7 persons per household.[3]

Kurdish and Arabic are both official languages in the KRI, but Kurdish is the language most spoken and understood in the region. Kurdish has two main dialects, Sorani and Kurmanji. Assyrian Neo-Aramaic, Chaldean Neo-Aramaic, and Turkmani are also spoken by their respective minority communities.

The dominant religion in the KRI is Islam, mostly the Sunni branch of Islam. Christianity (adhered to by Assyrian and Chaldean Christians) and Yezidism make up a significant minority.

About 70 percent of men and 13 percent of women age 15 or older reported wage and non-wage earnings in 2007. A majority (about 60 percent) of wage earners are employed in the public sector.

More than 50 percent of wage earners are providing government services. Otherwise, about 19 percent of wage earners are employed in construction, 6 percent in transport and communications, 6 percent in real estate and business activities, and 4 percent in manufacturing. (See Table 1.1.)

Table 1.1
Percentage of Wage Earners, by Economic Activity

Economic Activity	Percentage of Wage Earners
Government activities	
Public administration and defense	22
Community, social, and personal services	16
Education	12
Health and social work	3
Electricity, gas, and water supply	2
Other	
Construction	19
Transport, storage, and communication	6
Real estate, renting, and business	6
Wholesale and retail trade, motor vehicle repair, household goods	5
Manufacturing	4
Hotels and restaurants	2
Agriculture, hunting, forestry	2
Other	2
Total	100

SOURCE: IHSES, 2007.

NOTE: Numbers may not sum to 100 percent because of rounding.

[1] Since 1991, about two-thirds of the 4,500 villages destroyed by Saddam Hussein's regime have been reconstructed.

[2] Iraq Household Socio-Economic Survey (IHSES), 2007. This is an estimate, since no census of the population has been made in recent times.

[3] IHSES, 2007. IHSES defines illiteracy as not being able to read and write in one's primary language.

Education

Ministry of Education

The K–12 education system is highly centralized, with all major policy decisions made in the KRG's MOE, which oversees all aspects of public education and regulates private education. The MOE has 12 directorates general (DGs); they deal with all educational issues from planning to basic education and kindergarten, preparatory and vocational education, curricula, buildings, supervision, teacher training, student examination and evaluation, and sports and artistic activities. It also has a DG for Turkmen education and one for Assyrian education.

Implementation of education policies is the responsibility of the three governorates' DGs of education and its 26 education districts. The governorates' DGs report to the MOE.

The MOE employs some 145,000 persons, of whom about 60 percent are teachers and principals. MOE employees are a large share of wage earners. They account for nearly 23 percent of total government employees and 11 percent of total wage earners.

Public primary to post-secondary education is free for all. Education was compulsory to grade 6 until 2009, when compulsory education was increased to grade 9. We know of no enforcement mechanisms to ensure that students obligated to attend do so.

Public Schools

The school year runs from the middle of September for nine months, including a one-week holiday at the end of December and a two-week holiday starting in the middle of March. The school year is divided into two semesters, at the end of which students in grades 4–12 undergo an evaluation developed by each school's examination committee. The results of the examinations determine student promotions to the next grades. However, students in grades 1–3 are automatically promoted. Students in grade 12 take a final exam, developed by the MOE, that serves to determine the assignment of successful students to various post-secondary academic programs.

Students attend school six days a week for five hours in most cases. In schools that have to operate over two or more shifts, however, students attend for four hours. Students are assigned to schools primarily based on geographical location. About 36 percent of students are located in the capitals of the three governorates.

In 2009, the primary (grades 1–6) and intermediate (grades 7–9) school levels were combined into the basic education level, and students in these grades were to begin to study in the same building. In practice, most schools continue to operate for the most part in the following grade combinations: 1–6, 1–9, 7–9, 7–12, and 10–12. Secondary or preparatory schools that include grades 10 through 12 offer scientific and literary sections. In addition to basic and secondary schools, the MOE operates kindergarten schools and a limited number of vocational and adult (so-called quick learning) schools. Schools at all levels may be either all boys, all girls, or mixed. Primary school starts at age 6.

In 2009–10, there were 421 kindergarten schools; 5,162 primary, intermediate, and secondary schools; 32 vocational schools; and 73 quick learning schools. These schools served about 1.3 million students taught by nearly 89,000 teachers and principals.

Teacher Hiring and Preparation

The majority of existing teachers were prepared in one of the MOE's 26 teacher institutes. Would-be teachers had to be secondary-school graduates who were then trained for a period of two years after secondary school. The institutes also admitted some students who had completed primary education and trained them for five years after primary education. In addition to graduates from the institutes, primary and intermediate school teachers could be recruited from university education programs and other academic programs.

As part of the reforms implemented recently, the teacher institutes are in the process of being closed and replaced by teacher colleges, of which there are now four—one in each governorate plus one in the Garmain province.[4] The teacher colleges, which train basic-education teachers, are part of the Ministry of Higher Education, and their students graduate with a bachelor's degree. Basic-education teachers may also be recruited from teacher colleges. Secondary teachers, now as in the past, are recruited from colleges of education and various academic university programs.

Although the DG of Institutes is also responsible for in-service training, or professional development, the training provided is minimal. Training is on an as-needed basis using, alternatively, MOE supervisors or institute professors. The MOE currently has no ongoing in-service capability.

Basic as well as secondary teachers are specialized by academic discipline and teach in their academic discipline.

Higher Education[5]

Prior to 1991, there was only one public university, the University of Salahaddin, which was located in Sulaimanyah and eventually transferred to Erbil by Saddam Hussein in the midst of student protests and activism in Sulaimanyah. After the no-fly zone was instituted and security in the region increased, two more universities were opened, in Duhok and in Sulaimanyah, so that each governorate had a post-secondary institution. After 2003, the KRI experienced rapid growth in its number of universities. Four additional public universities were opened, two in Erbil and two in the district centers of Koya and Soran. And as many as five additional public universities are planned to open post-2011. As of 2009, about 12,000 students were attending public universities in the KRI.[6] Students in universities are assigned to academic programs depending on their scores on the secondary-school national exam. Highest scorers are typically assigned to medical schools, next highest to engineering schools, and so on, in a hierarchy of professions and academic specialties centrally administered by the government.

In addition to the growth in public institutions of higher learning, several private universities have opened since 2003, including the American University in Sulaimanyah and as many as six in the capital city of Erbil.

Recent Education Reforms

Beginning in 2009, the KRG's MOE began implementing an ambitious set of reforms to improve the quality of K–12 education in Kurdistan; these reforms had been suggested by a

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4 This province includes Kirkuk and is a disputed territory between the KRG and the government of Iraq.

5 The information in this section is primarily drawn from Krieger, 2007.

6 Kurdistan Region Statistics Office: Ministry of Planning, 2011.

conference of experts held in Erbil in 2007. The goal of these reforms is "to achieve a democratic educational philosophy that will forge the way ahead towards preparing and educating the next generation to become loyal citizens to the homeland with the capacity to think analytically."[7] The reforms included four major changes:

1. Compulsory education was extended from grade 6 to grade 9.
2. A new curriculum was adopted that emphasized the learning, from the early grades, of two languages, Arabic and English, in addition to Kurdish. The curriculum also emphasized the teaching of mathematics and the sciences. Textbooks to support this new curriculum were adapted from current Western textbooks and translated into Kurdish.
3. The traditional system of three distinct levels of education—primary, intermediary, and secondary—was replaced by a two-level system consisting of basic education (grades 1–9) and secondary education (grades 10–12).
4. Preparation requirements for teachers in the basic level of education were upgraded to require a bachelor's degree. Instead of two years of preparation in MOE-administered teacher institutes following secondary-school graduation, new teachers were to spend four years in teacher colleges (also colleges of basic education) administered by the Ministry of Higher Education. These teachers would graduate with a bachelor's degree.

To support these major changes, several other changes were implemented or encouraged in teacher instructional methods, retention of students, and student assessment. Teachers were encouraged to revise and reform their classical teaching method, which was based on memorization, and to adopt student-centered teaching techniques, emphasizing the development of creative and analytical skills. They were also encouraged to give students homework.

Student retention, which was at the discretion of school principals and teachers, was changed to require that students be automatically promoted until grade 4.

Finally, two levels of student assessment were established. Schools are now responsible for developing examinations and testing students every semester. Results on these exams determine student promotion to the next grade. In addition, a national exam administered by the MOE has been established for selected upper grades. Finally, there is a Ministerial exam at the end of secondary school, the results of which determine graduates' assignments to university programs.

Approach

Given the broad scope of the study, RAND employed a multi-method research design that entailed a literature review, a review of relevant documents and secondary data, on-site interviews, school visits and observations, a teacher survey, modeling, and geographic information system (GIS) mapping.

Literature Review

The RAND team reviewed the full range of available literature on education issues in the KRI. This included the United Nations Educational Scientific and Cultural Organization's

[7] KRG, 2009, p.6.

(UNESCO's) reports about education in Iraq; the KRI's Ministry of Planning statistical office yearbook; and the governorate profiles of Duhok, Erbil, and Sulaimanyah.[8] We also reviewed media coverage of education by the English-language press in Kurdistan. In addition, we extensively reviewed the literature in both industrialized and developing countries to assist us in identifying actions and best practices for addressing the implementation, access, and educational quality issues we identified.

Documents and Secondary Data

To develop an understanding of the context and the status of education in the KRI, we gathered and reviewed relevant documents and data from the MOE, including legislative documents, directives, curriculum materials, and test scores from the national grade 8 and 9 exam. The test scores were used to analyze student achievement by academic subject.

In addition, we obtained copies of the 2007 IHSES and the 2007–08 MOE annual survey of schools. These data were used to provide much of the descriptive information on students, schools, and teachers contained in Chapter Two. The MOE's Office of Statistics also provided historical data on enrollment by grade and gender, number of schools and teachers, and investment in new school facilities.

On-Site Interviews

The RAND team made multiple trips to Kurdistan between February 2010 and February 2011, spending a total of six weeks in the region. We used these trips to conduct some 36 interviews with all of the directors general at the MOE; staff at the governorates of Erbil; the heads of the education districts of Duhok, Erbil, and Sulaimanyah; the deans of three teacher colleges; and experienced supervisors in mathematics, science, and English. The interviews were confidential and focused primarily on gathering information about the perceived strengths and weaknesses of the current education system, the status of reform implementation, and ideas for improvement. Although some of the interviews were conducted in English, most were conducted in Kurdish using translators.

School Visits and Observations

RAND staff visited 16 KRI schools with a range of characteristics. These schools had various levels—grades 1–6, 7–9, 1–9, and 10–12—and were located in all three governorates, urban and rural areas, and a variety of socio-economic neighborhoods. Some schools were old, and some were new. During these school visits, we interviewed the principal, conducted focus groups of three to ten teachers, and toured the facilities guided by the principal. Occasionally, we observed classroom teaching.

The visits provided information on the physical characteristics and conditions of the schools, on classroom physical setup and class sizes, and levels of student-and-teacher interactions. Interviews with principals and focus groups with teachers provided information about strengths and weaknesses of the new curriculum and other reforms, teacher preparation and ability to teach the content and cover the full curriculum, and potential ways to better prepare and support teachers in the classroom.

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[8] UNESCO, 2004; KRG, 2008, 2010a, 2010b, and 2010c.

Teacher Survey

We designed and conducted a survey of 2,904 teachers in 226 schools randomly selected in proportion to enrollment in each of 11 randomly selected districts. The sample covers each of the governorates, urban and rural schools, and primary, intermediate, and secondary levels of education. Responses were weighted to reflect the teacher population by level and governorate. The primary purpose of the survey was to assist in determining the training needs of existing teachers. The survey asked about teachers' education, academic subjects taught, adequacy of preparation for using various instructional materials and instructional methods, priority for training, feedback received on instruction (including supervisory feedback), ability to teach and cover the new curriculum, and perception of student preparation for the new curriculum. RAND designed the sampling strategy and the survey instruments; the Office of Statistics in the DG of Planning fielded the survey and entered the data.

Modeling

The RAND team developed and ran a student-flow model to estimate future student enrollment in basic and secondary education under various assumptions of population growth, speed with which newly established compulsory attendance might increase in grades 7–9, and speed with which gender equalization might increase over time.

GIS Mapping

The RAND team used GIS mapping to display the geographical distribution of schools and other data across the KRI's directorates and districts.

Three Strategic Goals for Improving K–12 Education in the Kurdistan Region—Iraq

Our evaluation of the current conditions of K–12 education in Kurdistan identified three sets of problems, which, in turn, pointed to three principal strategic goals for improvement over the next decade or so:

- Expand school capacity to meet expected rapidly increasing student enrollment.
- Improve the quality of instruction.
- Strengthen stakeholders' incentives and accountability.

For each of these goals, we developed a range of specific measures that the KRG could implement; we present these in detail in the chapters that follow.

Expanding School Capacity to Meet Expected Rapidly Increasing Student Enrollment

As a result of the increase in the birth rate and the KRG's commitment to universal basic education for both boys and girls, enrollment in KRI schools is projected to increase by anywhere from 69,000 to 111,000 students annually over the next decade or so.[9]

[9] This broad range of estimates reflects various assumptions about growth in the number of annual births, enrollment of girls toward gender parity, and the continuation rate from grades 6 to 9.

Our analysis showed that existing facilities and teachers in KRI cannot meet this rapidly increasing demand. Nor is the output of new teacher-college graduates enough to close the gap if that output stays at the current level. This issue involves how to make full use of the system's existing capacity—classrooms, school buildings, and teachers—as well as how to expand it to meet the expected growth in student enrollment over the next decade.

Improving the Quality of Instruction

The KRG's new curriculum places unprecedented demands on teachers: They are now required both to master new subject matter (for example, in science, mathematics, and English) and to change their instructional methods. While up to 60 percent of them have received some training on the new curriculum, it has been insufficient. New teachers being educated in the teacher colleges also receive minimal instruction on the new curriculum and instructional methods, and get little practical experience. Further complicating the matter is a shortage of mathematics, science, and English teachers, which has led to many practicing teachers having to teach subjects in which they have no training at all.

Insufficient instructional time is a second issue. Teachers do not have enough hours in the school day to fully cover the new curriculum. This problem is exacerbated by a shortage of school buildings that has required many schools to teach in shifts, further reducing instructional time in classes.

Finally, the current system offers few opportunities to cultivate the high-performing students who could be tomorrow's KRI leaders. Instead, with a very limited number of exceptions, all students in the KRI—regardless of their ability—are assigned to the same type of school and follow the same curriculum.

This issue involves pursuing three paths to providing higher-quality education to Kurdistan's students: (1) improve teacher training, (2) increase instructional time sufficiently to enable teachers to cover the full curriculum, and (3) provide specialized learning opportunities for high-performing students.

Strengthening Stakeholders' Incentives and Accountability

Incentives deal with the motivation of stakeholders in the KRG education system, such as principals, teachers, students, and parents. Accountability involves influencing principal and teacher performance in the classroom. It also involves the ability of students and parents to influence educational objectives, policies, and the allocation of resources in order to improve overall educational outcomes.[10]

In the current KRG education system, both incentives and accountability are weak at all levels. Assigned on the basis of a placement test rather than by choice, students entering the teaching profession are among the test's lowest scorers and often not on the path voluntarily. Criteria for evaluating teacher performance are vague and not tied to promotion. The system has no measures in place to recognize the better teachers and principals. With regard to principals, they have limited input into teacher evaluation and no say at all in the assignment of teachers to their schools. They also receive no data that would allow them to compare their students' performance with that of students in other schools or to track trends in their school's

[10] World Bank, 2008; Shutz, West, and Wossman, 2007.

performance over time. Supervisors are required to both evaluate and train teachers, creating a potential conflict of interest. Finally, parental and public participation in education is minimal.

Resolution of this issue entails finding ways to better motivate the system's diverse stakeholders and to hold schools and school personnel more accountable for their performance.

Order of Priority for Implementation

Our analysis indicated that the KRG should make these three strategic goals—expand school capacity to meet expected rapidly increasing student enrollment; improve the quality of instruction; strengthen stakeholders' incentives and accountability—a priority over the next decade or so. But attempting to address numerous educational issues with limited resources will require the KRG to prioritize the needed improvements over time. Prioritization will also be important to avoid overwhelming the staff called upon to implement recommended changes.

Attention must first be given to expanding the capacity of the basic education system (grades 1–9) to meet the new demand. Because the resources required to build the needed new classrooms and schools are expected to be large, meeting this goal may leave few resources to meet other demands. Expanding capacity cannot be finished in the short term; it will need to be an ongoing activity.

Upgrading teacher training—part of improving the quality of instruction—should also be given immediate attention, but should similarly be expected to be an ongoing effort. Our multiple recommendations in this area may be implemented over time without negative effects.

Our other two recommendations for improving the quality of instruction—increasing instructional time and expanding learning opportunities for high performers—and the third principal strategic goal, strengthening accountability and incentives, can all be started later and implemented over time.

The exact time span over which our recommended improvements may be implemented—both across the three main strategic priorities and within each one—will depend on the amount of resources made available, the length of time required for implementation, and the capacity of leadership and staff to implement multiple improvements simultaneously. The costs of initiatives, in comparison with their levels of education performance, should also guide this prioritizing process.

Limitations

A short-term study of this large scope inevitably has several limitations. First, we aimed at providing practical advice in implementing and furthering reforms of K–12 education that the KRG's MOE had already begun implementing; we did not set out to redesign the education system. We believed this incremental approach would be more likely to succeed than would a complete restructuring at this time.

Second, as comprehensive as we sought to be, we did not address two potentially important issues that will need attention in the future. One concerns preparation for work. In recent times, the KRI has focused on and emphasized preparation for post-secondary education. To support the expansion and diversification of the economy, more attention will have to be paid to developing a way to prepare the majority of students for work, since they will not continue

on to secondary or post-secondary education. Currently, only a small minority of students receives some form of vocational education. A second issue concerns the efficiency and effectiveness of the system's management and operations. Currently, decisionmaking, management, and accountability for basic and secondary education is highly centralized, with even minute details handled at the ministerial level. As the system expands and additional changes are implemented, ways to provide a more efficient and effective decisionmaking and administrative structure should be explored. We discuss these two issues further in Chapter Seven.

A final limitation of this study concerns implementation of our recommendations. To the extent feasible, we have discussed the pros and cons of our recommendations in terms of effects on access to and quality of education. But, by and large, we did not address the political, financial, managerial, and other implications of our recommendations. In Chapter Six, we propose a process by which these issues can be identified and addressed and a plan of implementation developed for each of our recommendations.

Outline of the Report

In Chapter Two, we provide a quantitative description of the status of the KRI's K–12 education system. The next three chapters then cover the three principal strategic goals in turn. The first of these, Chapter Three, focuses on expanding capacity. We present the circumstances that make this one of the KRI's most pressing needs, along with our recommendations for filling the gap between supply and demand. Chapter 4 then takes a similar approach to discussing the goal of improving the quality of instruction. This chapter is organized into three parts, in line with our three main recommendations for achieving this goal: upgrading the training of teachers, increasing instructional time, and expanding learning opportunities for high performers. Each part is preceded by a discussion of the issues that the recommendations are designed to address. Chapter Five then discusses the goal of strengthening stakeholders' incentives and accountability.

Chapter Six provides a framework for organizing the implementation of our recommendations. The Afterword, which ends the main portion of the report, briefly discusses two longer-term issues that will need the attention of the KRG and the MOE in years to come. Following the Afterword are four appendices containing related materials: The first presents a tool for forecasting the demand for primary, middle, and secondary education in Kurdistan; the second contains the distribution of out-of-school students by sub-district; the third presents an analysis of alternatives for school construction; the fourth offers data on the number of new classrooms needed.

CHAPTER TWO

The Current K–12 Education System in the Kurdistan Region—Iraq

In this chapter, we describe the KRI's K–12 education system and explain how it works. We begin with trends in student enrollment, followed by school capacity and the availability of basic services. We then turn to the characteristics of the teacher force, along with the new curriculum (which the MOE has been introducing incrementally since the 2008–09 school year) and teaching methods. We next briefly outline funding, describe the structure of the administration and decisionmaking authority, and present existing mechanisms for accountability and incentives. We conclude with a description of the K–12 system's overall performance in recent years.

A great deal of the data in this chapter is for the 2007–08 school year (unless otherwise noted), because that is the most recent year for which information on all KRI schools is available in digital form. As such, these data precede the implementation of the reforms that resulted from the MOE's 2007 conference (discussed in Chapter One).

Student Enrollment

Student Enrollment Grew Rapidly

The number of students in the KRI's education system grew by 31 percent over the five academic years from 2004–05 to 2009–10 (Figure 2.1). In absolute numbers, this means that 67,000 new students entered the system annually during this period.[1]

The largest growth was in the primary grades (1–6).[2] In 2004–05, 675,000 Kurdish students were enrolled in primary school (Figure 2.2). By 2009–10, that number had grown to 813,000 students, at an average of 28,000 new students per year. This amounts to an average annual growth of 4.1 percent.

Growth in enrollment took place at a faster pace in grades 7–9 than in the primary grades—at an annual average of 4.9 percent over this five-year period. The number of students enrolled increased from 254,000 students in 2004–05 to just more than 316,000 students in 2009–10. But the rate of growth in this group slowed significantly starting in 2006–07, falling to about 2.9 percent annually as of 2009–10.

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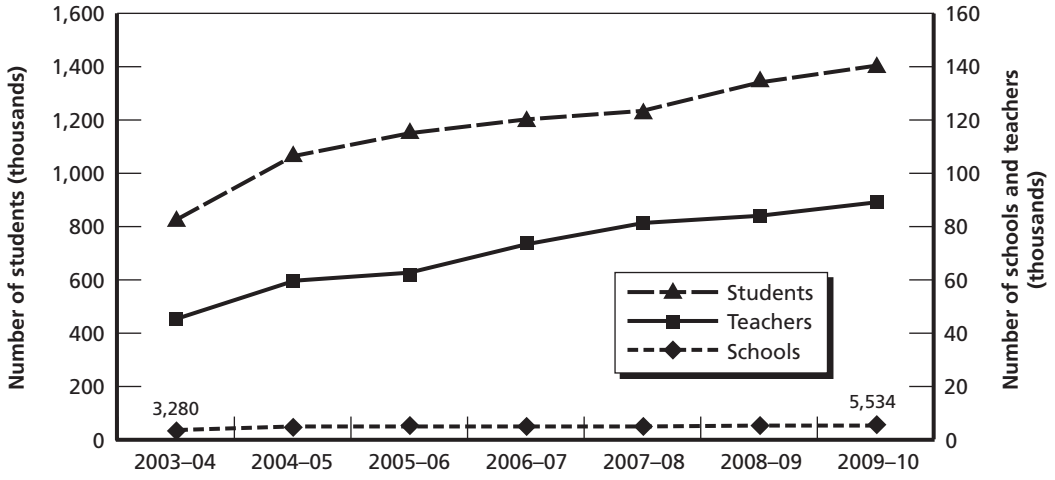
[1] 2004-05 was the first year for which there were reliable and consistently collected data.

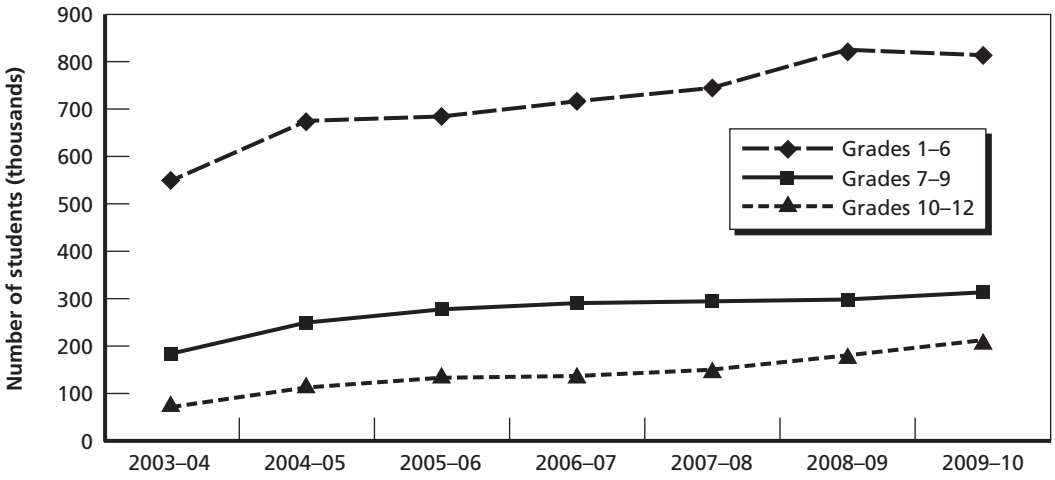
[2] Recall that the system was restructured as two levels (basic: grades 1–9, and secondary: 10–12) in the 2008–09 school year. Before that, there were three levels (primary, intermediate, and secondary), and by and large, the schools continue to function as they did prior to restructuring.

Figure 2.1
Growth in Number of Students, Schools, and Teachers, 2003–04 to 2009–10



SOURCE: RAND, based on Ministry of Education's Office of Statistics student data, 2003–04 to 2009–10.
RAND *MG1140-2.1*

Figure 2.2
Student Enrollment Growth, by Level of Education, 2003–04 to 2009–10



SOURCE: RAND, based on Ministry of Education's Office of Statistics student data, 2003–04 to 2009–10.
RAND *MG1140-2.2*

Enrollment grew most rapidly in the secondary grades (10–12). Although secondary education continues to be voluntary, the growth in enrollment among this group of students occurred more than twice as fast as in the compulsory primary and intermediate grades—an annual average of 13.8 percent. Whereas there were 129,000 students enrolled in grades 10–12 in 2003–04, by 2009–10, the number was 218,000. Two factors may have contributed to this disproportionate growth. One is the discontinued use of the grade 9 national exam as a gateway to secondary education, eliminating a limitation on the number of students continuing beyond grade 9. The second factor is the rapid growth in the supply of the post-secondary

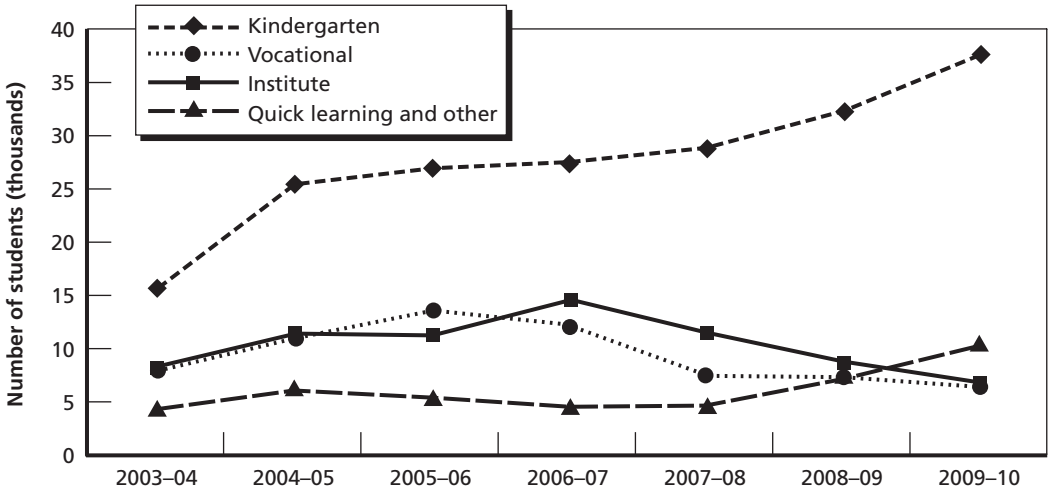
capacity that was noted in Chapter One and that may be an incentive for students who can now aspire to a post-graduate education.

Kindergarten enrollment also increased steeply. The number of Kurdish kindergarten students grew by 50 percent over a five-year period, as the MOE put emphasis on making schools for this grade level more available. Around 25,000 students were enrolled in 2004–05; 37,500 were enrolled in 2009–10 (Figure 2.3).

Enrollment in quick learning schools, which focus on providing literacy education to adults, remained steady from 2004–05 to 2007–08 at around 5,000 enrollees, but doubled over the next two years to around 10,000 participants. In contrast, enrollment in the teacher preparation institutes saw a steady decline beginning in 2006–07, from approximately 15,000 down to 6,000 enrollees. These institutes are being closed as their students graduate because of the KRG's new policy requiring that future teachers graduate with a bachelor's degree from four-year basic teacher colleges rather than from the two-year school teacher institutes.

The steepest decline in student enrollment was experienced by vocational education schools, which instruct some students in grades 10–12. In 2005–06, there were fewer than 15,000 students enrolled in these schools, and that number declined to just 6,000 by 2009–10. Our interviews with personnel in the vocational schools suggest that this may be attributed to a number of factors, including the difficulty vocational graduates have finding jobs because of a mismatch between the skills they acquire in school and the demand for skills in the job market, the difficulty vocational school graduates have getting admitted into university, and the lower prestige of vocational education compared with secondary school or preparatory education. In the past, some students were tracked to vocational schools, but that practice has been abandoned.

Figure 2.3
Student Enrollment Growth in Kindergarten, Quick Learning, and Vocational Schools and in Institutes, 2003–04 to 2009–10



SOURCE: RAND, based on Ministry of Education's Office of Statistics student data, 2003–04 to 2009–10.
RAND *MG1140-2.3*

Gross Enrollment Was Higher Than Net Enrollment, Particularly in the Upper Grades

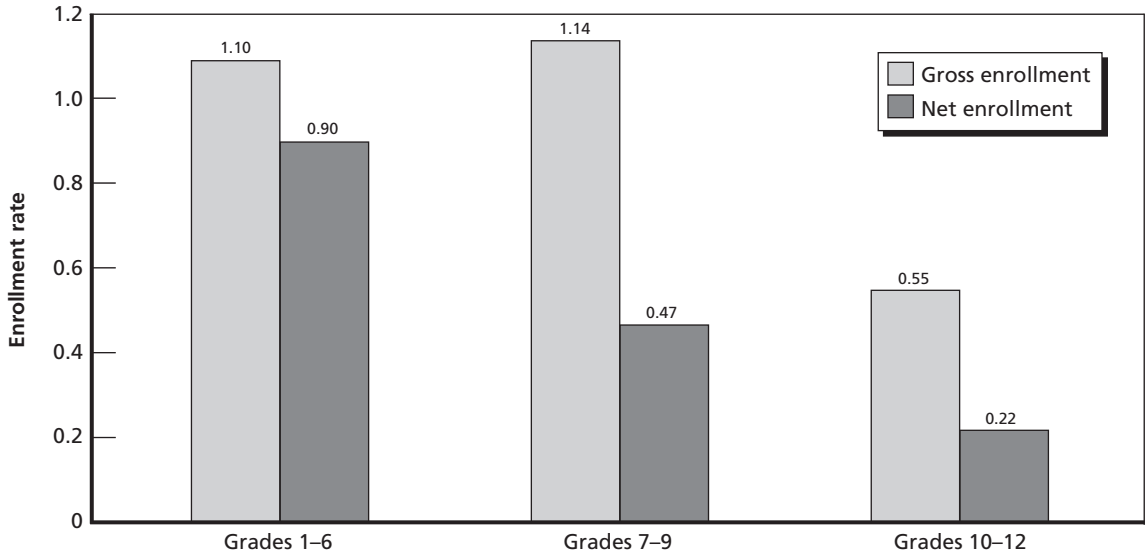
Gross and net enrollment ratios are two important measures of progress toward universal education. Gross enrollment is the total number of students enrolled in particular grades, including students not of the age group typically served by those grades. Net enrollment includes all students enrolled in certain grades who are in the age group appropriate for those grades.

In 2008, Kurdistan achieved near universal education in the primary grades, with little disparity between gross and net enrollment. Net enrollment in grades 1–6 reached 0.90, which means about 90 percent of children in the age group served by those grades were actually enrolled in those grades.[3] About two-thirds of the children who were not in primary school as they should have been were simply not enrolled, and the other third were children who had delayed their entry into the primary grades (i.e., entered at age 7 or later, rather than age 6).

Gross enrollment was somewhat higher, at 1.10 (Figure 2.4). This means that more students were enrolled in grades 1–6 than there were children in the corresponding age group.[4] This was primarily due to students in the age group 12 to 14 who were repeating grades and, secondarily, to students who started school late.

The gap between gross and net enrollment was much wider in grades 7–9 than 1–6. Net enrollment in grades 7–9 in 2007–08 was 0.47—much lower than in grades 1–6. This means that about half the students in the appropriate age group attended intermediate school that year. Gross enrollment, at 1.14, was much higher, however. This indicates that more than

Figure 2.4
Gross and Net Enrollment, by Grade Level, 2007–08



SOURCE: IHSES, 2007.
RAND *MG1140-2.4*

[3] Net enrollment for grades 1–6 is the number of students age 6–12 attending school, divided by the number of all children aged 6–12.

[4] Gross enrollment for grades 1–6 is the total number of students in those grades, divided by the total number of children age 6–12.

half of students in grades 7–9 were older than the corresponding age group. Reasons for this are similar to the reasons for a higher gross than net enrollment in grades 1–6.

Both gross and net enrollments were lowest in grades 10–12. Only about 20 percent of students in the corresponding age group of 16 to 18 attended school in the 2007–08 academic year (i.e., net enrollment). Gross enrollment was a little more than double that (0.55), with about half of the students in these grades older than the appropriate age group.

In the Upper Grades, the Share of Children Enrolled in Urban Schools Was Larger Than the Share Enrolled in Rural Schools

Figure 2.5 shows that approximately the same proportion of children attended primary school in urban and in rural areas in the 2007–08 school year. This was not true for intermediate school, in which many more children were enrolled in urban areas than in rural areas. There was also a difference at the secondary-school level.

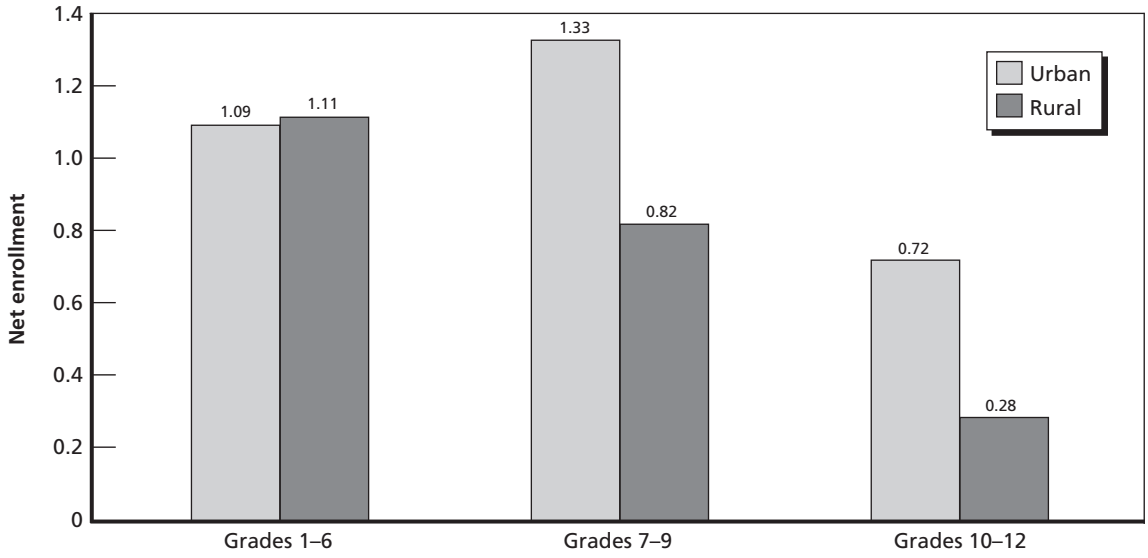
Youths were more likely not to be in school in rural than in urban areas because of supply constraints—no available school, economic reasons (cannot afford, or work for family)—or because parents were not interested. Otherwise, youths in both areas were just as likely not to attend school because of not being interested or being disabled (IHSES, 2007).

Girls Were Less Likely Than Boys to Be Enrolled

Gender parity is measured by the ratio of the number of boys to the number of girls enrolled in school. A smaller enrollment ratio of boys to girls means higher gender parity.

In the KRI, more boys than girls are enrolled in school. But gender parity somewhat increased over the five year period, at least at the primary level (Figure 2.6). In 2004–05, the

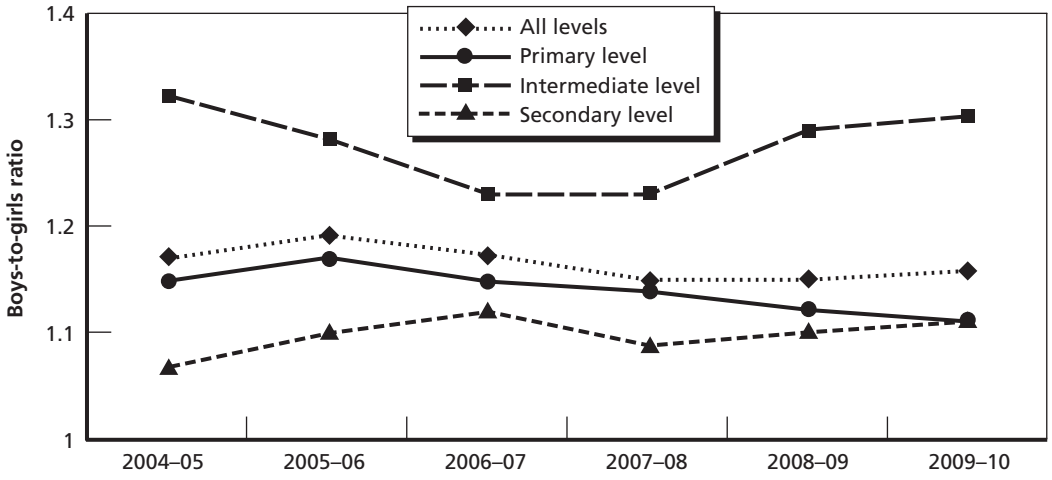
Figure 2.5
Gross Enrollment, by Urbanicity and Grade Level, 2007–08



SOURCE: IHSES, 2007.

RAND *MG1140-2.5*

Figure 2.6
Boys-to-Girls Student Ratios, by Grade Level, 2004–05 to 2009–10



SOURCE: RAND, based on Ministry of Education's Office of Statistics student data, 2004–05 to 2009–10.
RAND *MG1140-2.6*

ratio of boys to girls in grades 1–6 was just over 1.15. But it had decreased to 1.11 by 2009–10. This ratio is slightly larger than the Middle East regional average: 1.06.

In the upper grades, the ratio remained relatively constant over these five years, with some year-to-year fluctuations. It was about 1.30 at the intermediate level and 1.10 at the secondary level. The Middle East regional average in intermediate and secondary schools is 1.04.[5]

The differences in enrollment between boys and girls in the KRI may be due to several factors. The higher gender ratio in the intermediate grades may signal a greater propensity for girls to drop out of school after grade 6. While girls and boys age 6–11 were as likely to be enrolled in school in 2007–08 (93 and 94 percent, respectively), girls age 12–14 were much less likely to be enrolled than boys of the same age (80 vs. 90 percent).[6] At age 15–17, girls are even less likely than boys to be enrolled (63 vs. 75 percent).

Reasons for staying out of school were generally similar for boys and girls age 12–17. Fifty to 60 percent of both boys and girls stayed out of school because of supply constraints (either there was no school or no transportation available), economic constraints (could not afford to go to school, or was working), or lack of interest in continuing his/her education (Table 2.1). Beyond these reasons, girls were more likely than boys to not attend school because parents were not interested. Interviews with MOE and school officials also suggest that parents are more likely to send sons rather than daughters to school, especially in rural areas where schools are farther away. Finally, boys were more likely not to attend school because of disability or disease, most likely as a result of the many years of fighting and deprivation.

5 World Bank, 2008.

6 IHSES, 2007.

Table 2.1
Percentage of Youths Not in School, by Age Group, Gender, and Reason, 2007

	Youths Not in School (%)			
	Age 12–14		Age 15–17	
Reason	Male	Female	Male	Female
Supply constraints	9	11	15	16
Economic constraints	20	18	24	20
Family not interested	4	33	8	20
Youth not interested	20	17	22	19
Disability or disease	23	9	18	4
Other	24	12	13	21
Total	100	100	100	100

SOURCE: IHSES, 2007.

School Capacity

KRI Schools Were Either Single Shift or Multiple Shift, or Shared a Building

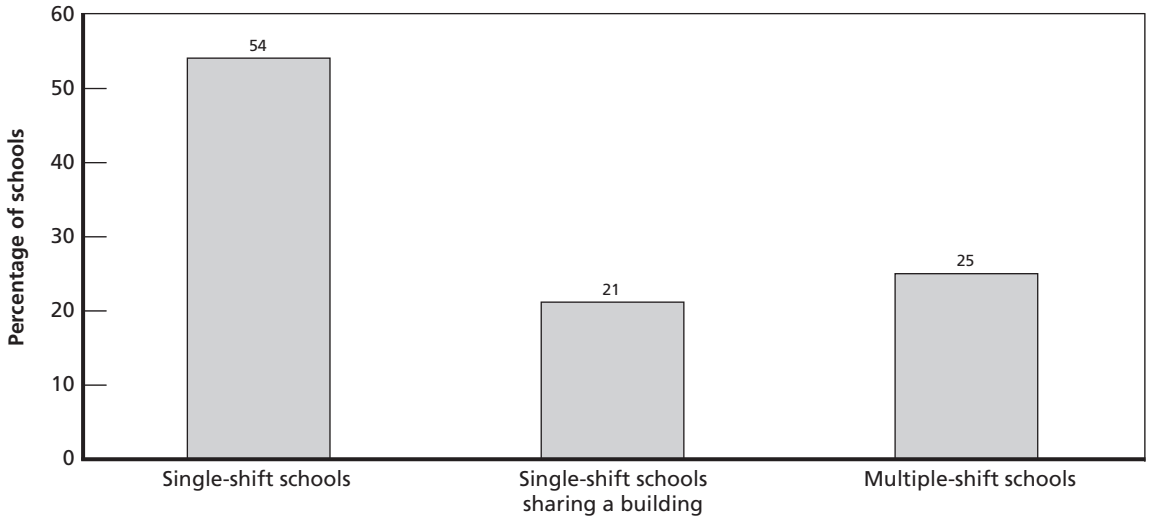
The growth in the number of schools was not as rapid as the growth in student enrollment between 2003–04 and 2009–10. From 2003–04 to 2004–05, the number of schools increased steeply, from just fewer than 4,000 to 4,750. But after that, growth slowed to an average of about 155 new schools[7] per year. There were around 5,500 schools in the KRI in 2009–10.

Because the number of new schools did not keep pace with the growth in enrollment, many schools have had to implement two or more shifts, and some schools have had to begin sharing a building with another school. As of 2007–08, 25 percent of schools in the KRI offered two or more shifts during the day, while 21 percent shared a building with another school (Figure 2.7). The remaining 54 percent were single-shift schools not sharing a building. One can expect that the share of single-shift schools has decreased since that time, as some of them had to convert to multiple shifts.

Multiple-shift schools typically have one session in the morning with one set of students and one session in the afternoon with another set of students, although a few schools may also have a session in the evening. Each session is four hours instead of the five hours per session in single-shift schools. The morning and afternoon sessions operate as quasi different schools, with different teachers, although the principal may or may not be the same for both sessions. Similarly, schools that share a building have one session in the morning for one school and one session in the afternoon for the other school. Sessions in this case are also four hours long. Schools sharing a building have different principals and different teachers. Principals and teachers we interviewed in these two types of schools indicated that as a consequence of sharing space, they did not put student or other types of displays on school and classroom walls. Otherwise, they shared everything in the facility, including instructional materials other than individual student textbooks.

[7] All of these "new" schools are not newly constructed schools, but include newly formed schools sharing a building with another school.

Figure 2.7
Distribution of Single- and Multiple-Shift Schools and Schools Sharing a Building in the KRI, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
RAND *MG1140-2.7*

The distribution of the three types of schools differed between urban and rural areas and among grade levels. In 2007–08, 75 percent of rural schools were single shift, as opposed to about 25 percent of urban schools. Within the remaining three-quarters of urban schools, 42 percent were multiple shift and 32 percent shared a building. (See Figure 2.8.)

With regard to grade levels, the majority (about two-thirds) of primary schools were single shift. In contrast, the majority of intermediate and secondary schools were either multiple shift or shared a building with another school.

School Sizes Increased

School sizes grew on average from 224 to 252 students per school between 2004–05 and 2009–10. With an average of 489 students per school, urban schools in 2007–08 were significantly larger than rural schools, with 81 students per school on average. Primary schools, with an average of 204 students, were generally smaller than intermediate schools and secondary schools, which average 334 and 380, respectively.

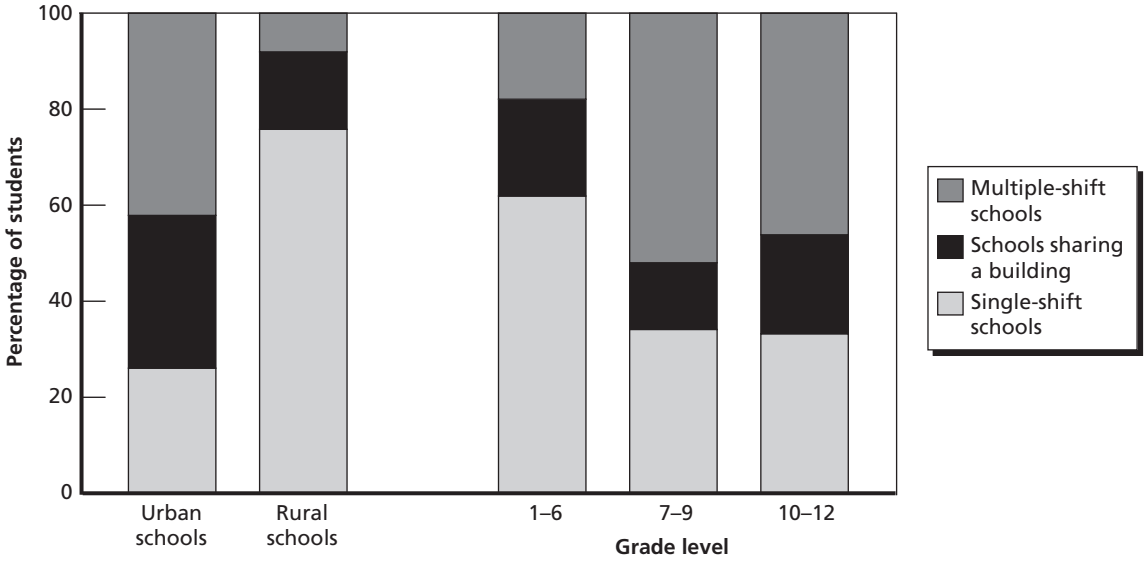
The average size of schools in the KRI is relatively small by international practice. For instance, the average intermediate school size across the 23 countries that participated in the Teaching and Learning International Survey (TALIS) was 489 students in 2009.[8] Norway and Poland were among the countries with the lowest average school size (243 students per school), while Malaysia and Turkey were among the countries with the highest average school size (800 or higher).

Class Sizes Were Large

Classes in the KRI are often overcrowded, especially in urban areas. Eighty-two percent of Kurdish students reside in urban areas. Whereas class sizes varying between 15 and 25 students

[8] OECD, 2009a, Table 2.4.

Figure 2.8
Distribution of Single- and Multiple-Shift Schools and Schools Sharing a Building, by Urbanicity and Grade Level, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
RAND *MG1140-2.8*

are often considered more desirable, urban class sizes in the KRI averaged 42 students. In contrast, class sizes in rural areas averaged 13 students.

Class sizes were also significantly larger in the intermediate and secondary grades than in the primary grades. (See Figure 2.9.)

While average school sizes in the KRI are on the low extreme of international practice, class sizes in the KRI are on the high extreme, especially in urban areas. For instance, in OECD countries, the average class size in secondary schools is 25 students.[9] At the high extreme, no country among the 65 countries that participated in the Programme for International Student Assessment (PISA) exceeded an average of more than 40 students per class in secondary schools. Countries at the high extreme include Jordan (32), Korea (36), and Singapore (35). At the other extreme are countries such as Switzerland (19), Finland (19), and Russia (21).

Availability of Basic Services[10]

Schools in the KRI often lack access to basic amenities such as electricity and potable water.

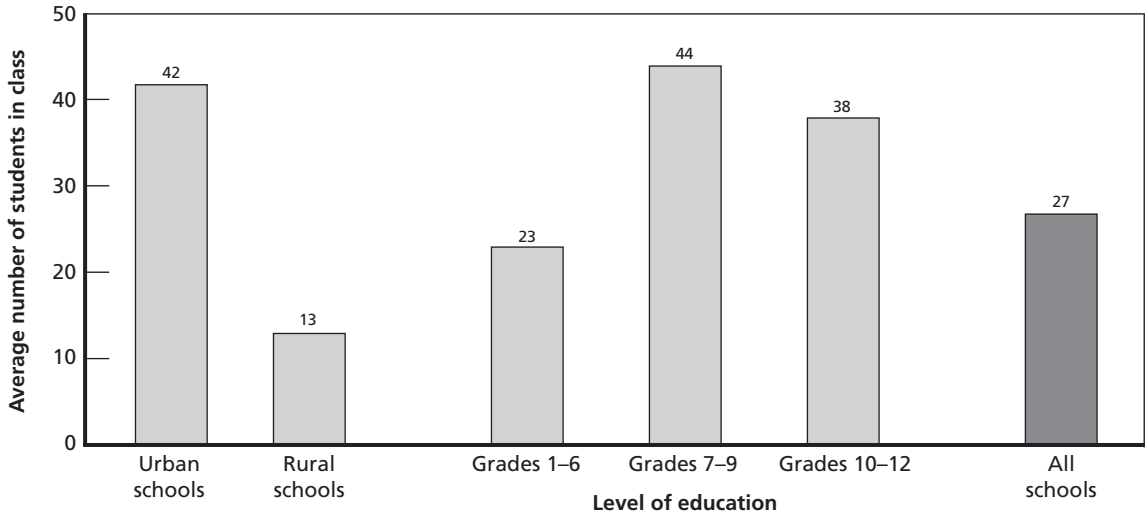
Electricity Was More Commonly Available in Urban Than in Rural Schools

As of 2007–08, approximately 62 percent of urban and 26 percent of rural schools had electricity. Figure 2.10 breaks down the distribution into sub-districts. At one end of the spectrum,

[9] OECD, 2010, Table IV.3.22.

[10] Infrastructure for basic utilities, including electricity, water, and sewage, is not the MOE's responsibility. Infrastructure development, especially for electricity, has been a priority of the KRG.

Figure 2.9
Average Class Size, by Urbanicity and Grade Level, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
NOTE: Eighty percent of schools responded to this item.
RAND *MG1140-2.9*

less than 14 percent of schools had access to electricity in 21 of the sub-districts (or 15 percent). At the other end, 62 percent of schools had access to electricity in 16 sub-districts (or 12 percent). In general, urban sub-districts—such as Sulaimanyah and Erbil Center—had more schools with access to electricity than did rural sub-districts.

The Majority of Urban Schools Had Potable Water

About 91 percent of urban and 62 percent of rural schools had potable water as of the 2007–08 school year. But in 37 of the KRI's 136 sub-districts, less than 57 percent of the schools had potable water. In more than half of the sub-districts, potable water was available in 57 percent to 88 percent of the schools. (See Figure 2.11.)

Access to a Sewage Network Was Much More Common in Urban Schools

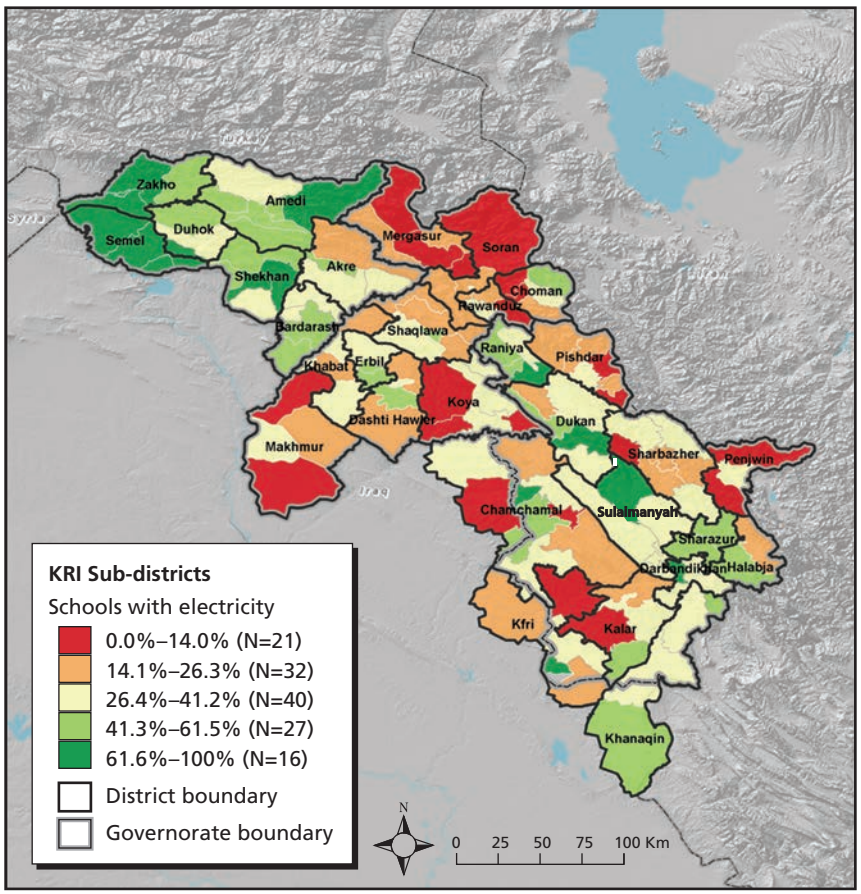
As of 2007–08, about half of rural schools had access to a sewage network; the other half used septic tanks. But in urban areas, nearly 75 percent of schools were linked to a sewage network. The remaining 25 percent relied on septic tank systems.[11]

Teacher Characteristics

Over the five year period, about 6,000 new teachers annually joined the KRI teaching force. In 2004–05, there were approximately 60,000 practicing teachers. This number had increased to 89,000 by 2009–10. In parallel, the teacher-to-student ratio decreased. Where there were 18 students per teacher on average in 2004–05, in 2009–10, there were 15.

[11] Approximately 39 percent of schools responded to this item.

Figure 2.10
Percentage of Schools with Access to Electricity in the KRI, by Sub-District, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
NOTE: Eighty-two percent of schools responded to this item.
RAND *MG1140-2.10*

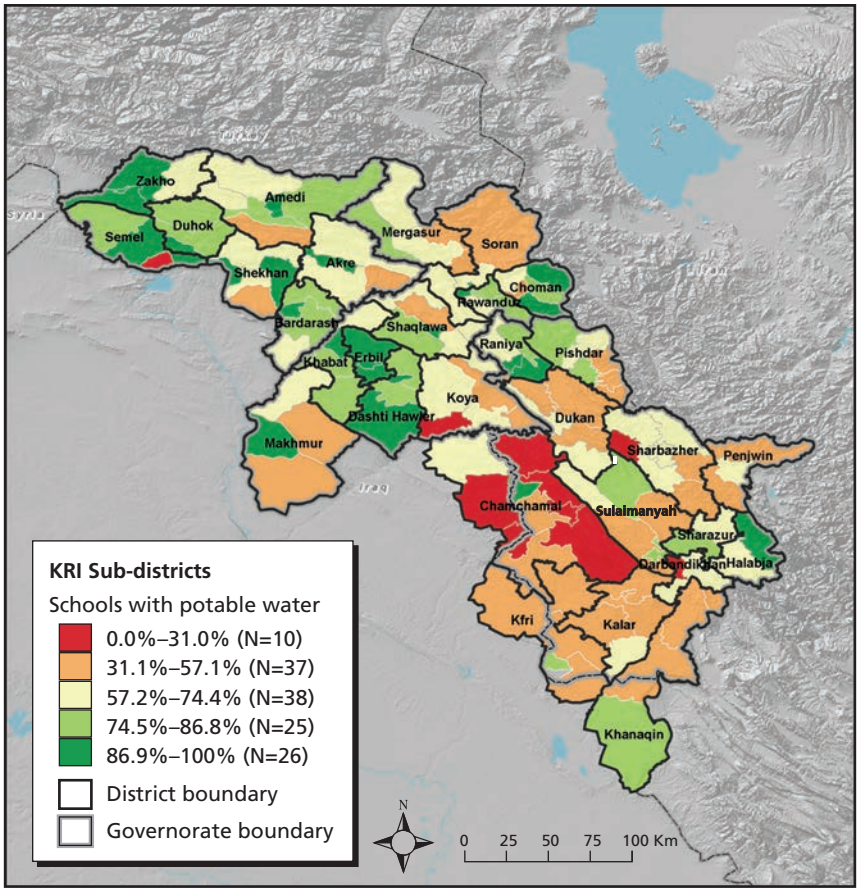
In spite of the very large class sizes in urban areas, the number of students per teacher remained relatively low—at an average of 24 students for each teacher in 2007–08 (Figure 2.12).[12] In rural areas that year, the average was 14 students per teacher. The ratio differed similarly between the primary and upper grades. In primary schools, the average was 14 students per teacher; in intermediate and secondary schools, it was 27 students per teacher.

Practicing Teachers Had Widely Varying Levels of Education

In 2007–08, about half of teachers (54 percent) had a diploma from one of the old teacher institutes, 27 percent had a bachelor's degree, and 18 percent had a preparatory or secondary

[12] That classroom size exceeds the student-teacher ratio suggests that some teachers do not carry a full load, are occupied with administrative tasks, or both. In addition, MOE staff indicated a sizable share of teachers may be on maternity or other leave at any one time. Maternity leave is one year. Given limited resources in the KRG, this issue should be carefully looked at.

Figure 2.11
Percentage of KRI Schools with Potable Water, by Sub-Districts, 2007–08



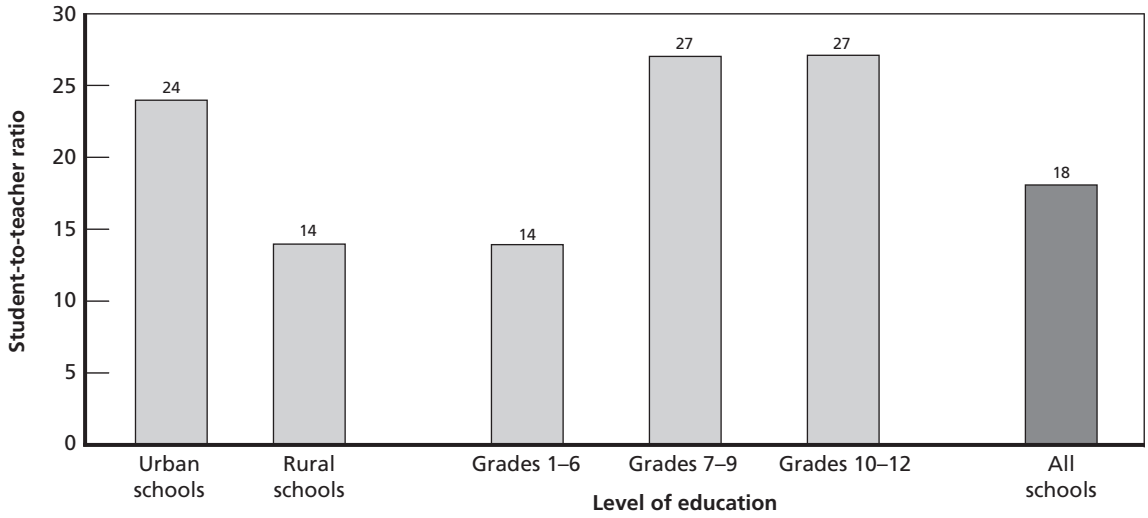
SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
NOTE: Eighty-two percent of schools responded to this item.
RAND *MG1140-2.11*

degree (Figure 2.13). Few primary school teachers—who made up more than 70 percent of the KRI's teaching force—held bachelor's degrees. In contrast, the vast majority of teachers in the upper grades (7–9 and 10–12) held a bachelor's degree.

One of the changes to education policy made in 2008–09 was a new MOE requirement that teachers must have a bachelor's degree to teach at any level. Before that, teacher institutes (administered by the MOE) trained teachers for grades 1–6 in five-year programs. Students could enter a program upon completing grade 9. Secondary-school graduates could also attend a teaching institute, taking a two-year additional training program after completing grade 12 in order to become a primary school teacher.

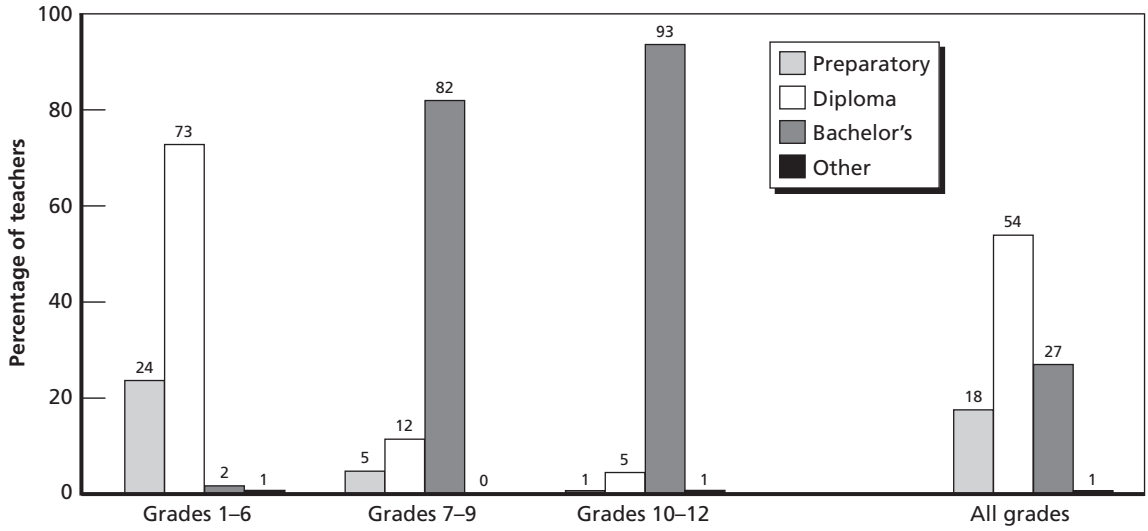
With the new education requirement, the teacher institutes are being phased out and replaced by teacher colleges that train teachers for grades 1 through 9. These teacher colleges are administered by the Ministry of Higher Education rather than the MOE. However, the computer, physical education and arts institutes continue to operate as before. Teachers for grades 10 through 12 continue to be recruited from the pool of graduates from education colleges and other programs at the KRI's universities.

Figure 2.12
Student-to-Teacher Ratio, by Urbanicity and Grade Level, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
NOTE: Ninety-five percent of schools responded to this item.
RAND *MG1140-2.12*

Figure 2.13
Education Level of KRI Teachers, by Grade and Total, 2007–08

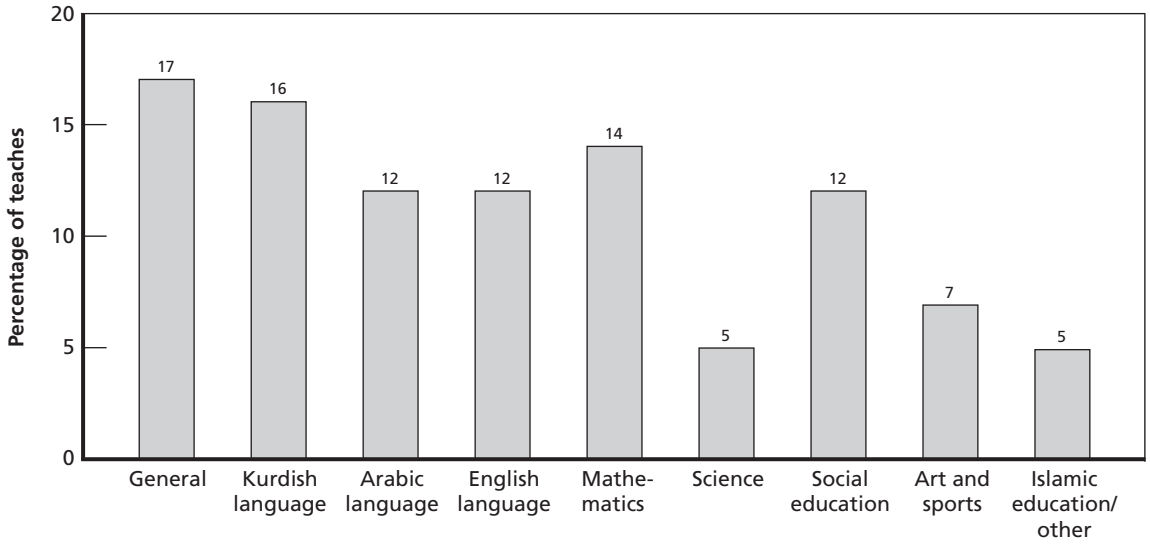


SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
RAND *MG1140-2.13*

KRI Teachers Had Specializations in Which They Were Supposed to Teach in All Grades

In 2007–08, about 17 percent of primary teachers specialized in general studies (Figure 2.14). About the same number of teachers specialized in other areas: Kurdish, 16 percent; Arabic, 12 percent; English, 12 percent; mathematics, 14 percent; and social education (i.e., social and

Figure 2.14
Academic Specializations of Primary Teachers, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
RAND *MG1140-2.14*

behavioral science), 12 percent. Approximately 5 percent of teachers specialized in sciences, and 7 percent in art and sports.

New Curriculum and Teaching Practices

The Old Curriculum Has Been Replaced with a More Challenging and Current One

A new curriculum in KRI schools was introduced in the 2008–09 school year. It greatly emphasizes languages, especially Kurdish and English, in all grades. English is now taught starting in grade 1; Arabic, starting in grade 4. One-third or more of total weekly units are devoted to languages units. Mathematics and the sciences account for another one-third of total units in grades 1–9 and one-half of units in the scientific secondary track. In the literary secondary track, science is replaced by social sciences, including geography, sociology, economics, and history. Four units weekly are devoted to the arts and sports, and two units weekly to Islamic education. (See Table 2.2.)

Within academic subjects, content is based on adapted Kurdish translations of international textbooks for mathematics, science, and English.[13] The new curriculum not only changed the content, but also upgraded the level of difficulty of what is taught to students, particularly in science, mathematics, Kurdish, and English instruction.

[13] The MOE uses adapted Kurdish translations of Harcourt and Macmillan textbooks for mathematics, the sciences, and English.

Table 2.2
Curriculum Units, by Grade Level and Academic Subject

	Grade Level				
				10–12	
Academic Subject	1–3	4–5	7–9	Literature	Scientific
Languages					
Kurdish language	10	5	4	4	4
English	3	5	5	5	5
Arabic	0	4	4	4	4
Math/sciences					
Math/computer	6	6	7	5	7
Sciences	5	5	6	0	12
Other					
Social sciences	0	4	4	11	0
Islamic education	2	2	2	2	1
Arts/sports	5	4	4	4	2
Vocational education	0	0	2	0	0
Total units	31	35	38	35	35

SOURCE: KRG MOE.

New Policy Calls upon Teachers to Change Their Methods

At the same time, new education policy encourages teachers to adopt different methods of teaching. There is a mandate, for example, to move away from lecture-based instructional methods to student-centered instructional practices. Teachers are also being asked to adapt instruction to individual students. The thinking is that this will close "the gaps between the students' level of understanding and engage them more effectively."[14]

Instructional Time

KRI schools are in session for six days per week, for 170 days per year. Instructional time varies according to grade level and according to how many shifts operate in the school. KRI single-shift schools in grades 1–6 offer 693 hours of instructional time per year, and KRI double-shift schools in the same grades offer 539 hours of instructional time per year. Both of these amounts are less than the OECD average of 794 hours per year for these grades. Similarly, in grades 7–9, KRI single-shift schools offer 765 hours of instructional time, and double-shift schools offer 595 hours of instructional time—both less than the OECD average of 892 hours per year for these grades.

The new curriculum—based on translations of international textbooks—was designed for greater amounts of instructional time.

In addition, the fact that the new curriculum now requires students to study three languages—Kurdish, English, and Arabic—complicates the issue of instructional time. While the reasons for teaching three languages are understandable, the KRI now spends more time on languages at early ages than do most OECD countries. In the early grades, English is limited to three units per week and Arabic to four units. But these two classes still take time

[14] KRG, 2009, p. 35.

that would typically be devoted to students' native language and mathematics (among other subjects).

Opportunities for High-Performing Students

All students in the KRI are assigned to schools on the basis of area of residence and follow the same curriculum, with one exception. Starting in 2001, so-called "typical" schools (similar to magnet schools in certain countries, such as the United States) were established to serve as model schools. Today, there are 30 of these schools; they offer a somewhat more challenging program than the other schools and are attended by a very limited number of students. About 7,000 students are enrolled in the typical schools, which is equivalent to about 1 percent of all students in the KRI. The average size of these schools is about 235 students.

Typical schools include grades 7–12 and are mixed boys and girls. Class sizes are smaller than in other schools, averaging 25 compared to 40 students or more in the same grades. All are single-shift schools, and they provide a somewhat longer daily instructional time of nearly six hours per day rather than the five hours normal for single-shift schools. Nevertheless, the curriculum in typical schools is generally the same as that in other public schools. Instruction is in English in 11 of the 30 typical schools.

Teachers in these schools were said to be selected from the best teachers known to supervisors. Entry to these schools is based half on a student's scores on his/her school's mathematics, sciences, and languages exams and half on a test. Parents in these schools are said to be more involved in the school than are parents in other public schools.

According to our respondents, typical schools were to be discontinued for the school year 2010–11 partly on the ground that all schools should be developed on the model of typical schools and partly because of how difficult it is to resist parents' pressure to have their children assigned to these schools in the face of a limited supply.

School Funding

Public basic to secondary education is entirely funded by the government. Parents pay no fee. Funding for public education in the KRI comes from the KRG budget allocated by the central Iraqi government in Baghdad. The KRI as a whole is allocated 17 percent of the total Iraqi budget, minus funds for central government functions.[15] Out of this, the KRG's Council of Ministers sets the internal budget allocation for education.

The MOE oversees the budgeting process for the K–12 education system. Budgets are first prepared at the district level and then sent to the MOE, which then prepares an overall education budget. This overall proposed budget is sent to the Ministry of Finance, which then decides how much of the proposed budget will actually be allocated.

[15] Interviews with the KRG's Minister of Planning.

Administration and Decisionmaking Authority

Decisionmaking and oversight of education policy in the KRI are highly centralized in the KRG's MOE. This arrangement is not unlike that in many other countries. Through its 12 DGs, the MOE sets the curriculum, designs the national and ministerial exams, hires and assigns teachers and principals to schools, provides professional development, sets the criteria for teacher and principal evaluation, designs schools, and (for the most part) determines where schools are to be built and which ones are to be upgraded. However, since the policy changes of 2008–09, the MOE no longer sets the curriculum and eligibility standards for training new teachers. These responsibilities now fall under the purview of the Ministry of Higher Education.

The KRG's MOE is autonomous and independent of Iraq's Ministry of Education in Baghdad. While the two ministries coordinate, the KRG's MOE has been more active than its counterpart in implementing education reforms.[16] There are 33 school districts of various sizes in the three governorates of Duhok, Erbil, and Sulaimanyah. These school districts administer the implementation of reforms in the more than 5,500 schools throughout the KRI. The districts also oversee the administration of all schools.

The MOE assigns teachers to schools, but school principals are responsible for assigning teachers to classrooms. Principals also organize the class schedules in their schools, deal with students and parents, organize the administrative aspects of the school, and deal with the district about supplies and other needs. Principals are not expected to be instructional leaders. They have a minimal role in supervising and assessing the performance of teachers and providing guidance on teaching methods. Their role is mainly administrative.

Accountability and Incentives Arrangements

The MOE holds KRI schools accountable for compliance with MOE directives and implementation of the curriculum through a cadre of about 830 supervisors for basic education (grades 1–9). These supervisors oversee more than 4,700 basic schools and 70,000 teachers in these schools. The number of teachers supervised by a single supervisor varies by academic discipline, from a low of 60 science teachers to a high of 123 English teachers per supervisor. Supervisors are typically experienced teachers with a specialization in a particular subject area; they are selected on the basis of an annual assessment.

Supervisors conduct three annual school visits. The first visit, which takes place at the beginning of the academic year, focuses on

- an overview of the curriculum, textbooks and materials to be used, and any changes from the previous year
- guidance on instructional methods and classroom management
- a reminder of any Ministry-level rules and regulations.

[16] A task force has been formed to reform education in Iraq. It includes various international organizations, such as representatives of the World Bank and the United Nations. The KRG's MOE is also a member. However, the task force had reportedly made little progress as of mid-2010 according to the MOE's DG of Planning.

The second visit, at the end of the first or beginning of the second semester, is a follow up on how teachers are implementing the instructions provided in the first visit. Supervisors check whether teachers are following the curriculum and using the required textbooks and other materials, or examine lesson plans.

The final visit, which occurs toward the end of the school year, is devoted to a formal evaluation of teachers. At this time, supervisors conduct a formal evaluation using a form that rates various indicators on a six-point scale that are then aggregated. Teachers rated as "weak" or "fair" may be required to attend training, usually given by another teacher.

With regard to incentives, salary and promotion are not based on performance. Teachers and other staff are automatically promoted based on seniority; intervention for poor performance, such as mandatory training, is not consistently administered. Authority to dismiss or transfer teachers or other staff rests solely with the MOE, and few, if any, teachers are dismissed for poor performance. Principals have little say in the evaluation of teachers, and even though data on student and school performance are collected annually, those data are not made available to principals or to parents.

Student Performance

The Number of Failing Students Was Relatively High in KRI Schools

In 2007–08, about 25 percent of KRI schools reported that half or more of their students had failed their school's assessment (Figure 2.15). Urban schools had a much higher incidence of failing students than did rural schools: In 49 percent of urban schools, more than half of students failed. In contrast, only 5 percent of rural schools reported more than half of the student body failing.[17] Students in secondary schools were about two times more likely to fail than students in basic schools. In 18 percent of basic schools, more than half of the students failed. But this was true in about 50 percent of secondary schools.

The relatively high incidence of failing students is matched by the large proportion of students who reported in 2007 that they had been held back one or more times at some point in their education. According to students' reports, by age 13 (approximately the end of primary school), half of them had repeated a grade at least once. That proportion increased as students got older: By age 15 (the end of basic school), nearly two-thirds of students had repeated a grade at least once, and 40 percent had repeated a grade twice or more. (See Figure 2.16.) By comparison, about one-third of all students in the United States are estimated to have been retained at least once by the time they reach high school.[18] In the OECD, an average of 13 percent of 15-year old students have repeated one or more grades.[19]

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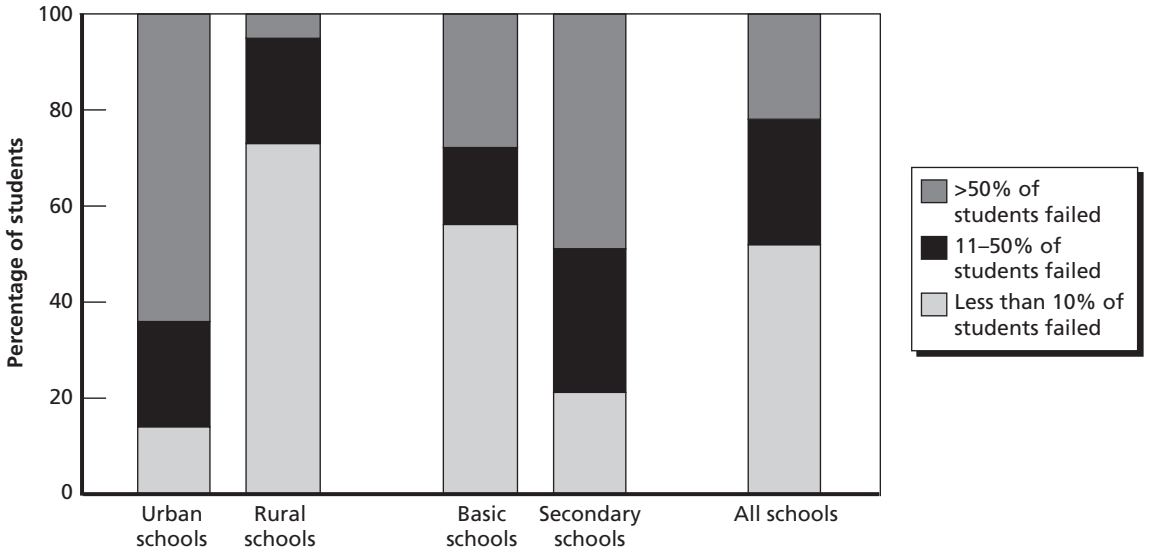
[17] One speculative explanation for this is that teachers in rural schools may be setting the passing standards at a lower level than are teachers in urban schools. End-of-semester exams are developed by a school committee comprising the principal and selected teachers.

[18] McCombs, Kirby, and Mariano, 2009; Nagaoka and Roderick, 2004.

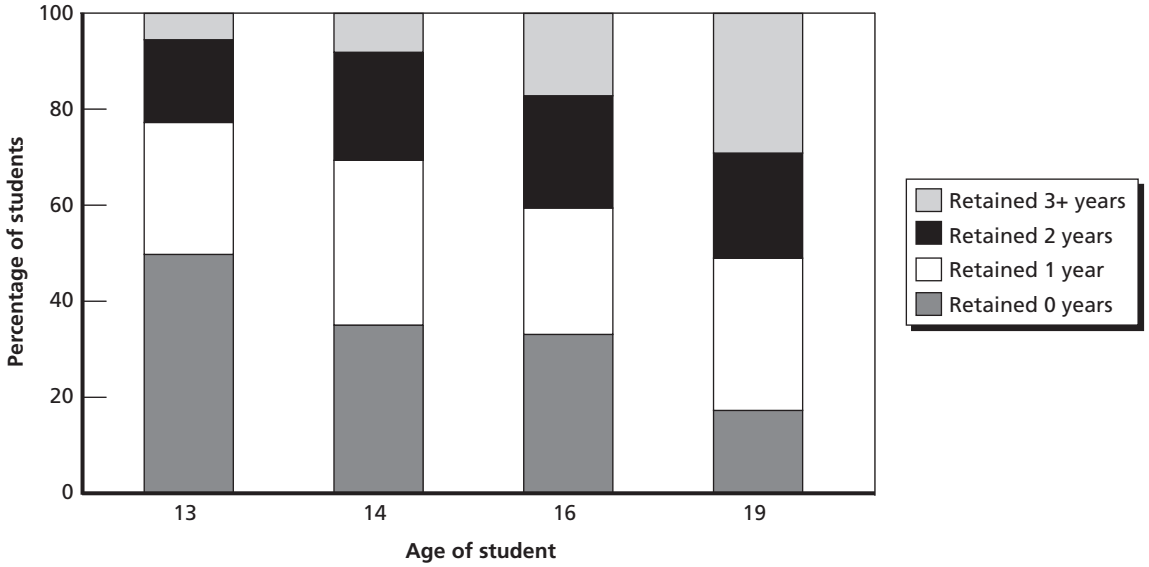
[19] OECD (2010). There is a great deal of variation across countries in repetition rates. Countries with high repetition rates include France and Portugal in the OECD and Tunisia and Brazil, with 35 percent or more of 15-year-old students having repeated at least one grade. Countries with low repetition rates include Finland, Korea, the United Kingdom (UK), and Thailand, with less than 3 percent of 15-year-old students repeating a grade.

Figure 2.15
Percentage of Students Reported to Have Failed the Year, by Location, Grade Level, and Total, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
RAND *MG1140-2.15*

Figure 2.16
Percentage of Students Retained, by Age and Number of Years, 2007



SOURCE: IHSES, 2007.
RAND *MG1140-2.16*

The policy reforms that went into effect in 2008–09 now prohibit students from being retained in grades 1 through 3.

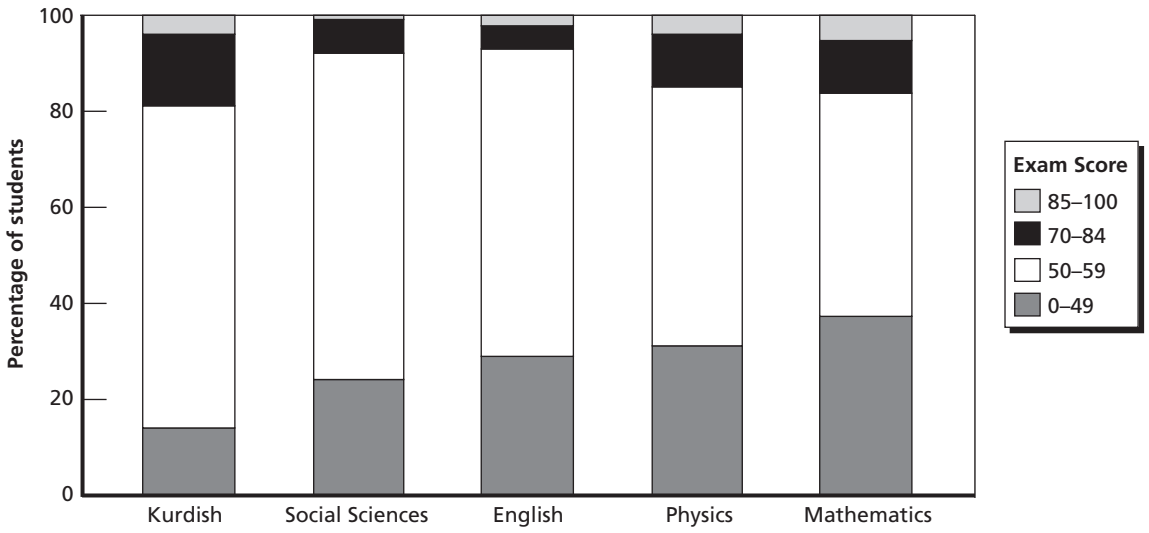
Performance on National Tests Was Below Expectations

Results of the 2008 grade 9 national test suggest that the performance of KRI students is low on the whole, at least relative to the implied standard set by the test. About one-third of students did not pass the English, physics, or mathematics tests, receiving grades of lower than 50 percent (the passing grade). Most of the passing students scored in the lowest passing bracket, with scores of 50 to 69 percent. Less than 5 percent of students scored higher than 85 percent in any of the subjects. (See Figure 2.17.)

These relatively low results could be the result of testing on a new curriculum that both teachers and students are still struggling to implement. They could also be attributed to such problems as low student motivation, poor test-taking skills, or other factors related to classroom instructional practices that would need to be carefully examined.

Currently, the results of the national test cannot be used to gauge the performance of KRI students relative to their peers in other countries. This is because the KRI tests are not benchmarked against international standards, and the KRI does not presently participate in any international tests.

Figure 2.17
Student Achievement on the Grade 9 National Examinations, by Academic Area, 2008–09



SOURCE: RAND, based on Ministry of Education's Office of Assessment data.
RAND *MG1140-2.17*

CHAPTER THREE

Strategic Priority One: Expand Capacity to Meet the Rapidly Growing Demand for Education

Perhaps the most urgent problem facing the KRI's K–12 education system is capacity. To summarize (we presented the background to this problem in detail in Chapter Two), between 2004 and 2010, rates of student enrollment grew rapidly, but the number of new schools being built did not keep pace. At the same time, growth in the total number of teachers was more aligned with growth in enrollment, although the teaching force lacks people with key skills. Today, these accelerated rates of student enrollment show no signs of abating. Indeed, added to expectations of continued growth in the birth rate is the sweeping change in education policy (as of 2008) that requires KRI students to attend school through grade 9 rather than grade 6, as previously. Consequently, enrollment can be expected to continue to grow at least at the same rate—if not an even more accelerated one—in the coming decade.

The problem of capacity is related to new schools and new teachers alike. The KRG will need to increase the supply of both schools and teachers enough to meet the demand created by rapidly growing enrollment. But this may present significant challenges. In this chapter, we look at needs for schools and teachers in turn.

First, we provide estimates of the expected growth in student enrollment under various scenarios, outlining what that growth implies for the number of new schools needed over the next ten years. We also discuss the issue of overcrowded classrooms. We then make recommendations for what the KRG can do to bring classroom capacity in line with the demand for education.

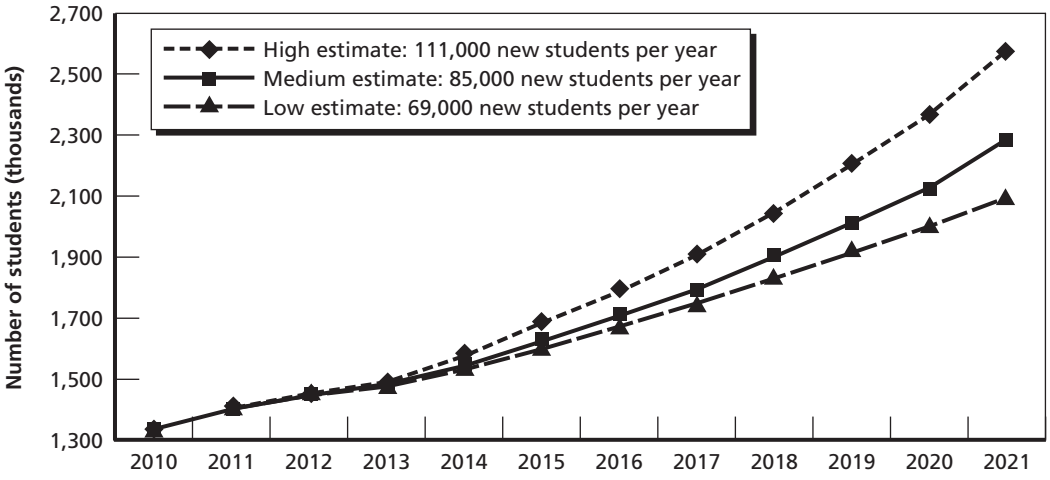
Next, we turn to the supply of teachers, using the same projected enrollment numbers to estimate the demand for new hires over the next ten years. We then follow this with several recommendations for the KRG to match supply with demand in the teaching force.

Projected Student Enrollment to 2021

Figure 3.1 presents our range of estimates for how much student enrollment in the KRI will grow over the coming decade, from 2010 to 2021 (see Box 3.1 for a description of our method for generating these estimates):

- The *low estimate* projects an average growth of about 69,000 students annually. It assumes a 5 percent annual growth in number of births and no change in the completion rate of basic education and gender parity.

Figure 3.1
Projections of Growth in Student Enrollment in the KRI, 2010–2021



SOURCE: RAND student-flow model.
RAND *MG1140-3.1*

- The *medium estimate* projects an average growth of 85,000 students annually. It assumes a 6.5 percent annual growth in the number of births and slow movement toward universal basic education.
- The *high estimate* projects an average growth of 111,000 students annually. It assumes a 7.5 percent annual growth in the number of births, a 90 percent basic education graduation rate, and gender parity by 2021.

These three different estimates of enrollment are about the same over the first five years of the 2010–21 period. But after that, they begin to diverge significantly. This is because the cohorts born between 2005 and 2009, who are expected to start entering grade 1 between 2011 and 2015 are already known. Consequently, they are common to all three estimates.[1]

In addition to the assumption noted above, we also assumed that students would not need special inducements to complete basic education under the medium and high estimates, other than the newly established compulsory requirement. Given the rapid growth in actual enrollment over the five-year period from 2005–06 through 2009–10, a disproportionately rapid growth in continuation into secondary education, and continuing economic growth that may induce families to encourage their children to stay in school, we think this is a reasonable assumption, at least until such time as demand exceeds supply. However, if and when the share of students continuing from grade 6 to grade 9 stabilizes in coming years, consideration may have to be given to actions that encourage students to attend school. Such actions might include educating parents about the benefits of education, providing financial incentives or other incentives to families and students, or instituting policies or actions to encourage families to send girls to school for gender parity (for example, such as addressing transportation or bathroom facility needs).[2]

[1] The size of these known cohorts is unaffected by our assumptions about the growth in the number of births from 2010 and beyond.

[2] Kanbur, 2009.

Box 3.1
Our Method for Generating Estimates of Projected Student Enrollment

To estimate future student enrollment by grade, we developed a causal forecasting model. The model contains the number of students historically enrolled in each grade (1 to 12) between 2004 and 2010 and the transition probabilities (percentage of students continuing) from one grade to the next. The model can simulate changes in three main variables whose behavior will affect future student enrollment:

- The annual growth rate of the population eligible to enroll in grade 1
- The annual increase in the share of students who complete basic education and then continue on to secondary education
- The speed at which gender parity between boys and girls is attained.

The model contains three assumptions. First, because there are no data available on immigration to and emigration from the KRI, we assumed that the flows of people age 6 to 18 in and out of the KRI cancelled each other out. Second, because there is also no available data on rural-to-urban migration within the KRI, we assumed that the ratio of rural-urban students would remain constant over the period considered. Third, we assumed that the rate at which students continue from grade 9 into secondary education would not change—in other words, the increase in the number of students who continue to secondary school would grow in proportion to the increase in the number of students completing basic education. We think this is a conservative assumption. Appendix A presents more details on the model.

Because policy and economic conditions may affect these variables in ways yet unknown, we used the projection model to make 27 different estimates of student enrollment reflective of the various combinations of the three variables—growth in number of births, completion rate of basic education, and gender parity. Of these 27 projections, we selected a low, medium, and high estimate to represent the range within which future student enrollment can be expected to fluctuate between 2010 and 2021:

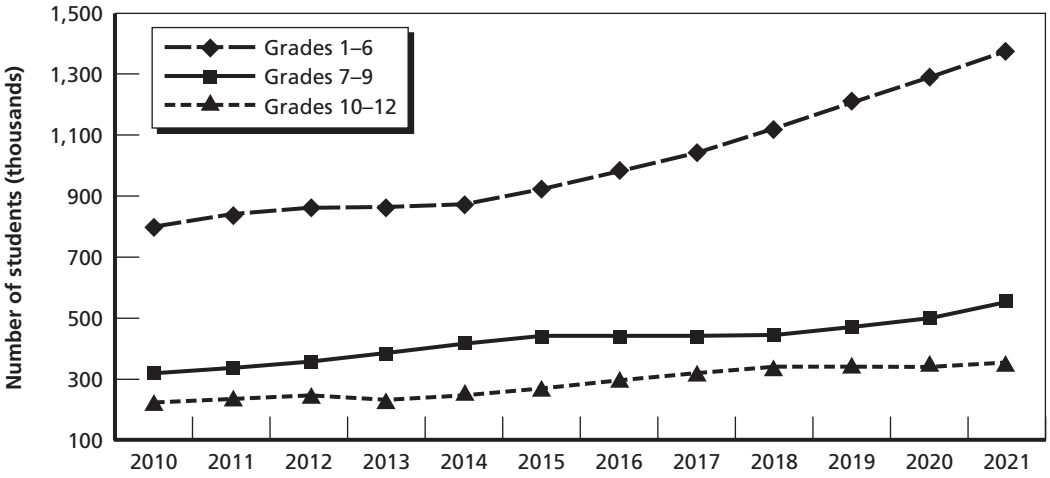
- The ***low estimate*** assumes a low average annual growth in number of births (5 percent) and no changes in the completion rate of basic education and the gender ratio.
- The ***medium estimate*** assumes an annual growth in number of births about equal to that of the last 13 years (6.5 percent), a slow movement toward universal basic education, and no change in the gender ratio.
- The ***high estimate*** assumes an average annual growth in number of births equal to that of the last five years (7.5 percent), universal basic education by year 2021 (assumed 90 percent completion rate), and gender parity by year 2021.

The projections of rapid growth in future enrollment present the KRG with a considerable challenge. But readers should note that our estimates are just that: estimates. It will be important to revise and adjust them at least every two years, if not annually, as the actual number of births and actual student enrollment by grade become known.

Enrollment Will Most Likely Grow Fastest in Grades 7 to 9

The pace of growth in student enrollment will differ among the various grade levels. Under our medium growth estimate, for example, enrollment in grades 7–9 is expected to grow at an average annual rate of 6.8 percent. In contrast, that rate will be 6.4 percent in grades 1–6 and 5.5 percent in grades 10–12. (See Figure 3.2.)

Figure 3.2
Projected Student Enrollment to 2021, by Grade Level (Medium Growth Estimate)



SOURCE: RAND student-flow model.
NOTE: Data are based on the medium estimate of new students enrolling per year.
RAND *MG1140-3.2*

Under our high estimate too, annual growth in enrollment is anticipated to be fastest in grades 7–9, followed by grades 1–6 and then grades 10–12. Under the low estimate, the highest average annual growth rate is expected to occur at grades 1–6.

New Classrooms Needed to Meet Demand from Rising Enrollment

The number of additional classrooms needed to meet rising student enrollment in the KRI between 2010 and 2021 will be sizable (Table 3.1). It would be approximately 21,400 over the ten-year period at the low end, and approximately 34,700 at the high end, assuming an average class size of 35 students. (See Box 3.2 for a detailed explanation of why we chose this size for the KRI, as well as the trade-offs involved in selecting a class size for planning purposes.) Should Ministry planners prefer to use a smaller class size of 25, the number of new classrooms needed would range from a low of 30,000 to a high of approximately 48,600.[3]

Table 3.1
Estimates of Increased Enrollment and Number of New Classrooms Needed, 2010–2021

Estimate	Increased Enrollment 2010–2021	Number of New Classrooms Needed
Low	750,000	21,430
Medium	924,000	26,400
High	1,216,000	34,740

SOURCE: RAND student-flow model.

[3] To facilitate comparison of needs between urban and rural areas and level of education, we use the same classroom size for urban and rural areas throughout this chapter. However, it is likely that classrooms in some rural areas will not need to be as large, even if a policy of consolidating small schools into larger ones on a regional basis were to be implemented (see subsection below, in this chapter, titled "Consolidating Small Schools in Rural Areas"). In this event, the number of classrooms needed in rural areas would be increased by the ratio of 35 to the selected size.

Box 3.2
Selecting a Class Size to Use for Planning Purposes

The choice of class size to use for planning purposes is a policy decision of great consequence. It involves a potential trade-off between costs, access, and quality of education. On the one hand, the smaller the class size, the larger the number of new classrooms that will have to be built, and the more new classrooms, the greater the expense. On the other hand, some of the more rigorous studies have shown that smaller class sizes may increase student achievement (Schanzenbach, 2010). At the same time, international studies show that some countries with large class sizes (such as Korea, Chinese Taipei, and Singapore) can produce high levels of student achievement (OECD, 2010). Finally, other studies have found that class size is less important to improving student performance than are other factors, such as textbooks, instructional time, knowledgeable teachers, and a clean and safe school building (Scheerens, 2000; Ehrenberger et al., 2001). Financial resources, therefore, may be more efficiently and effectively spent on these other factors.

We decided to use an average class size of 35 students to estimate the number of classrooms needed to meet future student enrollment in the KRI. This is slightly smaller than the KRI average in urban areas (42 students), although large by international standards: In OECD countries, the average class size varies between 21 and 24 in grades 7–9 (OECD, 2009). But it is not unusual in some high-performing Asian countries, such as Japan (33) and South Korea (36).

There were a number of reasons for our choice. Selecting a smaller class size would necessitate greater investments in building costs. We did not find enough compelling evidence for the positive effects of class size to justify these added investments, especially when the money could be used instead on improvements that may have a greater impact on student learning. In addition, given that the MOE will face a challenge in building the needed schools fast enough to meet growing enrollment, we felt that it was a more pragmatic and better use of resources to aim for the larger class size of 35 students, at least until a time when the expected growth in enrollment decreases and double-shift schools can be discontinued. With fewer new schools to be built, the likelihood increases that the MOE will be able to keep the speed of construction in line with demand.

Overcrowding Is a Growing Problem in KRI Schools

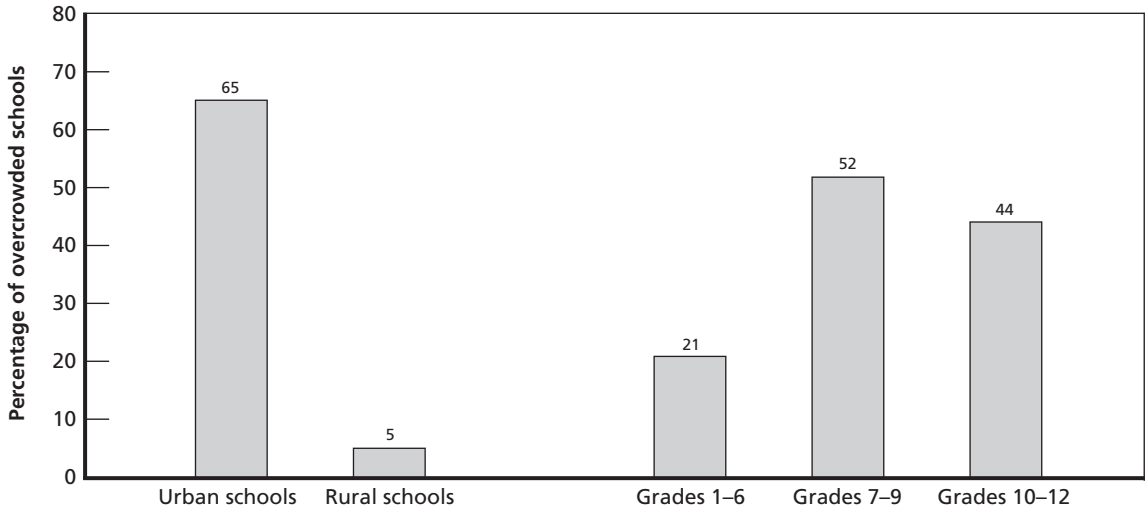
Of the current classrooms in the KRI, 25 percent are overcrowded, which we define as having more than 35 students. This is a problem that varies by location: There are significantly more overcrowded schools in urban areas (65 percent) than in rural areas (5 percent). Grade level also makes a difference, with schools offering grades 7–9 and 10–12 much more frequently overcrowded than those offering grades 1–6. (See Figure 3.3.)

New Classrooms Needed to Reduce Overcrowding

Overall, to reduce overcrowding in these classrooms over the next ten years, additional space will have to be made for about 183,000 more students.[4] This means that the KRG will need to create about 5,200 more classrooms, at an average of 35 students per class (Table 3.2). Ninety-

[4] We calculated the number of students for which additional space would need to be created by adding the number of students in excess of 35 in the 39 percent of classrooms that have more than 35 students per classroom.

Figure 3.3
Percentage of Overcrowded Schools, by Urbanicity and Grade Level, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data.
NOTE: Overcrowding means 35 or more students per classroom.
RAND *MG1140-3.3*

four percent of these additional classrooms will be needed in urban areas; 75 percent will be needed in grades 1–6. This is because although only a relatively low percentage of schools for grades 1–6 are overcrowded, there are more schools for grades 1–6 than for any other grade level.

The Need for New Classrooms Is a Particularly Urban Problem in the KRI

The KRI's urban areas will need about five times more new classrooms than will its rural areas to meet growing enrollment *and* reduce overcrowding over the next decade (see Box 3.3 for our estimation method).[5] Our low-end estimate of the need in urban areas was approximately

Table 3.2
Number of Classrooms Needed to Reduce Overcrowding, by Location and Grade Level, 2010–2021

Grade Level	Urban	Rural	Total
1–6	3,575	259	3,834
7–9	786	31	817
10–12	585	6	591
Total	4,946	296	5,242

SOURCE: RAND, based on MOE's Office of Statistics school data, 2007–08.

[5] In the absence of rural-urban migration data, we weighed two contradictory factors in assuming little change in rural-urban enrollment ratios, as noted in Box 3.3. On the one hand, there has been large displacement of populations from rural to urban areas during the war against the Saddam Hussein regime and the long period of instability. Even though, to date, a large share (79 percent) of the population already lives in urban areas, we can expect some continuing push toward urban areas. On the other hand, the KRG has had a policy of rebuilding villages destroyed during the war (it says that it has rebuilt more than 65 percent of the 4,500 villages destroyed) and encourages families to stay or return to their villages. For purposes of our estimates, we assumed that these two conflicting factors would cancel each other out.

Box 3.3
Assumptions Made to Estimate the Allocation of Needed Classrooms Between Rural and Urban Areas

To estimate the allocation of needed classrooms between rural and urban areas, we assumed that within the total number of students at all grade levels, the share of rural to urban students in grades 1–6 would remain the same—33 percent—for all three estimates of needed classrooms (low, medium, and high). But we assumed that the share would fluctuate at other grade levels, increasing for students in grades 7–9 from 17.8 (low estimate) to 24.9 percent (high estimate), and for students in grades 10-12 from 11.0 (low estimate) to 17.6 percent (high estimate). These increases would reflect that in the future, we may expect youths in rural areas to continue through basic and then secondary education at rates more similar to urban youths than is the case today.

Overall, for all grade levels combined, the share of rural to urban students remains relatively the same, at about 27 percent, for each of our three estimates. But if people move back in large numbers to the villages now being reconstructed within the KRI, this may be too low. On the other hand, it may be too high. Updating these assumptions on a biannual basis will be important.

21,900. But it could reach as high as 32,200 new classrooms. In sharp contrast, rural areas will likely need only somewhere between 4,800 and 7,700 new classrooms. (See Table 3.3.)

When the urban need is broken out by grade level, there is great variation: Of the new urban classrooms needed, 52 to 65 percent of are needed in grades 1–6, 22 to 29 percent in grades 7–9, and only 11 to 19 percent in grades 10–12, depending on the enrollment estimate.

Figure 3.4 displays where the need for new classrooms is potentially greatest across the KRI. Using GIS mapping, we show the distribution of overcrowded classrooms by KRI sub-district. In the urban sub-districts of Erbil, Sulaimanyah, Semel, Duhok, and Soran, typically 75 percent of the schools are overcrowded. In contrast, the sub-districts with few overcrowded

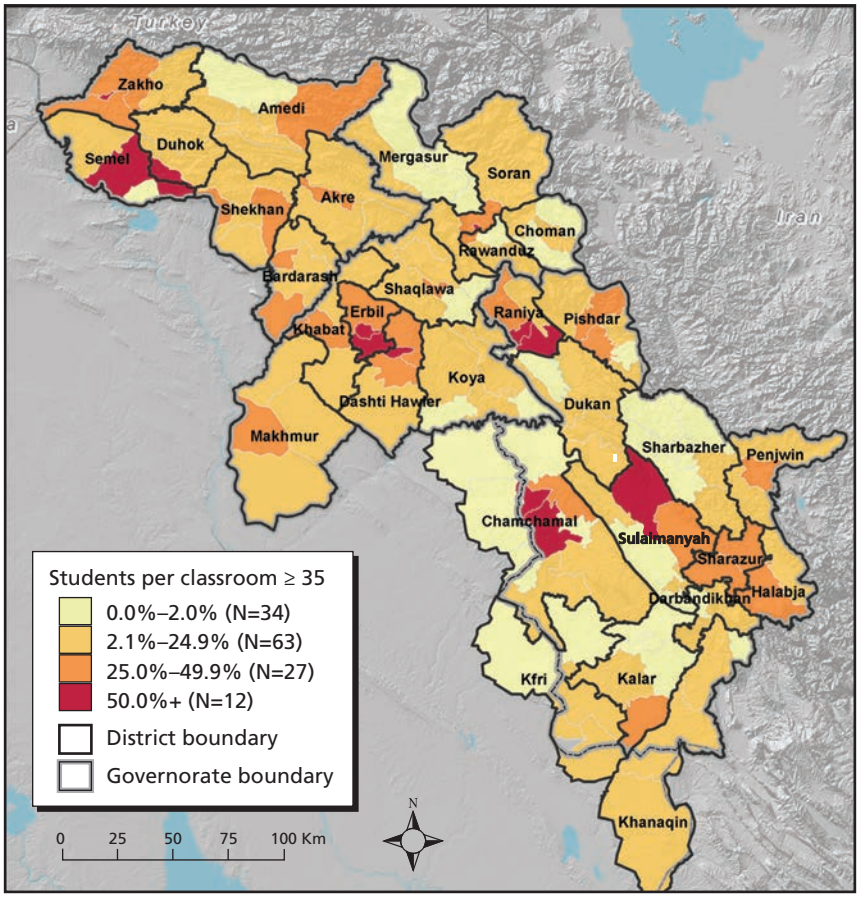
Table 3.3
Estimate of Number of Classrooms Needed to Meet Enrollment Growth and Reduce Overcrowding, 2010–2021

	Estimate of Enrollment Growth					
	Low		Medium		High	
Location/ Grade Level	Number of Classrooms	%	Number of Classrooms	%	Number of Classrooms	%
Rural Areas						
1–6	3,750	14	4,211	13	4,466	11
7–9	778	3	1,202	4	2,192	5
10–12	249	1	462	1	1,062	3
Subtotal	4,777	18	5,875	19	7,720	19
Urban Areas						
1–6	14,104	53	15,494	49	16,266	41
7–9	4,992	19	6,386	20	9,435	24
10–12	2,773	10	3,914	12	6,563	15
Subtotal	21,869	82	25,794	81	32,264	81
Total	26,646	100	31,669	100	39,984	100

SOURCE: RAND student-flow model.

NOTE: Columns may not sum to 100 percent because of rounding.

Figure 3.4
Percentage of Overcrowded Schools, by Sub-District, 2007–08



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.

RAND *MG1140-3.4*

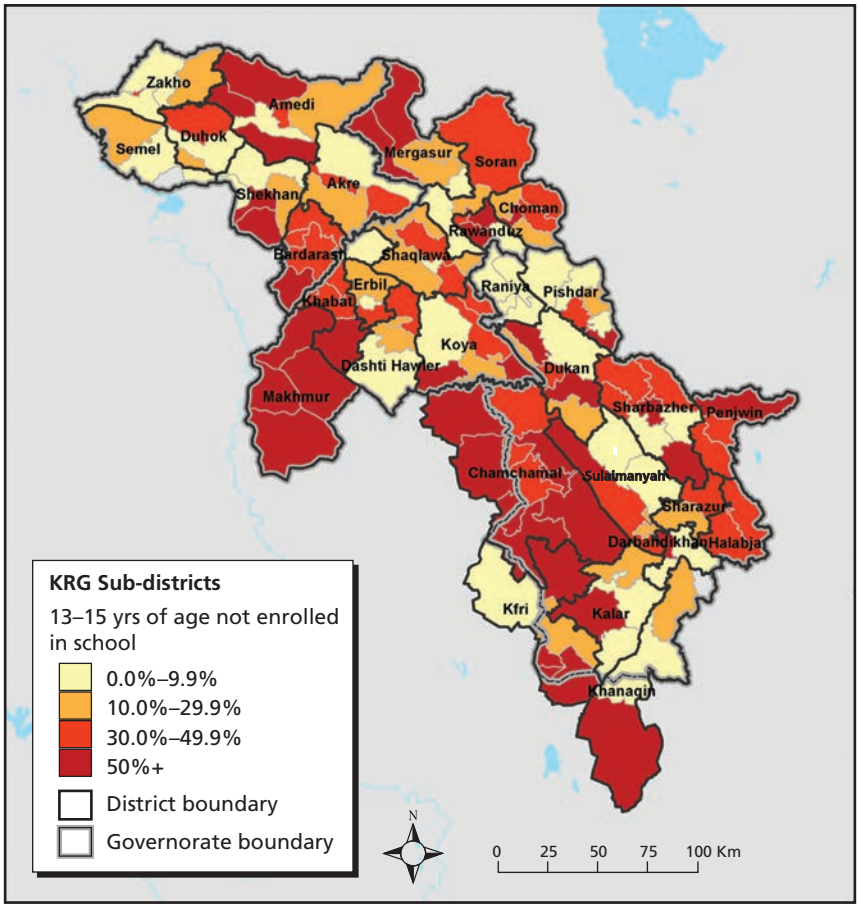
schools are mostly rural. The most overcrowded sub-districts might be priorities for KRG investments in new classrooms.

Figure 3.5 shows the distribution for youths aged 13–15 not currently enrolled in school. The Makhmur, Kalar, Amedi, and Ramandaz sub-districts have relatively high numbers of youths in this group who are out of school. This suggests that these sub-districts have a greater latent demand for education and may see greater relative growth in student enrollment and possibly a demand for new classrooms in grades 7–9 under compulsory education to grade 9. (Appendix B provides similar mapping for youths age 6–12 and 16–18.)

Recommendations for Meeting the Demand for New Classrooms

The number of KRI schools operating in multiple shifts or sharing a building is already quite large. Consequently, we recommend that if the KRG has sufficient resources, it accommodate the rapidly rising rate of student enrollment by building new schools and/or new classrooms

Figure 3.5
Percentage of Out-of-School Youths Age 13–15, 2009–10



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08; Ministry of Planning's pre-2010 census estimates of population; and IHSES.
RAND *MG1140-3.5*

in existing schools while setting class size at about 35 students per class. The advantage of our recommendation is that it would reduce the need for more of the KRI's existing schools to go to multiple shifts or shared buildings. It would also avoid further worsening of the already considerable problem of school overcrowding. And it would provide more flexibility for the MOE to increase the number of hours that K–12 students spend in class, something we recommend as a way of improving the quality of instruction in the K–12 system (see Chapter Four).

Over the next ten years, the KRG would need to build somewhere between a minimum of 134 new 18-classroom schools each year (under our low estimate of future student enrollment) and a maximum of 202 (under our high estimate). Using KRI's current method of construction, the cost for building one 18-room school would average about $1.5 million.[6] At this price, the total capital investment required to build all of the schools needed would range from $201 million at the low end to $303 million at the high end. Even though we believe that

[6] Estimated construction costs for a new school with 18 classrooms were provided to us by the DG of Buildings in the MOE.

this is the most advantageous approach to addressing the problem of classroom capacity, we recognize that the dollar amount needed is well above the KRG's current annual investment earmarked for building new schools and repairing or renovating existing schools in the KRI. Consequently, it will be essential for the KRG to find ways of using available capital resources as efficiently as possible, building as many schools as possible with the available budget and minimizing construction costs while still providing high-quality facilities. The KRI needs new schools and additional classrooms quickly, on a budget, and in the right locations.

Relying on Prefabrication Rather Than Traditional Building Methods Can Reduce the Costs of Constructing New Schools

One potential solution to the problem of cost and urgent need would be to use prefabricated buildings rather than relying on the traditional methods of building. Several other countries have used this approach successfully—the UK, for example, which rebuilt many of its high schools in this way. The United States, Turkey, Spain, Australia, Pakistan, and other regions of Iraq have also all used prefabricated schools.

Prefabricated buildings can be assembled faster and more cheaply than buildings constructed in the traditional way. In addition to costing $1.5 million (and possibly up to $2 million), building an 18-classroom school using traditional methods in Kurdistan also takes 8 to 18 months to complete.[7] In contrast, prefabricated schools typically cost between $0.7 and $1.3 million and take only 3 to 8 months to assemble. This cost to build each prefabricated school is as much as 35 percent less than the KRG is spending on building new schools now. The prefabricated buildings can be permanent, high quality, and attractive. They can also be "green," meaning that they can reduce water and electricity usage over the building's lifetime. Box 3.4 discusses quality in pre-fabricated schools (see Appendix C for more-detailed information on prefabricated schools).

The KRG's first step toward implementing a building strategy centered on prefabricated schools should be to circulate a request for proposal (RFP) among international companies who manufacture them (Appendix C provides a selected list of such companies). Given that the KRG will need so many new schools, in the future (although not in the near term), it could require the winning company or companies to build the prefabricated parts in the KRI. This could contribute to the local economy by providing new jobs, as well as training for local workers to put the prefabricated buildings together.

Building New Schools in Combination with Other, Lower-Cost Alternatives May Be the Best Way Forward If Funds Are Constrained

The KRG may not be able to allocate enough capital resources to rely solely on building new schools and classrooms to meet the anticipated demand for education. Should this be the case, there are several low-cost alternatives that the Ministry could consider using in tandem with building new schools:

- Use available capacity in some schools.
- Add a second shift to existing single-shift schools and all new schools.
- Reduce the number of students who are retained to grade 6.
- Combine all of these lower-cost options.

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[7] Data on construction costs of schools were provided to us by the DG of Buildings in the MOE.

Box 3.4
Ensuring the Quality of Prefabricated School Buildings

Prefabricated construction utilizes a standard set of design modules that can be arranged and customized for each application. Major components, or sometimes entire modules, are assembled in a fabrication plant and transported to the construction site for assembly, which considerably reduces wasted material and increases labor productivity. This method reduces costs by 25 to 60 percent. The controlled environment in the fabrication plant can increase the quality of the components and assembly relative to conditions at a traditional construction site (Pons, Oliva, and Maas, 2010). This system greatly assists regions that need to construct a large number of schools over a short period.

While the quality of prefabricated construction has improved dramatically (Pons, Oliva, and Maas, 2010), the quality, design, features, and expense of prefabricated schools can still vary widely. Some prefabricated schools can have higher quality, and higher costs, than traditional school construction methods, yet they are utilized primarily for the ability to reduce construction times.

Several steps can be taken to maximize quality for prefabricated school construction. First, a full comparative assessment of cost and quality should be completed that evaluates traditional and prefabricated methods for the local environment and specifications. If prefabricated methods are determined to be desirable, a small-scale demonstration program involving delivery of several schools can be undertaken, so that the owner can inspect and build confidence in the quality of the schools provided by that vendor. The opportunity for expanded future contracts incentivizes the vendor to deliver high-performance schools. Finally, it is important to clearly define and assign risks associated with cost, quality, and delivery of schools among all involved stakeholders so that project uncertainties are managed (French, 2006).

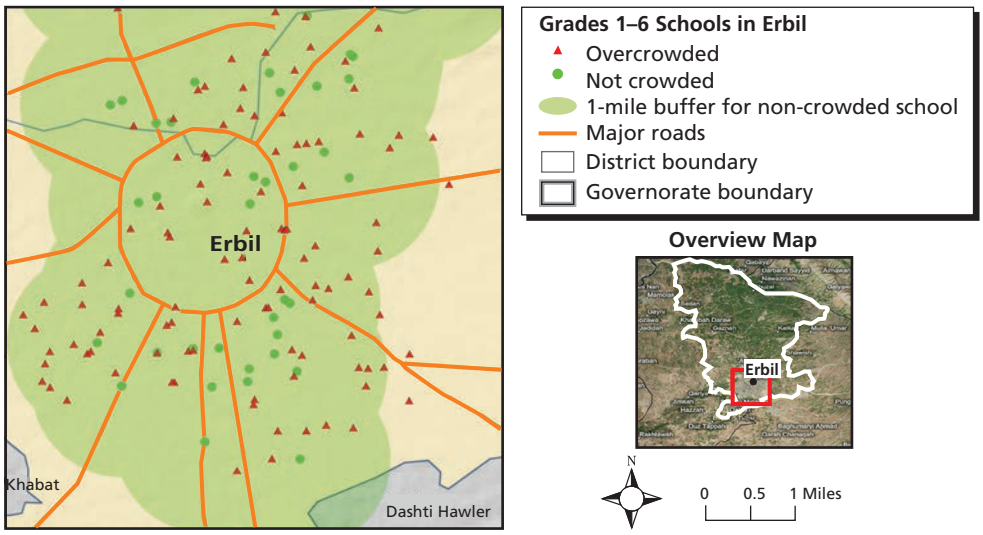
Taking this approach would reduce the number of new schools needing to be built, but without further overcrowding existing schools. However, we recommend using one or more of these lower-cost options along with building fewer new schools only as a last resort. These alternatives are the best way forward only if the financial resources available are insufficient to fully match the rapid growth in student enrollment.

Build some new schools *and* use available capacity. Some KRI schools and classrooms are very crowded, while others are not. Overall, 36 percent of urban schools have 35 or fewer students per classroom, and nearly 93 percent of rural schools fall into this category. The space in these uncrowded schools can be used to reallocate students—especially in urban areas where students can easily get to another school. Figure 3.6 shows how this might work: Students from overcrowded schools (noted by a triangle) are re-distributed to those that are uncrowded (noted by a dot) and located within the same two-mile radius.

Fully using the existing capacity in currently uncrowded urban schools in this way could create the equivalent of about 250 classrooms of 35 students each (Table 3.4). The majority of these classrooms would be in grades 1–6, for which 59 percent of the schools are uncrowded. A third of schools for grades 10–12 have enough space to take redistributed students. Little excess capacity is available in grades 7–9. In rural areas, the equivalent of more than 6,000 classrooms could theoretically be created in this way, almost all in schools with grades 1–6, 96 percent of which are uncrowded.

This measure can potentially reduce the urgency for building new schools in the medium term and increase equity by ensuring that fewer students are learning in overcrowded environments. Also, there would be no additional financial costs associated with this option. But

Figure 3.6
Potential for Redistribution of Students from Crowded to Uncrowded Schools



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
RAND *MG1140-3.6*

there are several challenges to implementing it. Perhaps the most significant of these is that unlike in urban areas, students in an overcrowded rural school may not have means of transportation to access an uncrowded school to which they might be assigned. This reality is likely to significantly curtail the Ministry's use of this option in rural areas. In urban areas, the issue of access is likely to be somewhat limiting only in grades 1–6. A second challenge could arise if parents of children at uncrowded schools object to the addition of redistributed students.

Build some new classrooms *and* add a second shift to existing single-shift schools and newly built schools. Establishing more double-shift schools in the KRI by adding shifts to current single-shift schools could create an equivalent of about 3,700 classrooms in urban areas and about 9,000 classrooms in rural areas. In urban schools, nearly half of the newly created classrooms would be for students in grades 7–9 and 10–12. (See Table 3.5.) In rural areas, only a few (perhaps up to 600 classrooms) of the total 9,000 could actually be used because of limited access.

Newly built schools could also accommodate two shifts, reducing the number of new schools needed by about half.

Table 3.4
Equivalent Number of Classrooms Available in Uncrowded Existing Schools

Grade Level	Urban	Rural
1–6	143	5,798
7–9	21	134
10–12	87	99
Total	251	6,031

SOURCE: RAND, based on MOE's Office of Statistics school data, 2007–08.

Table 3.5
Equivalent Number of Classrooms Available by Adding a Second Shift in Existing One-Shift Schools

Grade Level	Urban	Rural
1–6	2,033	8,423
7–9	865	342
10–12	767	342
Total	3,665	9,107

SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.

Adding a second shift in existing schools or newly built schools would save construction costs for the equivalent number of classrooms added by the second shifts. The added costs would be for teachers and possibly principals to staff the second shifts and for added maintenance of the facilities.

A possible objection to implementing this measure would be that adding second shifts to more schools in Kurdistan would reduce quality. Double-shift schools are used or have been used in a wide range of locations, including Indonesia, Hong Kong, Singapore, South Korea, Jamaica, and Brazil. In some of these places, student performance is low; in others, it is high. Only a few studies have assessed the effect of double shifts on student achievement. But of these—conducted in a diversity of countries, including Brazil, Chile, India, and Guinea—most suggest that students in multiple-shift schools perform at the same level as those in single-shift schools, provided they all receive the same amount of instructional time.[8] However, having double shifts can reduce the ability of schools to use the facilities for extracurricular activities for students. It also requires having classes earlier and later in the day, which may be less convenient.

Build some new classrooms *and* reduce the number of students who are retained through grade 6. About half of 12-year-old students in the KRI have repeated at least one grade, and nearly half of students who have repeated at all have repeated two or more grades. By the time a cohort of Kurdish students graduates from high school, only about 20 percent have not repeated a grade (see Chapter Two). These are high numbers.[9]

The policy reforms of 2008 now mandate that students be promoted automatically until grade 3. In other words, students cannot be held back until then.[10] By extending this policy to grade 6 and decreasing the current retention rate by half, the KRG would free up to an equivalent of 1,500 classrooms in urban areas and up to 300 in rural areas in grades 1–6.[11]

Yet the Ministry would almost certainly face objections to implementing this measure. For example, teachers we interviewed voiced concern that the recent policy of automatic promotion through grade 3 was detrimental to student learning and hindered preparation for sub-

[8] Fuller et al., 1999; Farrell and Schiefelbein, 1974; PASEC, 2003; Bray, 2008; Linden, 2001.

[9] By comparison, an average of 13 percent of 15-year-olds have repeated at least one grade in OECD countries. However, there are large variations across countries. France and Tunisia have repetition rates of about 40 percent, whereas the UK and Finland have repetition rates of about 2 percent (OECD, 2010, Table IV.3.1).

[10] In practice, schools may not yet fully adhere to this policy.

[11] These estimates are based on the flow model used to project student enrollment to school year 2020–21 by assuming transition probabilities of 0.99 from grade to grade through grade 6.

sequent grades. Extending automatic promotion to grade 6 to a higher share of students would spur the same concerns.

The research should alleviate this concern. Studies have shown that students who repeat grades are less likely to finish school and often have emotional and behavioral problems.[12] A study of schools in Latin America comparing changes in retention, completion rates, and student achievement over a ten-year period concluded that reduced retention has two benefits. First, the overall stock of knowledge increases, since there are more primary school graduates who, at the very least, know more than primary school dropouts. Second, the same learning achievement is reached at a lower cost, freeing resources for investments in other areas.[13]

Student achievement appears to be unaffected by promoting students who have performed poorly (to keep them with their age group—called social promotion) or by requiring them to repeat the year. Instead, additional help seems to be the key to improving performance. Promoting students who have learning difficulties without giving them additional help does not raise achievement. Retaining these students without additional help does not improve achievement either. But when struggling students are given additional academic support, it can make either retention or promotion much more effective.[14] A more recent study comparing the aggregate performance of countries with varying degrees of student repetition concluded that countries with lower rates of repetition had overall higher student performance and that students from disadvantaged backgrounds appear to be hurt most by grade repetition.[15]

Should the MOE opt to expand promotion to grade 6, it may need to accompany this measure with more teaching or tutoring. This may require additional funding to pay teachers to provide the additional support in the form of tutoring, weekend reviews, or summer school.

Build some new schools *and* combine all of the low-cost options. Implementing all of the low-cost options together would significantly impact the number of new classrooms needed over the next decade. Under our low estimate of the expected growth in student enrollment, taking this route would reduce the number by 6,600, from about 26,600 to 20,000; under our high estimate, the reduction would also be close to 6,600, from about 40,000 to 33,400 (Table 3.6). In terms of the number of new 18-room schools that the KRG would need to build, this translates into a reduction of anywhere from 134 down to 101 schools (under the low estimate) and from 202 down to 168 schools (under the high estimate). Overall, this alternative can potentially reduce the need for newly built classrooms by anywhere from 17 to 25 percent. The reduction would be somewhat greater for grades 1–6 than for 7–12 (see Appendix D).

To reduce the number of new classrooms needed even further, the Ministry could add a second shift to the newly built schools as well as to existing single-shift schools. This would lower the overall need for new schools by a full half over the next decade. For example, instead of the 101 to 202 18-classroom schools that would need to be built each year under our low and high estimates of future enrollment, the KRG would need to construct only about 50 to 100.

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[12] Wolff, Schiefelbein, and Schiefelbein, 2002; McCombs, Kirby, and Mariano, 2009; Nagaoka and Roderick, 2004. In the second and third of these references, the authors did comprehensive reviews of the literature before concluding that repetition increases dropouts.

[13] Wolff, Schiefelbein, and Schiefelbein, 2002.

[14] McCombs, Kirby, and Mariano, 2009; Nagaoka and Roderick, 2004.

[15] OECD, 2010, p. 35.

Table 3.6
Options to Meet Demand for New Classrooms, 2010–2021

	Low Estimate	Medium Estimate	High Estimate
Number of classrooms needed	26,646	31,669	39,984
Options			
Use existing capacity	551	551	551
Add second shift	4,265	4,265	4,265
Lower retention	1,800	1,800	1,800
Subtotal	6,616	6,616	6,616
Build new classrooms	20,030	25,053	33,368
If use all newly built classrooms for two shifts	10,015	12,527	16,834

SOURCES: Tables 3.3, 3.4, and 3.5.

Consolidating Small Schools in Rural Areas

The low-cost alternatives to building new schools discussed above are more readily feasible in urban than in rural areas. In rural areas, an additional alternative to minimize the number of schools that may need to be built or upgraded may be to build a larger, central school for all students within a catchment area. While this alternative to having several small schools in rural areas would require that transportation be provided for students living beyond walking distance of the central school, it would also provide for economies of scale. It would most likely save on capital resources and on operational costs because fewer teachers and only one principal (rather than several) would be required. In addition, the school would be able to offer more academic and non-academic opportunities to students than otherwise would be possible.

Figure 3.7 illustrates a potential catchment area. It contains a cluster of nine schools ranging in size from 9 to 114 students, all within a five-mile distance from the center of the catchment area. Several of the schools are located directly on the main road, whereas others are located within walking distance (one-half mile) from the road (see Box 3.5 for our method[16]). Were all of the schools consolidated, they would form a school of about 400 students. Alternatively, they could be consolidated into two schools, each with room to grow.

New Teachers Are Needed to Keep Pace with Enrollment to 2021

The number of new teachers that the KRG will need to hire over the next decade will likely range from about 53,000 at the low end to about 76,000 at the high end (Table 3.7).[17] This translates into an average of 4,800 to 6,900 teachers annually, which is not dissimilar to the number of teachers hired annually in recent years.[18] Thus, the teacher aspect of increasing school capacity is not as much of a problem as the building aspect.

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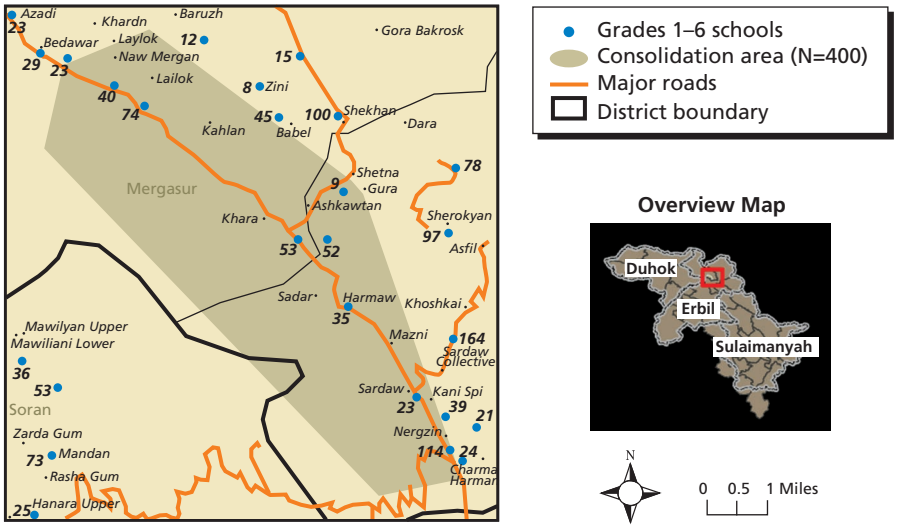
[16] GIS mapping is a useful tool to help identify potential rural catchment areas for potential school consolidation. However, to be most accurate, GIS mapping of existing KRI road infrastructure needs to be updated.

[17] These estimates are based on maintaining the 2009–10 student-to-teacher ratio at each grade level. In rural areas, this is 10 students per teacher. In urban areas, it is 18, 29, and 27 students per teacher at the primary, intermediate, and secondary levels, respectively.

[18] In addition to teachers, additional supporting staff such as librarians and school administrative personnel will be needed.

Figure 3.7
Potential School-Consolidation Catchment Area



SOURCE: RAND, based on Ministry of Education's Office of Statistics school data, 2007–08.
NOTE: Numbers in italics are the numbers of students in the primary schools.
RAND *MG1140-3.7*

Box 3.5
Method to Identify Potential School-Consolidation Rural Catchment Areas

GIS mapping can be used to identify potential school-consolidation catchment areas in rural areas. For our illustration, we used the following criteria: The area must contain clusters of small schools (grades 1–6) within a relatively small (five-mile) radius and have an existing road infrastructure. We allowed schools within a one-mile walking distance from a major road to be contained in the cluster.

Grades 1–6 Will Need the Most New Teachers

The required number of new teachers varies according to grade level (Table 3.7). It will be largest in grades 1–6, with anywhere from 40,000 to 47,000 new teachers needed over the coming ten years. The need will be significantly lower in grades 7–9: about 8,500 to 19,500 new teachers. In grades 10–12, it will be lower still, at about 4,000 to 11,000.

Table 3.7
Projected Number of New Teachers Needed, by Grade Level, 2010–2021

	Grade Level			
Estimate	1–6	7–9	10–12	Total
Low	40,250	8,580	4,250	53,080
Medium	44,650	11,380	6,250	62,280
High	46,950	19,680	10,950	75,580

SOURCE: RAND student-flow model.

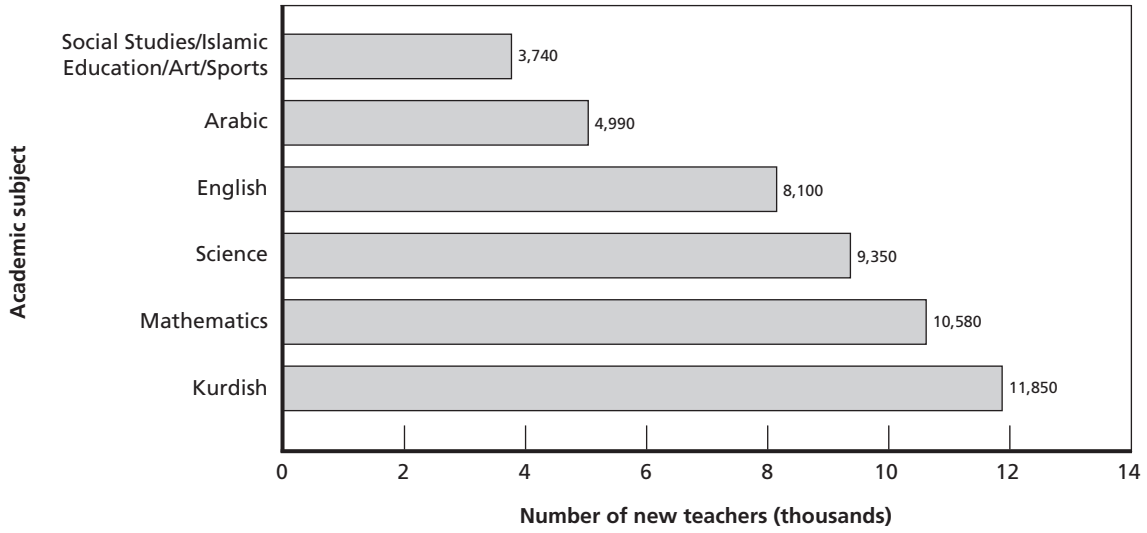
Teachers of Kurdish, Mathematics, and Science Will Be in Greatest Demand

The need for additional teachers will differ across the academic subjects included in the new curriculum (Figure 3.8) (see Box 3.6 for our method). Under our medium estimate of the total number of new teachers required over the next decade, Kurdish language will be the subject with the greatest need for new hires: The K–12 system will require nearly 12,000 new teachers in this area. Teachers of mathematics and then science will form the two next largest groups needed, followed by English teachers. Islamic education, social science, sports, and the arts will have the lowest requirements for new teachers—about 3,700 in each of these subjects.[19]

Recommendations for Meeting the Demand for New Teachers

The considerable need for new teachers over the next decade will have to be met through a combination of two measures: Expand the capacity of the KRI's teacher colleges to produce basic-school teachers and continue to hire graduates from other university programs as secondary-school teachers.

Figure 3.8
New Teachers Needed, by Academic Subject (Medium Estimate), 2010–2021



SOURCE: RAND, based on medium estimate of enrollment growth and hours devoted to each academic subject.
RAND *MG1140-3.8*

Box 3.6
Method for Estimating the Need for New Teachers by Academic Subject

To estimate the need for new teachers across subjects in the new curriculum, we calculated the number of class hours designated for each subject being taught, across all grades. The proportion of teachers needed in each subject area is based on the percentage of hours taken by that subject in the curriculum. Kurdish accounts for 19 percent; mathematics, 17 percent; science, 15 percent; English, 13 percent; and Arabic, 8 percent. Islamic studies, social studies, sports, and art each account for 6 percent of the total hours in the curriculum.

[19] These projections are for future years in order to keep up with growth.

Expand the Capacity of the KRI's Teacher Colleges to Produce Basic-School Teachers

The KRI's teacher colleges graduate about 1,000 students per year—far fewer than the 4,440 to 6,000 new basic-school teachers that may be needed annually over the next decade. To fully meet the coming demand for teachers in grades 1–9, the capacity of teacher colleges will eventually need to be quadrupled (assuming that all basic-education teachers should be trained in these colleges).

In the short run, relying solely on the teacher colleges to meet the growing demand for basic-school teachers is not feasible. Instead, the MOE will have to continue to draw new teachers from the pool of students graduating from other university programs. Indeed, Ministry officials in charge of hiring and assigning teachers reported that they are currently relying on this alternative pool and do not have trouble finding enough recent graduates to meet their needs.

Continue to Hire Graduates from Other University Programs as Secondary-School Teachers

An increasing number of students graduating from university are having difficulty finding employment. Consequently, we anticipate that the MOE will have no problem hiring the 400 to 1,000 new teachers needed annually to meet the growth in student enrollment in grades 10–12 over the next ten years. As for basic education, Ministry staff in charge of hiring and assigning teachers to secondary education have had no difficulties filling vacancies in the past and do not expect to have difficulties in the future. Government employment is considered highly desirable in Kurdistan for its stability and pension provisions that are not available in the private sector, and teaching is one of the most rapidly expanding areas of the government. Also, wages for teachers are competitive relative to those for similar professionals in other fields, such as mathematics, engineering, and science professionals, and life and health professionals. Teachers' wages are also higher than wages in the services and crafts occupations. (See Table 3.8.)

Table 3.8
Average Wages, by Selected Occupations, 2007

Occupation	Average Monthly Wage (thousands Iraqi Dinar [ID])
Managerial	
Senior government officials	1,277
Corporate managers	706
General managers	597
Professional	
Physical and engineering sciences	745
Life science and health	413
Teaching	413
Physical and engineering science associate	365
Life science and health associate	327
Other	270
Services	
Office clerks	297
Personal and protective services	323
Models, salesperson	192
Craft	
Precision and printing trades	267
Metal and machinery trades	308

SOURCE: IHSES, 2007.

CHAPTER FOUR

Strategic Priority Two: Improve the Quality of Education

The Kurdistan education system currently faces a number of challenges related to improving its quality of education. We described these in detail in Chapter Two: Students have relatively high rates of failure in annual school assessments, particularly in the upper grades; they repeat grades at high rates (i.e., have high retention levels); and their performance is weak on the KRI's national standardized tests. These are basic indicators of student achievement. There are a variety of ways that making changes in the education system can boost student performance.

Our analysis indicates that three main factors contribute to this issue with quality of education. First, the teaching force lacks the knowledge and training needed to teach the new curriculum introduced in 2008–09. Second, KRI schools currently provide too little instructional time to cover the new curriculum. Third, there are few opportunities for high-performing students to engage in accelerated learning. Addressing these issues could improve the overall quality of education that K–12 students receive.

We recommend making changes in three principal areas:

1. Better train and prepare teachers (both new and practicing).
2. Increase instructional time.
3. Provide more learning opportunities for high-performing students.

This chapter focuses on each of the three contributing factors in turn. For each factor, it first explains the issue in detail and then offers recommendations for changes the MOE could implement to address it.

Teachers—Both Practicing and New—Need Better Training and Preparation

Deficits in the training and knowledge of the KRI's teaching force constitute an important issue that applies to both experienced teachers and new entrants.

Practicing Teachers Need More Knowledge to Teach the New Curriculum

The existing KRI teaching force as a whole is not adequately prepared to teach the new curriculum. There are several issues involved, ranging from a lack of needed knowledge and training, to teachers being compelled to teach outside their specializations, to difficulties applying the student-centered learning methods required by the new policy.

Many practicing teachers lack the required knowledge to effectively teach the new curriculum. Much of the subject matter in the new curriculum is unfamiliar to practicing teachers, who are accustomed to teaching the traditional curriculum—the one they were trained

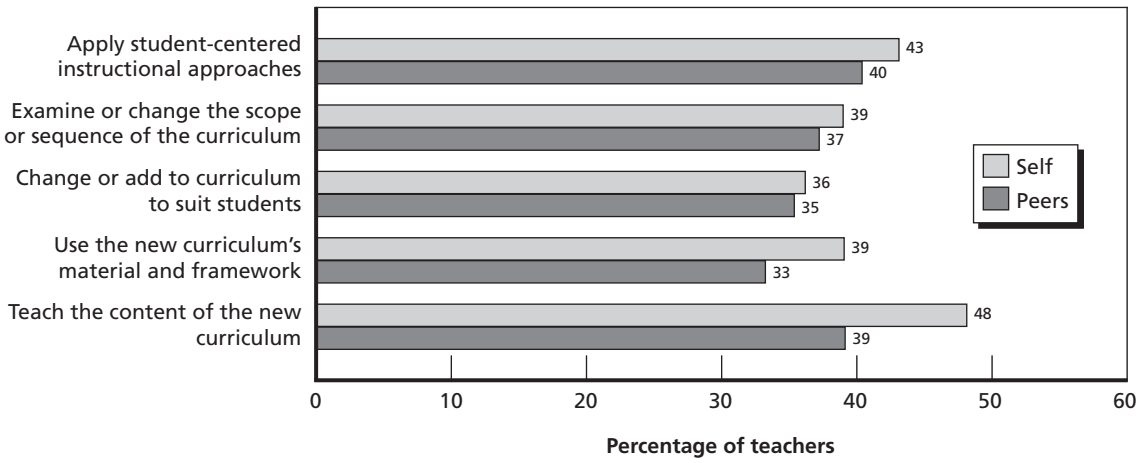
to teach during their years of preparation. Less than half the teachers rated themselves as well prepared or very well prepared to teach the content of the new curriculum, and 39 percent rated their colleagues the same (Figure 4.1). Less than 40 percent of teachers rated themselves and their colleagues as well prepared or very well prepared to use the new curriculum's materials and frameworks, change or add to the curriculum to suit their students' needs, or examine or change the scope or sequence of the curriculum to suit student learning needs.

Many teachers also indicated that they received limited support in implementing the new curriculum. Overall, 50 percent of teachers surveyed reported that the teaching materials accompanying the new curriculum provided insufficient guidance and explanation (Figure 4.2). Teachers also reported concern over adequately covering the material during the course of an academic year, as well as the quality and availability of textbooks and other curriculum materials. Less than half of mathematics and science teachers surveyed reported being able to cover all the material during the course of the year, and 52 percent of social studies, 63 percent of English, 65 percent of Arabic, and 70 percent of Kurdish teachers reported being able to cover the curriculum material during the course of a year.

Our field interviews further revealed that many teachers do not feel they have the knowledge they need to teach the new curriculum. For example, they reported a lack of familiarity with some of the new concepts and terms they are now required to teach. Supervisors from the Ministry put forth a similar view, observing that teachers often have a very weak command of their subjects.

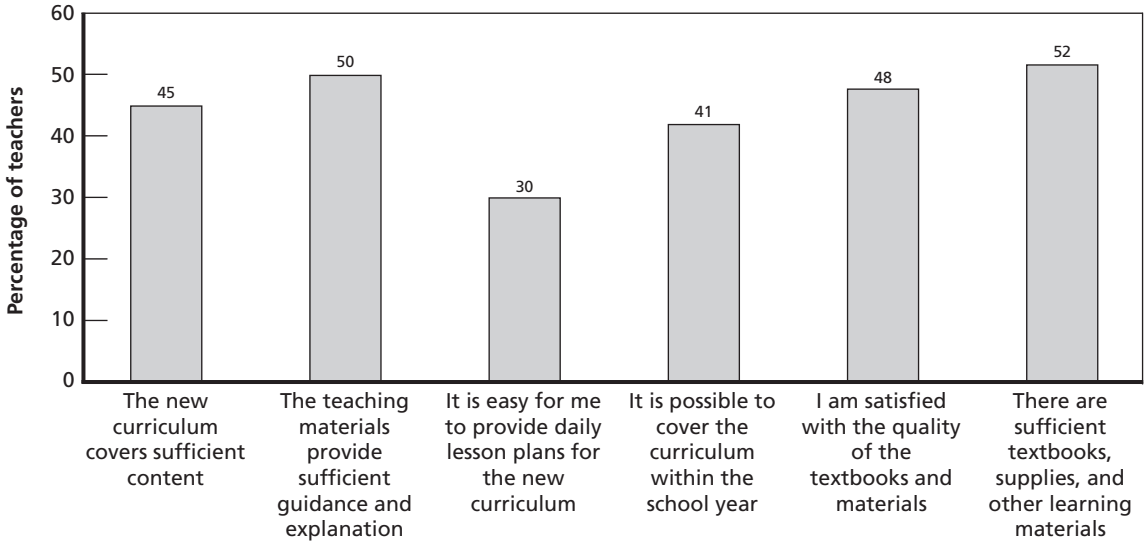
Practicing teachers receive too little training. With the introduction of the new curriculum, the MOE has begun training teachers in five- to ten-day training sessions, mainly to familiarize them with the new textbooks. Although these training courses have met some of the need for training in the new curriculum, teachers generally reported that they required

Figure 4.1
Percentage of Teachers Reporting to Be Well or Very Well Prepared, by Selected Instructional Activities Related to the New Curriculum, 2010



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: Ninety-five percent of surveyed teachers responded on question about how prepared they thought they were, and 80 percent responded on question about how prepared they thought their peers were.
RAND *MG1140-4.1*

Figure 4.2
Percentage of Teachers Reporting They Disagreed or Strongly Disagreed with Selected Statements About the New Curriculum, 2010



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: Ninety-two percent of surveyed teachers responded.
RAND *MG1140-4.2*

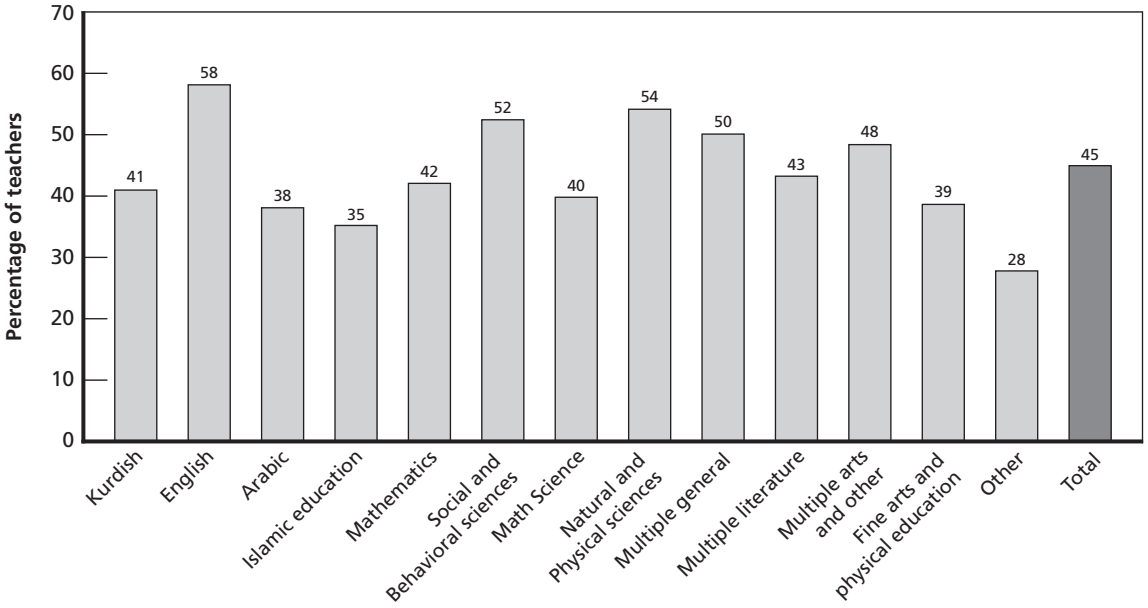
more time and in-depth training to familiarize themselves with the content of the new curriculum. Less than half of teachers across all grade levels reported that they had received any training in the previous two years (Figure 4.3). There were, however, some variations among teachers of different subjects. A greater share of English teachers (58 percent), science teachers (52 percent), and social science teachers (54 percent) reported access to training compared with Kurdish, Arabic, and Islamic Education teachers. This is not surprising given recent changes to the curriculum in the former subjects.

Not only is teacher access to training limited, but less than half of teachers who reported having received any training rated the training as sufficient to meet their needs (Figure 4.4).

To support implementation of the new curriculum, the MOE employed a train-the-trainer approach to train a large number of teachers. The Ministry hired an external contractor to train a limited number of select staff on the new curriculum. This staff includes Ministry supervisors, teachers considered to possess good skills, and, occasionally, university professors. These select staff members then, in turn, trained the teachers. These trainers often have not received enough training themselves in the new curriculum. They are also frequently rotated. The Ministry has also occasionally hired trainers from Lebanon from companies affiliated with the translation of the Harcourt and Macmillan textbooks into Kurdish. Some teachers reported difficulty understanding the training courses because they were offered in Arabic rather than Kurdish.

Overall, this limited training infrastructure was intended to provide a temporary solution to meeting teachers' short-term training needs. While it has done that, there is no standardized teacher training designed to meet the long-term needs of the KRI's education system. There are few, if any, full-time professional trainers and not enough established institutional capacity to provide ongoing training and professional development for all KRI teachers. There

Figure 4.3
Percentage of Teachers Reporting They Had Received Training in Previous Two Years, by Subject Taught, 2008–10



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: Seventy-eight percent of surveyed teachers responded. Teachers who taught multiple subjects were grouped into three categories: multiple subjects that include math, natural and physical sciences, languages, and social sciences; multiple subjects that only include languages and social sciences; and multiple subjects that include arts, P.E., health, and other subjects (human rights, computers, and an 'other' category).
RAND *MG1140-4.3*

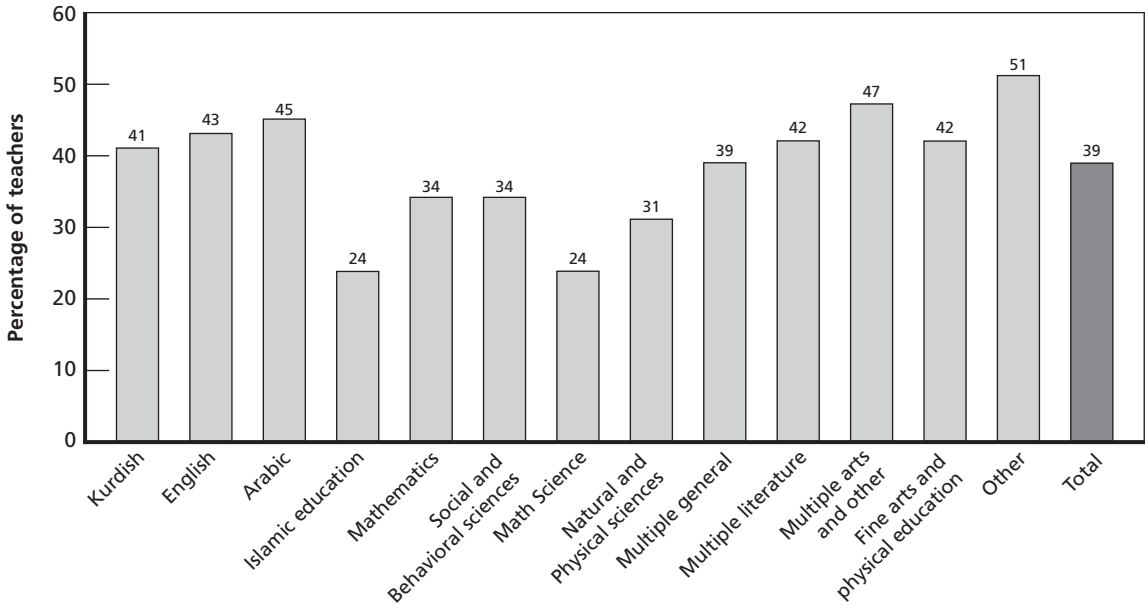
are neither standardized training materials nor a standardized approach to training teachers to teach the new curriculum. Consequently, the trainers have created their own materials and offered training according to their own capabilities. During interviews, teachers reported varying levels of quality. Indeed, principals and supervisors observing KRI teachers reported that many teachers do not have the necessary preparation to teach well, even in their own specializations.

Many practicing teachers are called upon to teach subjects outside of their specializations. Studies have shown that student achievement is lower when students are taught by teachers who lack training in the subjects they are teaching.[1] About one-third of teachers we surveyed reported teaching outside of their subject matter specialization (Figure 4.5). There are significant differences across subjects. Nearly 40 percent of teachers in the sciences were teaching outside their field, whereas around 25 percent of teachers in mathematics and English were doing so. A Ministry supervisor interviewed in the field claimed that the 20 to 30 percent of primary school teachers he estimated to be teaching outside of their subject specialization were not qualified to teach the subject. He went on to explain that teachers were assigned to teach subjects for which they are not qualified because of teacher shortages in those subjects.[2]

[1] UNESCO Institute for Statistics, 2006.

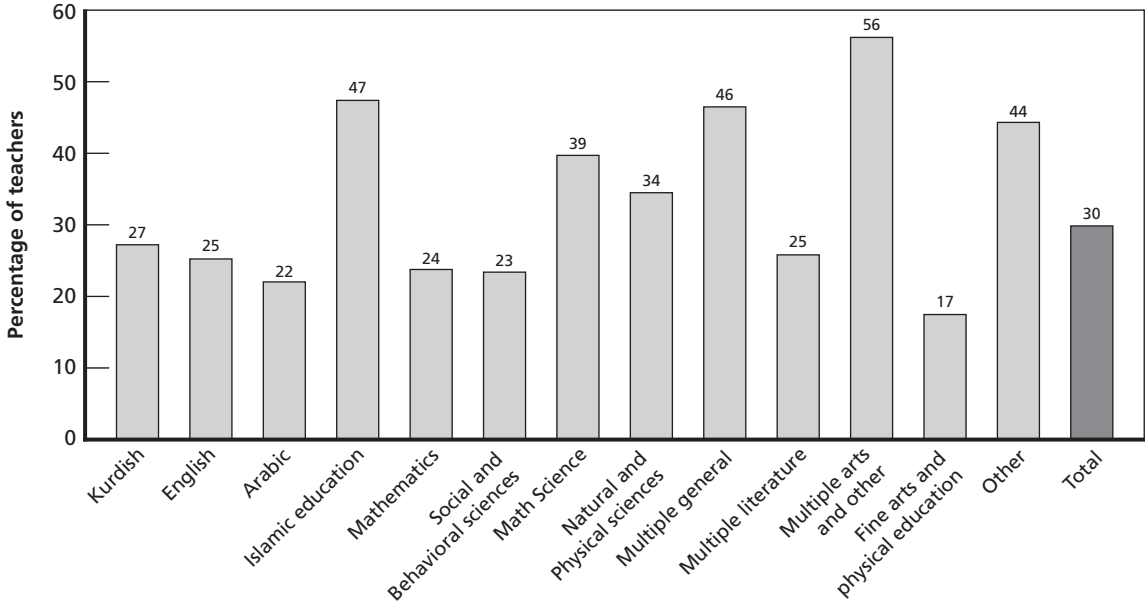
[2] The approximately 15 percent of teachers with a "general specialization" may lack the knowledge to teach certain subjects.

Figure 4.4
Percentage of Teachers Reporting That Training Received Was Sufficient, by Subject Taught, 2008–10



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: Ninety-three percent of teachers responded.
RAND *MG1140-4.4*

Figure 4.5
Percentage of Teachers Reporting They Teach in an Area Different from Their Subject Specialization, by Subject Taught, 2010

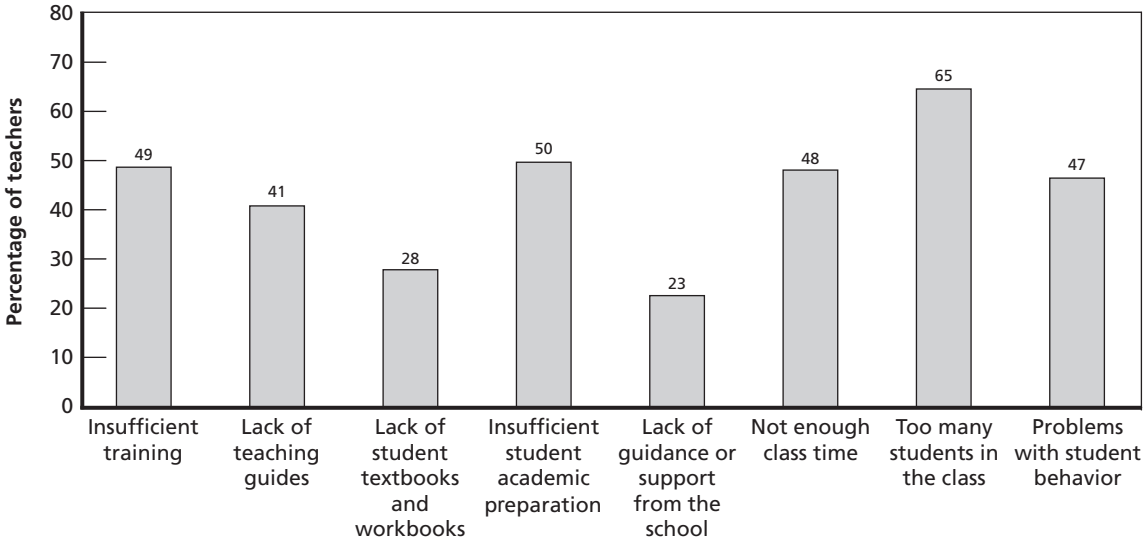


SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: Ninety-eight percent of teachers responded.
RAND *MG1140-4.5*

Practicing teachers have difficulties implementing teaching methods for student-centered learning. Student-centered education refers to a model of teaching that is generally represented by "minimal teacher lecturing, small group activities that engages students in problem solving, and frequent questions and discussion."[3] KRI teachers are now expected, as part of the policy reforms of 2008–09, to use new, student-centered teaching methods. Yet the Ministry and school officials in our interviews acknowledged that there is little understanding throughout the K–12 system of how that is to be done. Indeed, there is some ambiguity among researchers and practitioners globally about what student-centered instruction really entails and how to go about implementing it.[4] All of this results in confusion about how to take this approach and makes it difficult for teachers to implement it in the classroom.

A second problem is that classroom circumstances in the KRI make using student-centered methods impractical for teachers. Class sizes are large, making it difficult for teachers to provide the individual attention necessary for student-centered learning. Students sit crowded in classrooms at small desks that do not support the small-group work characteristic of student-centered learning. Over 60 percent of surveyed teachers indicated that having too many students in the class posed a constraint to implementing student-centered instruction (Figure 4.6). Surveyed teachers also reported other constraints to implementing student-centered learning, such as insufficient training (49 percent), not enough class time (48 percent), and lack of teaching guides (41 percent).

Figure 4.6
Percentage of Teachers Reporting Constraints to Using Student-Centered Instruction, by Type of Constraint, 2010



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: Ninety-five percent of teachers responded.
RAND *MG1140-4.6*

[3] Leu and Price-Rom, 2006.

[4] Richardson, 2003; Lampert, 2000; Holt-Reynolds, 2000; MacKinnon and Scarff-Seatter, 1997.

New Teachers Entering the Teaching Force Are Not Being Sufficiently Prepared

The challenges with preparing new teachers to teach the new curriculum in teacher colleges differ from those for practicing teachers.

The current system for assigning students to post-secondary education does not place high achievers in the teaching profession. In the KRI, students who have completed K–12 education do not choose their post-secondary academic program. Instead, the Ministry of Higher Education assigns students who apply to university in a field of study on the basis of their score on the secondary-school exit exam. According to our respondents in both the university education programs and the teacher colleges, students assigned to become teachers are among the lowest scorers on this exam.[5] This process is unlikely to foster high quality and strong motivation among the teaching force.

The teacher colleges do not provide enough training in pedagogy and teaching methods. Over 60 percent of current teachers surveyed indicated that their peers were "not at all" or only "somewhat" prepared in a variety of classroom instructional areas, including applying student-centered approaches, using different strategies to address the varying learning needs of individual students, using various approaches to group students, engaging students in critical thinking, and teaching the new curriculum.[6] There is general consensus across industrialized and other countries that preparing future teachers in teaching methods, including providing them with practical classroom experience, is important, although the amount desirable relative to preparation in subject matter may vary.[7]

As a way to assess the relative amount of preparation in pedagogy and teaching methods that future teachers will receive in the new teacher colleges, we compared these colleges' curriculum with that of two U.S. teacher colleges. We selected them partly because the new curriculum implemented in the KRI is using adapted textbooks from U.S. publishers and partly because of easy access to their curricula. For illustration, we chose to compare their respective mathematics curricula (Table 4.1).[8]

In terms of the overall number of units required, the KRI colleges and U.S. colleges are quite comparable—and the KRI requirements may be even greater. In the KRI colleges, requirements vary from 138 units for prospective teachers of mathematics to 160 units for prospective teachers of social science. The two U.S. colleges require 128 to 141 units. Yet

Table 4.1
Comparison of the Curricula of the KRI and Selected U.S. Teacher Colleges

Requirements	KRI Teacher Colleges	Respected U.S. Teacher Colleges
Total units	138–160	128–141
Teaching methods and practice (number of units)	12	24–43
Practice in school settings (time equivalent)	0–½ semester	1½ semesters–1 year
Subject matter specialization (number of units)	60	28–34

[5] The highest scorers are assigned to medical schools, the next highest to engineering schools, and so on down the ranks to other professional schools (such as business schools).

[6] 2010 RAND and MOE survey of teachers.

[7] National Council for Accreditation of Teacher Education, 2008; OECD, 2005; Stoel and Thant 2002; Morey, Bezuk, and Chiero, 1997.

[8] University of Michigan, 2011a and 2011b; University of Wisconsin–Madison, 2011a and 2011b.

there are three major differences between the KRI and U.S. teacher programs that may negatively affect how well new Kurdish teachers are prepared to teach in a classroom:

- Students in KRI teacher colleges study little about teaching methods and practice, with only 12 out of 138 units allocated to instruction in this area. Students in the U.S. teacher colleges spend two to three times as many units studying teaching methods.
- KRI teacher colleges offer their students little, if any, actual classroom teaching practice before they graduate. One of the KRI teacher colleges, for example, offers only half a semester of teaching practice. In contrast, one of the U.S. colleges requires three-quarters of a year of full-time supervised teaching in a classroom setting; the other requires more than a year of teaching practice.
- Students in KRI colleges spend nearly twice as many units on subject matter specialization. They must study advanced mathematics (e.g., calculus and linear algebra), although they will be teaching only elementary mathematics in basic schools. Consequently, that part of their training may be excessive, and those units might better be devoted to training that is more relevant to what they will be doing as basic teachers.

The teacher colleges do not provide enough training on the new curriculum. Although the KRI teacher colleges offer new teachers one general course on the new basic curriculum, this is unlikely to be sufficient. There appears to be no deliberate alignment between the content of the new curriculum and the set of subject matter courses in the teacher colleges. Current teachers that were surveyed indicated that their four top-ranking priorities were to receive training in (1) curriculum content in the subject that they teach, (2) how to use curriculum materials and frameworks, (3) how to develop daily lesson plans to guide classroom instruction, and (4) how to prepare homework assignments for students.[9]

New teachers educated in institutions other than teacher colleges may not receive enough preparation in teaching methods. Many of the basic-education teachers needed in the KRI over the next decade will be trained in other academic departments of universities. However, university students specializing in such academic subjects as mathematics and the sciences receive no training in pedagogy and teaching methods before they enter a classroom. Nor are they trained in the new curriculum. Consequently, they may not be adequately prepared to teach effectively.

Recommendations for Training *Practicing* Teachers

We recommend that the KRI implement five measures to better prepare practicing teachers to teach the new curriculum more effectively:

- Establish regional training centers with professional trainers and standardized teaching materials and methods.
- Focus training mainly on the subject matter to be taught, in line with the new curriculum.
- Focus pedagogy training on techniques most likely to be effective in the KRI's large classrooms.

[9] 2010 RAND and MOE survey of teachers. Also see Table 4.2, below.

- Develop curriculum maps to help practicing teachers accurately deliver the content of the new curriculum.
- Provide ongoing support to practicing teachers as they implement the new curriculum.

The basis for these recommendations is our interviews, focus groups, and survey, as well as a review of the literature on teacher training in both developed and developing countries. We have drawn specifically from training and professional-development interventions to suggest concrete ways of bridging the gap between the knowledge and preparation of the KRI's existing teaching force and what is required by the KRI's recent education reforms.

Establish Regional Training Centers with Professional Trainers and Standardized Teaching Materials and Methods

Research suggests that to improve student achievement, systematic teacher training should be provided regularly and on an ongoing basis. Regional training centers would provide stable facilities in which to do this. They could be staffed by a cadre of full-time professionals whose only job is training (as opposed to the current system of rotating in professionals from other parts of the education system) and who use standardized materials.

To ensure professionalization, the trainers themselves will need intense initial preparation to develop their expertise in both subject matter content and instructional practices, and then ongoing training to keep their knowledge up to date. This may involve participating in train-the-trainer programs provided in the KRI or abroad, as well as conferences, workshops, and other trainer-preparation courses. According to interviewees, the Ministry of Higher Education has allocated about $120 million per year to send students from the KRI to universities in other countries for their degrees. To develop an internal capacity to prepare trainers, the MOE could use some of these scholarships to send promising individuals abroad to acquire master's or doctoral degrees in education, with a focus, for example, on curriculum content or pedagogy.

Standardizing the training will ensure that all KRI teachers receive the same high level of instruction and have access to the same training materials. It will also enable the MOE to make sure that the materials include all of the relevant content related to the new curriculum and any other learning goals outlined by the Ministry.

Focus Training Mainly on the Subject Matter to Be Taught, in Line with the New Curriculum

It will be important to make the most efficient use of training time because training may be expensive, and it will take teachers away from their other duties. The new curriculum demands knowledge of both new subject matter and appropriate teaching methods. But there is likely to be too little time during any given teacher training session to cover both of these areas thoroughly. Consequently, the MOE will need to set priorities between the two in terms of how training time will be spent.

A teacher's knowledge of the subject matter he or she is teaching has been associated with higher student achievement.[10] Achievement is highest when teachers have in-depth knowledge of the subject matter—regardless of what teaching method they employ (lecturing, small-group work, individual work, group work at the blackboard, etc.).[11] Training of teachers in the

[10] Hill, Rowan, and Ball, 2005; Yoon et al., 2007; Glewwe and Kremer, 2005; Clewell et al., 2004.

[11] Glewwe and Kremer, 2005; Hill, Umland, and Kapitula, 2009; Lewis, 2010.

content of the subjects they will teach in particular, as opposed to training on teaching methods, has been found to have the most consistent link to gains in student achievement.[12] Given the need for efficiency in training and, accordingly, the need to prioritize, the Ministry should focus teacher training on improving knowledge of the subject matter to be taught first.

Among teachers surveyed in the KRI, 38 percent of teachers in grades 1–6, 41 percent in grades 7–9, and 49 percent in grades 10–12 considered training in curriculum content in the subject they teach to be their top priority among 14 possible training areas. Other top-ranked priority training areas included developing daily lesson plans, using curriculum materials and frameworks, and modifying or adding to the curriculum. Less important according to surveyed teachers were areas such as training in developing student assessments and training in using different strategies to address the varying learning needs of individual students. (See Table 4.2.)

There were only small variations across teachers of different levels, with one exception: Teachers of higher grades (9–12) were more likely than teachers of lower grades (1–6) to assign a higher ranking to training for "modifying or adding to curriculum to suit your students' level and learning needs."

The centers should regularly (such as every three to five years) gather information from teachers on their professional development and training needs. Doing so will allow teachers to

Table 4.2.
Teacher-Reported Training Priorities, 2010

	All Grades	
Training area	Percentage of Teachers	Rank
Curriculum content in the subject(s) I teach	40	1
Developing daily lesson plans to guide classroom instruction	34	2
Using curriculum materials and frameworks	33	3
Modifying or adding to curriculum to suit your students' level and learning needs	30	4
Preparing homework assignments for students	29	5
Applying student-centered instructional methods	26	6
Engaging students in critical thinking	23	7
Incorporating instructional technology in teaching	19	8
Examining or changing scope or sequence of the coverage of specific curricular topics	18	9
Managing classrooms and addressing student discipline	15	10
Using various approaches to group students	14	11
Identifying students with special education needs	13	12
Developing student assessments and analyzing results to target instruction	12	13
Using different strategies to address the varying learning needs of individual students	11	14

SOURCE: 2010 RAND and MOE survey of teachers.

NOTE: Ninety-one percent of teachers reporting. The rankings are based on the percentage of teachers within each grade level and are for all grade levels reporting the area as a top 3 priority relative to the other areas.

[12] Yoon et al., 2007; Glewwe and Kremer, 2005; Clewell et al., 2004. Studies of primary-level schools find moderate gains (21 percentile points) in student performance on standardized tests in mathematics, science, and language arts/reading for students whose teachers received significant professional development (at least 14 hours) of content-based training (Yoon et al., 2007, p. 2).

reflect on their own strengths and weaknesses, as well as the supports they require to promote their professional and career growth.

Focus Pedagogy Training on Techniques Most Likely to Be Effective in the KRI's Classrooms

The student-centered teaching methods that KRI teachers are being asked to implement as part of the recent policy reforms may not be the best choice for KRI classes. First, because practicing KRI teachers lack an understanding of what student-centered learning entails or how to go about providing it, their attempts to apply these methods in the classroom could be counterproductive unless they receive further training. Research on schools in other countries that encouraged student-centered learning found that when teachers tried to use these practices without fully understanding what the practices entailed, teachers could feel overwhelmed and the result could be poorer instruction.[13] Moreover, studies generally have produced limited empirical evidence that student-centered instruction results in better learning outcomes than traditional approaches do. Thus, it may be unwise to make this form of instruction a central pillar of education reform.[14]

Second, 65 percent of surveyed teachers reported that large classes posed a constraint to implementing student-centered instruction (see Figure 4.6, above). Student-centered learning requires that teachers try different approaches to organizing students around learner-centered activities. It also requires teachers to give all students sufficient individual attention to actively engage them in their learning. These approaches may be difficult to implement because of the limited space in many of KRI's classrooms, and may be especially so if teachers are not provided with adequate training in these methods.

A more appropriate approach for the KRI at this point in time is to strengthen the teaching methods with which practicing teachers are familiar (such as traditional lecturing) while introducing new practices that have proven effective elsewhere. Research has shown that one of the most effective teaching methods is to deliver instruction in a clear and structured way. Therefore, pedagogy training might focus on preparing teachers in how to provide an overview of course content at the beginning of the class, organize course content in a step-by-step sequence, signal transitions between sections of a lecture, stress key points, use examples to illustrate key points, pause briefly at appropriate times to assess student comprehension, avoid unnecessary information, and review course content periodically during the lecture and at the end of the class.[15]

In the longer term, as teachers become more familiar with the content of the new curriculum, the Ministry and teachers can explore alternative pedagogical approaches.

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[13] This was found to be the case in Qatar and Bolivia, examined, respectively, by Zellman (2009) and Contreras and Talavera Simoni (2003).

[14] Richardson, 2003; Din and Wheatley, 2007; Le et al., 2009; Wilson et al., 2010.

[15] Scheerens, 2004; Chilcoat, 1989; UNESCO, 2004.

Develop Curriculum Maps to Help Practicing Teachers Accurately Deliver the Content of the New Curriculum

Curriculum maps have been found to improve student achievement.[16] These maps combine content, suggestions for teaching methods and classroom exercises, student assessment, monitoring, and teaching plans, and provide teachers with step-by-step guidance on how and what to teach. Essentially, a curriculum map is a grade-specific form of navigated instruction, with a detailed schedule of expectations and deadlines for a course. The subject matter to be covered can be divided into the number of days, class periods, or even minutes for each topic.[17] In this way, curriculum maps help ensure that the curriculum is presented in a standardized fashion.[18]

Before creating its own curriculum maps, the MOE should check with the publishers of its textbooks to learn if they currently offer curriculum maps for those textbooks. The Ministry might also want to partner with a city or state in the United States that uses curriculum maps in order to adapt them for the KRI.[19] An important first step would be to set up a committee of some of the KRI's best supervisors and teachers, who would then be responsible for developing curriculum maps for each subject in the new curriculum.

Provide Ongoing Support to Practicing Teachers as They Implement the New Curriculum

Combining formal training sessions with hands-on experience and continued consultation even after training is completed has proven to be much more effective than training alone.[20] Teachers in the KRI reported having limited access to supports, such as working with teachers in the same subject(s) that they teach, working with teachers in other subjects, and receiving feedback on their teaching from peers, head teachers, and school administrators (Figure 4.7). Just over half of teachers reported working with other teachers in the same subject to plan lessons and review curriculum, and 44 percent of teachers reported working with other teachers in other subjects to align curricula and ensure instructional continuity. Moreover, a significant number of teachers seem not to be receiving feedback from peers or school leadership.

The MOE can provide support to assist in the implementation of the new curriculum in several ways. These recommendations stem from cross-national studies that have looked at ways to promote development and retention of effective teachers.[21]

Assign new teachers a mentor. Junior teachers could receive mentoring from senior teachers to help them navigate the first few years on the job. For many junior teachers, these years can be intimidating and overwhelming. A mentor can ease the transition and help improve teacher retention rates. Studies have shown that it is critical to provide new teachers with support, because the struggles that many of them undergo during the first few years of teaching can impact performance and lower the retention of good teachers. In countries that do provide induction programs for new teachers, assigning a mentor for up to a year is a common way

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16 Fairris, 2008; Lucas, 2005; Shanahan et al., 2005; Newmann, Bryk, and Nagaoka, 2001; and Roehrig and Garrow, 2007.

17 David, 2008.

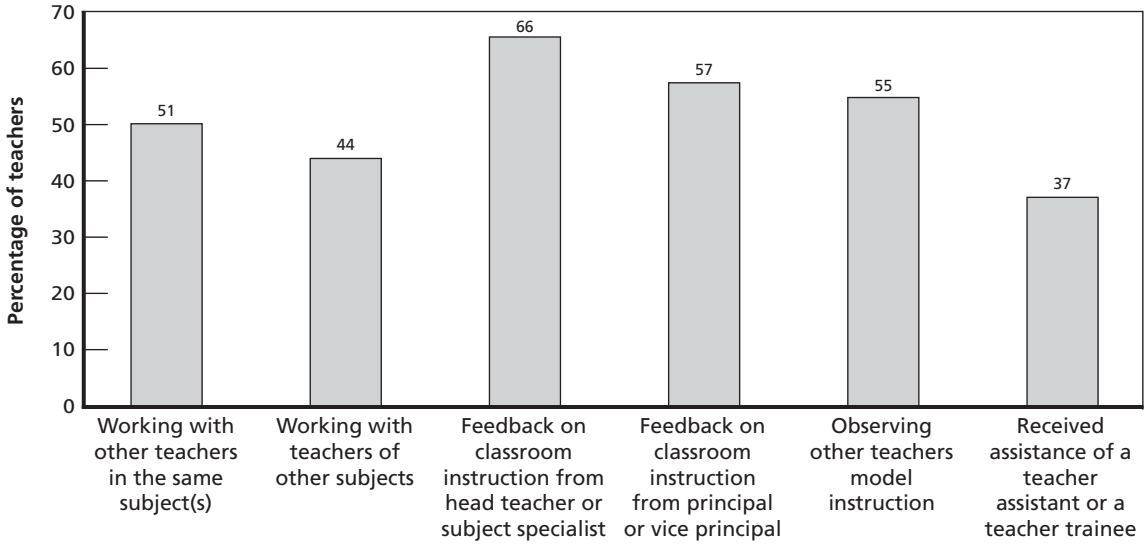
18 One drawback of using curriculum maps is that they may constrain a teacher's ability to introduce material not included in the map but relevant to student needs.

19 This could also be an opportunity to engage in training and collaborative learning.

20 Klein, 2004; Kremer, Walker, and Schlüter, 2007; Plevyak, 2007; Joyce and Showers, 2002.

21 OECD, 2005.

Figure 4.7
Percentage of Teachers Who Received Support, by Type of Support, 2009–10



SOURCE: 2010 RAND and MOE survey of teachers.
RAND *MG1140-4.7*

of addressing this concern.[22] Mentors can be drawn from more-experienced teachers from the same school, teachers from another school, or teacher retirees. In some countries, mentors are provided additional compensation or relieved of some of their duties to perform their mentoring activities.

Ensure ongoing access to expert advice. Teachers may not fully understand, absorb, or be able to apply what they have learned in training. They may have questions as they attempt to change their instructional practices in the classroom. Offering them access to expert advice can help minimize these problems. This advice can come in the form of semi-regular visits from trainers to schools to counsel teachers and answer questions, and having teachers repeat training over time.

Create peer-to-peer support for teachers. Teachers could also gain valuable professional advice from their colleagues. The Ministry might implement two measures to facilitate this:

- Train all teachers in a single school at the same time. Teachers who participate in training collectively are more likely to reinforce what was learned and implement new instructional methods in the classroom.[23]
- Establish professional learning communities that bring together teachers in the same school and teachers at nearby schools. Inter-school collaboration—such as joint lesson planning, classroom observation, and regular meetings—can promote curriculum alignment and knowledge exchange.[24] The objective is to facilitate teachers from different schools to meet regularly to discuss the curriculum and share ideas on teaching methods.

[22] OECD, 2005.

[23] Borko, 2004; Desimone et al., 2002, p. 102; Garet et al., 2001; Hill, 2001.

[24] Borko, 2004; Desimone et al., 2002, p. 102; Garet et al., 2001; Hill, 2001; Loucks-Horsley, Stiles, and Hewson, 1996; Knapp, 1997.

Professional learning communities can help reduce feelings of isolation or being overwhelmed in an environment of education reform.

Recommendations for Upgrading the Training of New Teachers

We recommend that the KRI implement several measures to upgrade the training of new teachers:

- Set higher requirements for assigning secondary-school graduates to teacher and education colleges.
- Provide new teachers recruited from various university programs with training in teaching methods.
- Restructure the curriculum of the teacher colleges.

Similar to the recommendations on improving the training of practicing teachers, these recommendations draw upon our interviews, a teacher survey, and a review of the literature.

Set Higher Requirements for Assigning Secondary-School Graduates to Teacher and Education Colleges

The KRI needs to recruit highly qualified and motivated people into the teaching profession. Yet the current system of assigning students who score in the lower tiers on the secondary-school exit exam to teacher colleges presents an impediment. There are two ways to change this without necessitating major reform: One is to raise the minimum score that a student needs on the grade 12 exit exam to be assigned to the teacher track so that it falls just below the score required for engineering schools. In this way, students entering the teaching profession will be higher achievers than is currently the case. The second way to effect the change is to allow students who score high on the exit exam to enter a teacher college or university education program if they want to, instead of assigning them to a different professional school.[25]

A more comprehensive measure—and one involving a much greater degree of change—is to reform the assignment system. The goal would be to eventually move toward a fully self-selective system in which students make their own choice of post-secondary discipline, subject to minimal requirements set by individual academic departments. While this will not guarantee that all students choosing the teaching profession are among the higher scorers, it is likely to ensure higher motivation and a broader spectrum of qualifications among the future teaching corps.

Recruitment of higher-motivated students may be eased by the high desirability of securing government employment among Kurdish youths because of its stability, disproportionate benefits relative to the private sector, and competitive wages, as noted in Chapter Three.[26] A potential limiting factor is a perception, by about half of teachers surveyed, that teaching is not

[25] Such a change would require coordination among the various institutions affected.

[26] These favorable conditions for teacher recruitment are likely to change over time as the economy develops and diversifies, but this process will take time.

a well-respected profession in the KRI.[27] However, this perception may become less limiting over time to the extent that higher-scoring students are assigned to the teaching profession.

Provide Training in Teaching Methods to New Teachers Recruited from Various University Programs

The MOE should provide recent university graduates hired to teach in basic and secondary schools with one to two semesters of training in pedagogy and teaching methods, while at the same time arranging for them to work as teacher aides in classrooms for up to 2.5 days per week. In this way, current teachers will receive additional help from these teaching aides while the new teacher recruits gain invaluable classroom experience. The practicing teachers we interviewed indicated that they would welcome such assistance, given their relatively large class sizes. Teacher aides can free them up to pay more attention to lower-performing students and to teach students in smaller groups.

Restructure the Curriculum of the Teacher Colleges

The Ministry of Higher Education should consider restructuring the curriculum of the teacher colleges along the following lines:

- Increase the number of courses on teaching methods.
- Require the equivalent of one to two semesters of practical experience in a classroom setting.

As noted earlier, a significant focus on pedagogy, teaching methods, and practical experience is standard practice in most countries. Indeed, there is support, albeit limited, for the idea that preparation in teaching methods can contribute to more-effective teaching, particularly if it is designed to be subject specific (for example, on how to teach mathematics or sciences).[28] In addition, consideration should also be given to

- aligning the new curriculum for basic schools more closely with the content of the required courses for subject-area specializations. This would better prepare new teachers to teach the new curriculum and would allow teacher colleges to reduce the number of subject-matter courses that are not related to the basic curriculum content.
- requiring students to select both a major specialization (as they must do currently) and a minor specialization. This would not necessarily add to the total number of units required to graduate, but it would require some redistribution of the types of courses required (for example, fewer courses in the major specialization in order to create time for courses in a minor specialization). Adding this requirement would eventually provide the MOE with more flexibility in assigning teachers to schools, as teachers would be able to teach two different subjects. It would also provide principals with greater flexibility in assigning teachers to classrooms.

Restructuring the curriculum along these lines will require the organizations involved to plan and coordinate carefully. These include the MOE, the Ministry of Higher Education

[27] 2010 RAND and MOE survey of teachers.

[28] Education Commission of the States, 2003; Wilson, Floden, and Ferrini-Mundy, 2001.

(which oversees the teacher colleges), and the deans of the teacher colleges. There may not be enough faculty members with the right expertise and skills to cover the new distribution of courses in the curriculum. In this case, new faculty may have to be hired or developed, and existing faculty may need to be retrained, especially in teaching methods. To assist in planning for a restructuring of this sort, the stakeholders involved should seek advice from a respected international teaching college. Given the multiplicity of the proposed changes, we suggest that they initially be implemented in one college so as to gain experience and assess their effectiveness before they are implemented in all teacher colleges.

Students Need More Instructional Time

Currently, the amount of time students spend in the classroom is another challenge to providing high-quality education in the KRI.

The KRI Generally Provides Less Instructional Time in Its Schools Than Do OECD Countries and Many Other Countries in the Middle East

KRI schools offer students fewer hours of instructional time annually than schools in most countries with high-achieving students. Schools in the OECD member countries, for example, provide students in grades 1–6 with about 100 hours more time per year in the classroom, on average, than do KRI single-shift schools and about 250 hours more per year than do KRI double-shift schools (Figure 4.8).[29] KRI grades 7–9 similarly offer less instructional time than the OECD average, which is nearly 900 hours per year. KRI single-shift grade 7–9 schools offer 765 hours per year; KRI double-shift schools, 595 hours.

Schools in other Middle Eastern countries also offer more annual instructional time than do KRI schools. In Egypt, for example, students spend about 1,200 hours per year in the classroom. Morocco offers about 800 hours of class time. At 693 hours per year, KRI single-shift schools provide more time than schools in Lebanon, Tunisia, and Yemen, each of which offers about 600 hours. But the amount of time provided in these three countries is still about 60 hours more than is provided in KRI double-shift schools.[30]

The need for KRI schools to operate in shifts is a primary source of this problem.[31] All schools in the KRI operate six days a week. But whereas schools that operate in single shifts typically offer students five hours a day, double-shift schools only offer four hours a day in each of the two shifts (morning and afternoon). In addition, the school year in the KRI is 170 days, shorter than the average of 180 days in OECD countries. When this shorter school year is combined with the reduced number of hours in the double-shift schools, it results in a considerable deficit.

The lower number of instructional hours affects quality of instruction. In our survey of teachers, 48 percent of teachers reported not having enough time in class to teach the new curriculum (see Figure 4.2, above). In addition, during our interviews, many teachers reported that they do not have enough class time to fully cover all the lessons of the new curriculum.

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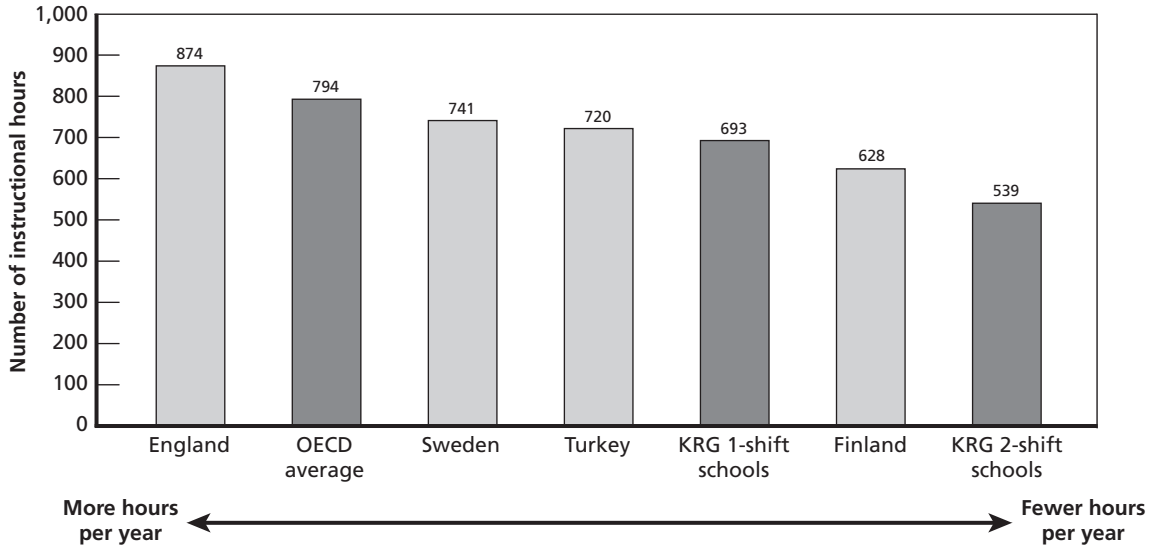
[29] OECD, 2009a.

[30] Abadzi, 2009.

[31] KRI schools that share a building with another school are usually in a similar situation.

Figure 4.8
Number of Instructional Hours per Year in OECD Countries and in the KRI, Grades 1–6



SOURCE: OECD, 2009a; KRG Ministry of Education, undated.
RAND *MG1140-4.8*

Instead, they must either teach their subjects in less depth than they would like or skip parts of the curriculum. Furthermore, the textbooks used in the new curriculum are translations of American textbooks, which were designed for more instructional time per year than is provided in the KRI and are not adapted to suit KRI's context.

Recommendations for Increasing Instructional Time

Research shows that increasing instructional time in classrooms can be an effective way of increasing student achievement.[32] Provided the added instructional time is spent on tasks, it will enable KRI teachers to cover the curriculum more fully; and if teachers are not rushed during class, it may improve their teaching. It will also increase equity among KRI students—at both single- and double-shift schools—because they will all receive the same amount of instructional time in a year.

The KRI has four options for increasing instructional time in K–12 schools:

1. Increase the number of annual school days in all schools.
2. Increase the length of the school day in double-shift schools.
3. Increase the number of annual school days in all schools *and* the length of the school day in double-shift schools.
4. Increase class time per unit and adjust time allocated to academic subjects.

[32] Cerdan-Infantes and Vermeersch, 2007; Benavot et al., 2004; Millot and Lane, 2002; Valenzuela, 2005; Bellei, 2009.

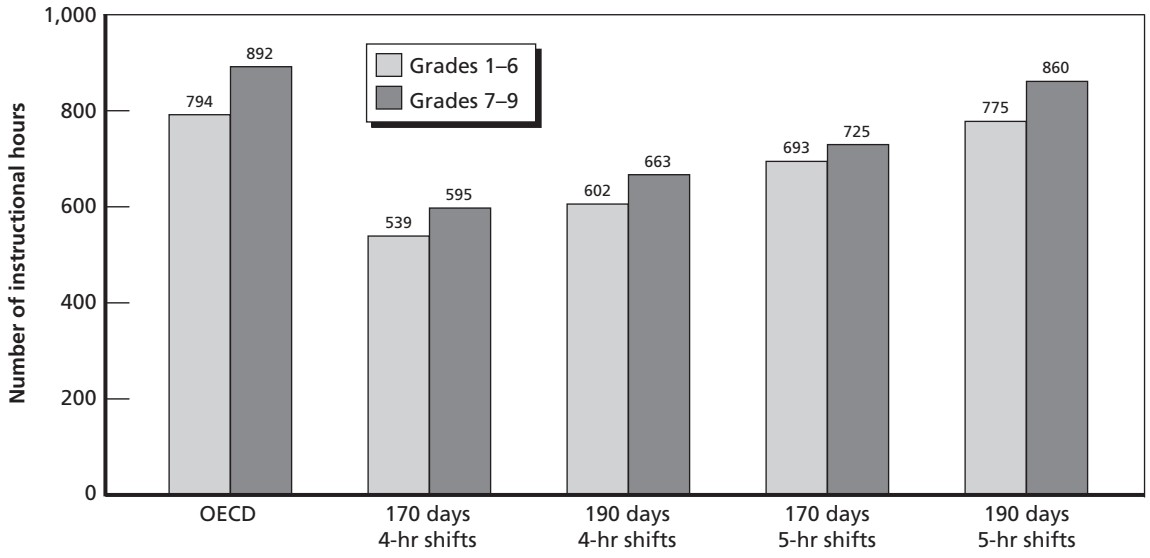
Option 1: Increase the Number of Annual School Days in All Schools

Increasing the number of school days in all KRI schools to 190 days (from 170) a year would make a significant difference in the amount of time students spend in the classroom. In grades 1–6, instructional time would increase by 12 percent in both single- and double-shift schools, and in grades 7–9, by 11 and 18 percent, respectively. Single-shift schools would then be providing only slightly less annual instructional time than the OECD school averages. However, in double-shift schools, the time provided would still be less than the OECD averages, increasing by about 63 hours annually in grades 1–6 and 68 hours annually in grades 7–9. (See Figure 4.9.)

Option 2: Increase the Length of the School Day in Double-Shift Schools

Double shifts have been used in such high-achieving countries as Singapore, South Korea, and Hong Kong. Studies have shown that schools in Asia, Latin America, and Africa that operate in two shifts can produce levels of student achievement generally equal to single-shift schools, if they provide enough instructional time.[33] While there are modest differences in achievement in some cases, the literature generally concludes that given shortages in infrastructure, children are still better off receiving double-shift schooling than no schooling at all. Double shifts can give more students access, reduce class size, and make it easier to justify spending on libraries, laboratories, and other infrastructure at schools if each school serves two shifts of students, improving the quality of education in a system as a whole.[34]

Figure 4.9
Hours of Instruction per Year in OECD and in KRI Schools, by Grade Level, Length of School Year, and Length of Daily Shift



SOURCE: OECD, 2009a.

RAND *MG1140-4.9*

[33] Bray, 2008.

[34] Bray, 2008; Fuller et al., 1999; Valenzuela, 2005; Garcia and Concha, 2009; PASEC, 2003; Batra, 1998.

Double-shift schools in Latin America, Asia, and India commonly operate in two five-hour shifts.[35] In KRI double-shift schools, instructional time could be gained by adding an hour to the current four-hour shift. For example, the first shift could run from 7:30 a.m. to 12:30 p.m.; the second, from 1:00 p.m. to 6:00 p.m.[36] This would increase annual instructional time to 693 hours in grades 1–6 and 725 hours in grades 7–9—an increase of about 25 percent (Figure 4.9).

Disadvantages of this measure may be that starting classes earlier and ending them later might present difficulties for some children and teachers if they must arrive at or leave school when it is dark or, in the case of teachers, if they work a second job.

Option 3: Increase the Number of School Days in All Schools and the Length of the School Day in Double-Shift Schools

As discussed above, this is our recommended option. Combining a five-hour school day (six days a week) with 190 school days annually in both single- and double-shift schools would have a marked effect. In single-shift schools, hours of instruction would increase by about 12 percent. In double-shift schools, the increase would be about 44 percent (Figure 4.9). As a result, all KRI students would receive the same amount of instructional time:

- 775 hours per year in grades 1–6
- 860 hours per year in grades 7–9.

Implementing these measures would bring the number of hours KRI students spend in the classroom in line with those of students in OECD countries.

Option 4: Increase Class Time per Unit and Adjust Time Allocated to Academic Subjects

This measure would increase hours of instruction by reducing the transition time between classes and including more time in units that the Ministry decides are more important. Currently, class periods are 50 minutes in the KRI's single-shift schools and 40 minutes in its double-shift schools. By making class periods longer and at the same time decreasing the number of periods in a day, the MOE could reduce transition time between classes, thereby increasing instructional time.

For example, the Ministry could make class periods in single-shift schools 10 minutes longer (increasing them from 50 to 60 minutes) and have five periods per day instead of six. This would result in one less transition period each day, which would add about an hour of instructional time per week. Students would gain 10 minutes of instruction per day—or 34 to 38 hours per year, or 5 percent of total instruction time. However, depending on the length of the school year, this gain can be relatively minimal.

At the same time, the Ministry would need to significantly restructure the current schedule. Changing the schedule in this way would mean that some subjects will gain class time, and some will lose class time. The Ministry would need to prioritize which subjects should gain time and which subjects should lose time on a grade-by-grade basis. In addition, in KRI schools, students do not spend their day with a single teacher who can adjust and make decisions about how to spend time when necessary. Rather, students change teachers at the end of

[35] Bray, 2008; Linden, 2001.

[36] Bray, 2008; Linden, 2001.

every period. Extending the lengths of periods for some classes in one grade has implications for the daily schedule of all other students in the school. Therefore, these adjustments can be complicated. Compared with the other three options, there may be too little gain and too much effort involved in implementing this measure to make it of good value.

Recommended Option

Of the four possible options for increasing instructional time in K–12 schools, we recommend the third one: The KRI should increase the number of annual school days in all schools from the current 170 to 190 and should lengthen the shifts in double-shift schools from the current four to five hours, thereby bringing the double-shift schools in line with the single-shift schools. Implementing both of these measures will bring the instructional time in KRI schools up to international norms, but will, of course, have some costs and other implications. Cost implications include an increase in teacher wages with the longer school year, additional utilities and maintenance for buildings that accommodate students for more time, and communication to schools, parents, and students about implementing new policies. The increase in teacher wages for lengthening the school year is anticipated to be the major additional cost. We do not expect that wages will have to be increased with the lengthened school day, since teachers who already teach the longer shift in single-shift schools receive no more pay than those who teach the shorter shift in double-shift schools. Costs associated with additional maintenance are not expected to have a big impact on the budget, and costs associated with communicating the changes to parents are expected to be an initial expense only.

High-Performing Students Need More Opportunities for Accelerated Learning

A lack of challenging learning opportunities for Kurdish students who demonstrate above-average talents and particular promise is a third factor contributing to student underachievement in the KRI at the present time.

High-Performing Students in Kurdistan Have Few Opportunities for Accelerated Learning

We described the current handful of opportunities for high-performing students in the KRI in detail in Chapter Two. The absence of accelerated opportunities for high-performing students is problematic for several reasons. Teachers must manage the learning needs of many kinds of students (including those who are failing and repeating grades) in their classrooms. As a result, they may not be able to offer high-performing students the more in-depth and demanding educational experiences that enable them to live up to their potential. When the most-promising students lack such opportunities, the KRI runs the risk of failing to produce the future leaders in government, business, health, and education that it will need to advance its economy and society and eventually compete in the global market. Developing a highly educated and capable group of such leaders, entrepreneurs, and engineers may help the KRI build and diversify its economy.

Recommendations for Expanding Learning Opportunities for High Performers

Tracking students into classes according to their academic performance is common in many OECD and other countries, including Germany, the United States, France, Switzerland, England, Tunisia and Turkey. It is also frequent in Asian countries, such as South Korea and Taiwan. The form of tracking may differ and range from assigning high performers to different schools, different classes within a school, or different groups within classrooms. The age at which students are tracked also differs, with some countries putting students on different tracks as early as grade 7 and others at grade 9 or 10. A third area of variation is the proportion of students tracked: Some countries, such as Finland and Tunisia, assign only a small percentage of students to a high-performer track, whereas others, such as Jordan, Korea, and Turkey, offer this opportunity to a broader group.[37]

The effects of tracking high-performing students—both positive and negative—are still very much disputed. But there is consensus in the literature that focusing teaching material on the needs of high performers benefits these students cognitively by enabling them to study in a more challenging environment. One major advantage of identifying and tracking high-performing students is that it allows teachers to better design lessons to these students' level of ability and assign them advanced work. Studies have shown that students given these opportunities can learn more and achieve at higher levels, increasing their long-term educational and professional prospects.[38] Another advantage is that it is potentially a more efficient and effective way of expanding the pool of leaders and entrepreneurs than are education policies directed at improving the whole system and all students, including most of the other recommendations made in this report.[39]

Tracking may also have some undesirable effects, however. Some studies suggest that it stigmatizes those students not placed in the high-performing tracks and reduces opportunities for academic stimulation from the higher-performing students who can serve as role models. It may also result in an increase in disparities between high and low performers.[40] However, some findings also suggest that much of the inequality that may emerge from tracking high-performing students can be diluted or even eliminated if the level of instruction in the low and predominant track is not reduced. Also, much depends on the number of students who are tracked and how they are tracked. A recent OECD report concluded that countries that have fewer track options and a relatively low incidence of students tracked by ability tend to perform better and have lower socio-economic inequalities. In our recommendations, presented below, the proportion of students to be assigned to a single track is low compared to the OECD average of 12 percent of students tracked in all subjects and 55 percent of students tracked into different classes within schools for some subjects.[41]

To broaden the learning opportunities of the KRI's high-performing students, we recommend considering the following measures:

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37 OECD, 2010.

38 Ariga and Brunello, 2007; Duflo, Dupas, and Kremer, 2009; Gamoran, 2009.

39 Pritchett and Viarengo, 2009.

40 Hallinan, 1994; Gamoran, 1992; Braddock and Slavin, 1992; Dweck, 2006; Hesson, 2010;

41 OECD, 2010; Gamoran, 1996; Broaded, 1997.

Select students for the high-performing track in a transparent way. Teacher assessments, a voluntary or mandated test, or a combination of both should be the basis for selection. To avoid concerns about discrimination or the appearance of unfairness, basing assignment uniquely on a test may be preferable. Making the test voluntary rather than mandated would place the decision to apply for high-performing status on students and their parents. The down side is that it may disproportionately benefit children of well-to-do or better-educated parents. Making the test mandatory would make selection more even-handed and also draw students assigned to the high-performing track from a larger pool.

Assign students to the high-performing track in grades 7 and 10. Tracking should start when students are entering either grade 7 or 10. Given that the majority of KRI students currently do not continue from basic school into secondary school, offering the tracking option at entry to grade 7 may be preferable. If high-performing students enter a high-performing track at this age, they are likely to gain a strong foundation of excellence in education, better preparing them for secondary school and later university. The KRI might offer another opportunity for admission at grade 10 so that high-performing students who perhaps missed their opportunity in grade 7 have another chance.

Start small and aim to gradually enter 10 to 15 percent of students into a high-performing track. It may be preferable to start the program relatively small in an experimental way. This will help minimize any possible adverse effects. A reasonable goal might be to enlarge the program to 10 to 15 percent of the target-age student population within the next decade or so.

Track high performers in separate schools. Tracking high-performing students in separate classes within the same school that regular students attend is feasible only in schools where there are enough students to create several classrooms in each grade. However, given that basic schools in the KRI are relatively small, this approach is unlikely to work. In contrast, if the Ministry assigns high-performing students to separate schools, it could build on the set of typical schools already in operation. This approach also offers the Ministry a chance to experiment with modifying the content of the curriculum in these schools. Lessons learned about offering high-quality education in the tracked schools could also inform future quality improvements in other schools.

CHAPTER FIVE

Strategic Priority Three: Strengthening Accountability and Incentives

In its 2008 report titled *The Road Not Traveled: Education Reform in the Middle East and Africa*, the World Bank argues that the reason education reforms in these regions have not produced desired results is that insufficient attention has been devoted to motivational and accountability concerns and to the extent to which the behaviors of teachers, school leaders, and parents are aligned with the broader national goal of education improvement.[1] Building on current practices in the KRI education system, this chapter discusses the role that selected expanded accountability measures and incentives can play in further advancing quality in the KRI education system.

We first describe the main issues associated with the current performance evaluation system and the incentives offered to school leaders, teachers, and parents to become agents for change. We then provide recommendations for changes to strengthen and make more effective the system currently in place. Stopping short of proposing a comprehensive redesign of the current system, we attempt to strike a balance between the need to strengthen accountability and incentive measures in order to drive improvement, and the feasibility of implementing such measures without overburdening a system that has other pressing needs, as outlined earlier in this report.

Accountability and Incentive Issues

Collecting and reporting objective information on how various components of the education system are performing is essential to making the strategic policy decisions needed to drive education improvement. Performance-based assessments and monitoring, however, are not sufficient to drive education improvement. It is also necessary to have appropriate incentives in place, incentives that encourage teachers, school leaders, and parents to embrace certain behaviors and that discourage other behaviors.

At present, the rudimentary system that KRI has in place to evaluate performance, collect and use information, and encourage desirable stakeholder behaviors is not functioning in a way that drives education improvement (see Chapter Two). This system has several main issues: an insufficiently robust teacher evaluation, a weak support and incentive structure for teachers and principals, and a lack of information for gauging progress and performance of schools. Along with the current inadequate capacity to match rising enrollment and issues of quality

[1] World Bank, 2008.

of instruction, these issues are the most pressing problems facing the KRI's K–12 education system today.

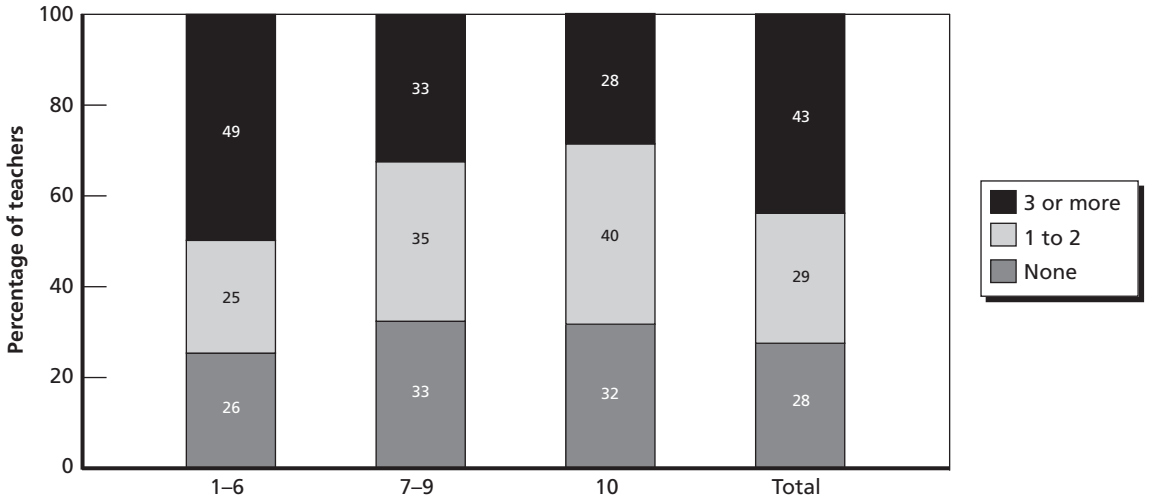
The Evaluation Process for Teachers Is Not Sufficiently Robust to Identify Low Performers Accurately, and There Are Few to No Consequences for Poor Performance

Supervisors from the MOE play a dual role in K–12 education: not only are they supposed to provide the first line of support for teachers who need help with the new 2008 curriculum and instructional methods, they also must evaluate teacher performance. In our field interviews, teachers and members of the Ministry staff alike reported that supervisor visits were too few and too short (often just a day) to allow supervisors to perform both of these roles—objectively evaluating teachers *and* transferring knowledge. This assessment was generally confirmed in our survey of teachers. Twenty-eight percent of teachers reported that a supervisor did not observe their instruction or meet with them during the 2009–2010 academic year (Figure 5.1). Also, an additional 29 percent reported that a supervisor met with them or observed them only once or twice during the year, suggesting that infrequent follow-up is occurring between supervisors and teachers.

Ministry officials also called into question the rating system used to assess teacher performance (described in Chapter Two). They expressed doubts about how effectively the system is able to identify poorly performing teachers and their areas of weakness. Currently, for instance, out of more than 89,000 teachers in the K–12 system, only about 2 percent to 3 percent received a "poor" rating. Yet at the same time, principals report that many teachers lack the knowledge to implement the new curriculum.

Also, teacher evaluation is not in step with the recent changes to the national curriculum. For example, the evaluation form that supervisors use to rate teachers has not been fully

Figure 5.1
Percentage of Teachers Interacting With Supervisors, by Frequency of Interaction and Grade Level, 2009–10



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: The question asked the number of times supervisor observed the teacher's classroom or met with him/her. First-year teachers were not included. Seventy-six percent of surveyed teachers responded.
RAND *MG1140-5.1*

revised to align with new, higher standards for what and how teachers are expected to teach. This makes it difficult to identify those teachers who are having the most problems implementing the new curriculum.

Finally, the current teacher performance evaluation process provides no follow-up for poorly performing teachers. Ministry stakeholders and school leaders reported that teachers are rarely dismissed for low performance. Although underperformers are supposed to receive additional training, interviewees reported that this seldom takes place.

At present, the only means of dealing with underperformers is to transfer them to another school. Some principals with the wherewithal to remove teachers from their school are able to do so, and this occasionally does happen. But the vast majority of school leaders have limited authority to effectively deal with a poorly performing staff member. Moreover, this "solution" merely shifts the problem from one school to another.

The Current Support Structure for Teachers Does Not Meet Their Needs

Underlying the weak support structure for teachers are three main concerns: the reported lack of sufficient qualifications of the supervisors who are supposed to train and support teachers, the dual and potentially conflicting role that supervisors assume, and the limited role that principals play in evaluating teacher performance and making personnel decisions.

Many supervisors lack sufficient qualifications for training and supporting teachers. Introduction of the new curriculum has been challenging for the KRI's K–12 teachers. Several teachers we interviewed expressed feelings of isolation and of being overwhelmed with what they consider to be unreasonable expectations. The current system of sporadic and brief visits from Ministry supervisors, as noted earlier, is reportedly not enough to meet teachers' needs for support.

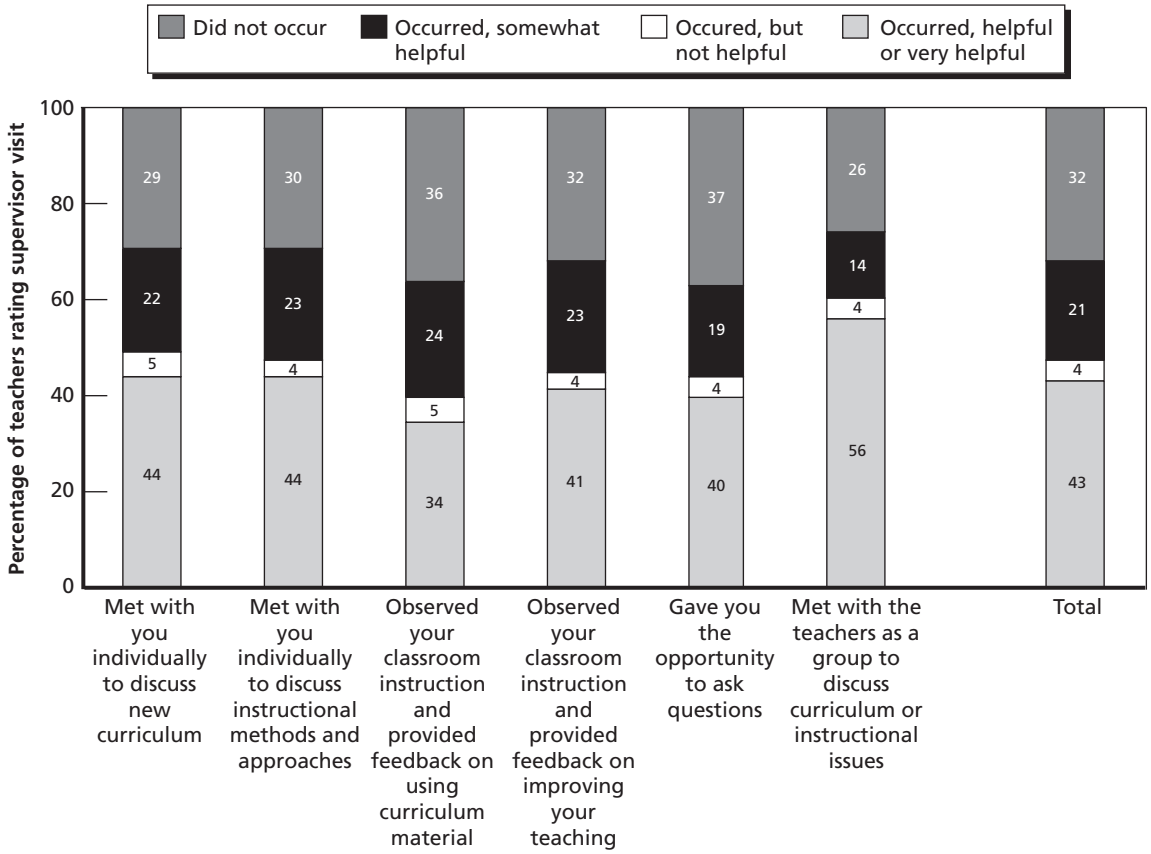
Even when supervisors visited the schools, teachers rarely were given information or feedback on instruction or help on teaching the new curriculum. For example, 44 percent of teachers reported that they did not meet individually with supervisors to discuss the new curriculum or to discuss instructional methods and approaches. Of the remaining 56 percent, nearly half indicated the interactions were not helpful or only somewhat helpful. Furthermore, over half of the teachers reported that the supervisor did not meet with them as a group to discuss instruction or curriculum, and more than 30 percent of teachers reported that they were not observed or provided feedback on using the curriculum materials and on improving their teaching (Figure 5.2). Teachers in the upper grades (7–12) were less likely than primary-grade teachers to interact with supervisors on instruction and the new curriculum.

Part of the problem, according to our respondents, is that many supervisors lack sufficient qualifications to perform effectively in their supportive role since they have not received the intensive training required to make them experts in their subject area. Ministry officials generally agreed that the training provided to supervisors is not sufficient.

The process by which supervisors are selected also needs improvement: It is presently neither rigorous nor standardized. Ministry officials noted a need for a more robust system to evaluate the suitability of candidates, one that includes an assessment of academic qualifications, career and experience, managerial experience, leadership, and personality traits.

Supervisors play a dual role that can present a conflict of interest. Supervisors are expected to adopt a dual role as trainers and evaluators that can be both challenging and present a conflict of interest. When supervisors train and evaluate the same teachers, they are

Figure 5.2
Percentage of Teachers Interacting With Supervisors, By Topic Discussed and Usefulness of Interaction, 2009–10



SOURCE: 2010 RAND and MOE survey of teachers.
NOTE: First-year teachers were not included; 83 percent of surveyed teachers responded.
RAND *MG1140-5.2*

implicitly evaluating their own training. Their role as trainer compromises their ability to objectively perform their role as evaluator.

The role of the school leader or principal is limited in guiding and supporting teacher behavior. Principals contribute only 25 percent to the overall evaluation of teachers in their schools; the remaining 75 percent falls to supervisors. Yet supervisors rarely observe classrooms or meet with teachers, as noted earlier, whereas principals are on site daily. This disproportional allocation of the weight that each evaluation carries gives principals little incentive to play a more prominent role in personnel decisions and aspects of instructional leadership that target teacher behavior. Principals who did take initiative and assume instructional leadership roles did so on their own, not through an existing support and incentive structure.

School Leaders, Parents, and Other Stakeholders Have Limited Information on School Performance Systemwide

Key to improvement in an education system is a process for gathering data on performance and for equipping stakeholders (principals, teachers, parents, and policymakers) with information that affords them a broader view of how aspects of the system are performing. Currently,

some data on performance exist, but stakeholders have limited access to these data in ways that empower them to change their own behavior and push for improvement. For example, school leaders have no access to standardized information on the performance of all K–12 schools in the KRI. Consequently, they cannot gauge the progress of their particular school against other schools and have no incentives to make improvements in their schools.

Parents and other community stakeholders face a related version of this problem: There is no structure in place that enables them to access information that would allow them to know how their child is performing or how their child's school is performing compared with other schools. As a result, they cannot make informed judgments about the quality of instruction their child is receiving. This may, in turn, discourage them from getting involved in their child's education and school activities and from putting pressure on the schools to upgrade performance.

Recommendations for Improving Accountability and Incentives for Teachers, Principals, and Parents

We suggest an incremental set of recommendations to increase supports to teachers and school leaders and implement improvements to the existing K–12 performance evaluation system:

- Redesign the system for evaluating teacher performance.
- Reward high-performing schools and teachers.
- Restructure the role of supervisors to separate their evaluation role from their training functions.
- Give principals a more prominent role in teacher evaluation, hiring, and firing.
- Measure overall progress on improving student achievement and make the results public.
- Increase the involvement of parents and the public in education.

Redesign the System for Evaluating Teacher Performance

The teacher performance evaluation form should be revised to be aligned with the new curriculum, clearly linked to teaching standards and performance criteria consistent with the revised goals of the K–12 system. The evaluation process should be transparent, and evaluators and principals should be trained to be more consistent in applying the evaluation criteria. The evaluation system should also provide a feedback mechanism to help guide the content of training and professional development from year to year.

An element should be built into the design of the system that delivers a way of dealing with both high- and low-performing teachers. The evaluation system should be linked to a wider accountability framework that offers rewards and promotion to teachers who excel (see below) and that supports interventions and sanctions for those who perform poorly. The MOE might seek to involve teacher representatives in revising the evaluation in order to ensure teacher buy-in and support for the changes.[2]

[2] Avalos and Assael, 2006.

Reward High-Performing Schools and Teachers

Performance-based incentives have been implemented on both a large and a small scale in countries around the world. The evidence from implementation of these systems has been mixed in terms of impacts on student achievement, but it is generally accepted that these systems, if properly designed, are likely to be more cost-effective than are traditional salary increases.[3] Performance-based incentives are most effective when they are based on well-defined performance outcomes that capture progress over time and incorporate multiple measures (e.g., student test scores, teacher evaluations). Incentives can be targeted to reward individual-level performance or group-level performance, as in rewarding an entire school for showing improvement on one or more indicators. The difficulties associated with developing effective individual-based incentive systems make group-based incentives a potentially more appropriate approach for the KRI.

The advantage of using individual-based over group-based incentives is that such a system minimizes free-riding or shirking behavior on the part of group members. However, compared to group-based incentives, individual-based rewards require more-precise and greater amounts of data to accurately identify individual-level performance. Group-based, or school-based, incentives are less precise measures of the effort that individuals undertake, but this type of system can encourage school-wide teacher and administrator collaboration toward a common goal of education improvement.[4] In the KRI case, providing incentives based on school-wide performance is an important initial step that can lead to more-refined performance-based rewards in the future. Additionally, some research points to greater acceptance for school-based over individual-based incentives within the education community.

In Chile, for example, the National System of School Performance Assessment (known as SNED) implemented school-based incentives to improve overall education outcomes. Schools whose students did well on the national exam received monetary rewards. Under this arrangement, schools are stratified according to similar circumstances (i.e., socio-economic factors), and high-performing schools within each stratum are given financial rewards for good performance. Ninety percent of the financial reward is allocated to bonus payments to all staff in each winning school. The remaining 10 percent can be used at each principal's discretion to additionally recognize individual teachers.[5]

Restructure the Role of Supervisors to Separate Their Evaluation Role from Their Training Functions

The need to better train practicing teachers is acute in the KRI. In Chapter Four, we recommended that regional training centers be established to help meet this need. We suggest that to staff these centers, the MOE should look to supervisors with the appropriate training credentials. These individuals need to focus fully on this important role, so they should assume a new job title and no longer perform the evaluation functions required of a supervisor. Indeed, this measure would contribute to the creation of a professional force of teacher trainers.

In tandem with this, supervisors' functions should include monitoring schools' compliance with policy and requirements while downplaying their role as evaluators of teachers.

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[3] McEwan and Santibanez, 2005; Santibanez, 2010.

[4] Santibanez, 2010; Glewwe and Kremer, 2005; Birdsall, Levine, and Ibrahim, 2005.

[5] McMeekin, 2000; Santibanez, 2010.

Give Principals a More Prominent Role in Teacher Evaluation, Hiring, and Firing

School leaders should not be overlooked as a lever for change in improving school outcomes, especially since they oversee the day-to-day operations of schools.[6] Therefore, we recommend that principals have a greater say than they currently have in the evaluation of their teachers. Instead of the principal's input constituting 25 percent of the total score (as it does now), it should be raised to 50 or even 75 percent. Principals also need to have greater authority in personnel decisionmaking; for example, they should be able to secure training and support for low-performing teachers. Moreover, they should be able to recommend that consistently low-performing teachers be let go. To implement these measures, principal capacity will need to increase through training and a gradual increase in school leadership responsibilities. This will help transform the role of principal into one of proactive and comprehensive instructional leadership that will contribute towards school improvement.

Measure Overall Progress on Improving Student Achievement and Make the Results Public

Studies have shown that education systems that have a way to monitor and report on student learning outcomes show more improvements over time than those that do not.[7] The MOE already collects a broad array of school-level information that can be used to monitor the overall progress of the KRI's recent education reforms. For example, the MOE administers a national achievement test at grades 6, 8, and 9, the main purposes of which are to measure educational progress at the school level, provide an indicator of overall progress in student learning, and identify schools in which intervention and assistance may be needed.

The Ministry should maintain this exam, aggregate the results at the school level, and develop the capability to provide school-level results to principals, teachers, and parents.[8] It might also consider participating in one of the international student-achievement assessments, such as the Programme for International Student Achievement (PISA) or the Trends in International Mathematics and Sciences Study (TIMSS), as a way to benchmark KRI schools against schools in other countries.

Equipping parents with information about the performance of their child's school may help engage them and get them more involved in their child's schooling. This can then lead to improved school outcomes.[9] Disseminating performance data on the education system as a whole may also get the general public more involved in education.

Increase the Involvement of Stakeholders and the Public in Education

An active community involvement in education can help ensure that education reflects local values and priorities, can raise the public's stake in the quality of education, and can increase the demand for education.[10]

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6 Augustine et al., 2009.

7 Hanushek and Raymond, 2004.

8 Currently the DG of Assessment does not have the capacity to digitize the results of the tests (they are aggregated by hand). To provide school-level achievement data on a timely basis, the Ministry will need to acquire this capability.

9 Gunnarsson et al., 2009; Gertler, Patrinos, and Rubio-Codina, 2008; Andrabi, Das, and Khwaja, 2009; Duflo, Dupas, and Kremer, 2007.

10 Birdsall, Levine, and Ibrahim, 2005, p. 341.

A critical first step in getting principals, teachers, and other key stakeholders involved in the decisionmaking process about education reform is setting up a process to consult with them. Consultations of this sort will provide bottom-up ideas and inputs to strengthen access to and quality of education in the KRI. They will also help ensure that those who must implement and act on changes to current practices understand the reasons for the changes.

Cultivating an informed community is another crucial part of increasing the involvement of stakeholders. The more data and information made available to inform the community of the KRI's progress toward goals such as universal education, the more the national dialogue about education will expand and its visibility increase. To this end, the KRI might consider conducting awareness campaigns on the following topics:

- the importance of education in building a civil society
- the roles and responsibilities of parents in the education of their children
- the importance of a broadly educated society for the KRI's future economic development and welfare.

CHAPTER SIX

Guidelines for Implementing the Recommendations

Chapters Three, Four, and Five described in detail the three strategic priorities for the KRI that we identified in our analysis of the current KRI education system. Along with each of these priorities, we provided recommendations for further actions. While the efforts needed to implement our recommended changes may at first seem daunting, it should be remembered that the changes need not be executed all at once. Our vision is that the MOE will further deliberate on the priorities and put our recommendations into action over multiple years, partly to avoid overloading principals and teachers with too many changes at the same time, and partly to manage the sheer scale of the effort involved.

Large-scale changes in education systems typically require strong leadership and technical capability—to steer the effort, navigate challenges, make decisions, and build consensus among stakeholders. This will require extensive coordination among multiple actors, who commonly have varying interests. In the case of the KRI, these actors include several ministries, multiple offices within the MOE, the governorates and districts, and the schools. Change also requires negotiation, a good communication plan, and political will. Some of the changes will require that additional funding be secured; others may require that Ministry staff undergo training. For all of the changes we recommend, effective implementation will require careful planning, with clearly articulated goals, well-defined tasks, metrics to measure progress, and timelines. In some cases, it may be desirable to conduct feasibility studies or pilot studies in a limited number of schools to see what issues arise that will have to be addressed before the changes are implemented system-wide.

In this chapter, we suggest a coordinated approach that the MOE could adopt to implement the recommendations in a manageable way. This approach has three pillars:

- Appoint task forces for each primary recommendation to make key decisions; design new policies, programs, and operational guidelines; and develop detailed implementation plans.
- Conduct the implementation in phases.
- Coordinate those parts of implementation that affect all of the task forces.

We start with detailed descriptions of the composition and implementation design responsibilities of the five task forces that we propose the Ministry set up at the outset of the effort. We then present a framework for planning and conducting the implementation in phases. Finally, we describe several actions that may be beyond the purview of any of the task forces but may be needed to ensure successful implementation.

Convene Five Task Forces to Plan Implementation

We suggest that the Ministry form five task forces to do the detailed planning required for implementation of the recommendations:

- school capacity task force
- teacher training task force
- instructional time and retention policy task force
- diverse opportunities task force
- accountability and incentives task force.

Each of these task forces corresponds to one of our five chief sets of recommendations: (1) expand the capacity of the school system; (2) better train and prepare teachers; (3) increase instructional time; (4) expand learning opportunities for high-performing students (within the overarching strategic goal of improving the quality of education); (5) strengthen stakeholders' accountability and incentives.

The work of the task forces will require extensive coordination, not only among directorates within the MOE, but with other organizations outside the Ministry. Ideally, members of each task force should represent (when appropriate) all relevant ministries, the appropriate DGs from the MOE, education districts in the governorates, principals, supervisors, teachers, and parents. Inclusion of respected administrators, principals, and teachers will ensure that changes are viewed as legitimate and will aid effective implementation.

Because the task forces may overlap to some extent, the Minister of Education could oversee and coordinate all five, appointing for each one a leader who reports to either him or to his deputy. Relevant task force and subcommittee leads with overlapping responsibilities will need to coordinate with each other as well. The choice of leadership is critical: Each leader will perform the vital functions of formulating policy, sustaining the task force's focus over several years, and generating support for changes. Accordingly, each leader must be fully committed to the changes to be implemented, possess effective coordination and managerial skills, and have (or be provided with) the authority necessary to effectively coordinate across DGs, levels of government, and even across ministries.

The School Capacity Task Force

The school capacity task force is charged with planning the expansion of schools, classrooms, and teachers to absorb the new students expected to enroll in the next decade and with reducing school overcrowding. Given the extent of expansion anticipated, this task force may need to be institutionalized and stay in place for many years. It should include representatives from various directorates at the MOE; the ministries of Planning, Finance, and Higher Education; the governorates and districts; and municipalities. Each of these stakeholders has authority over one or more parts of this effort.

This task force has three main areas of responsibility: using existing school capacity, building schools, and hiring new teachers. Each area should have a subcommittee.

Subcommittee on using existing capacity. Responsible for planning second shifts at certain single-shift schools and redistributing students to reduce overcrowding, this subcommittee should coordinate with the instructional time subcommittee. It would be tasked with

- using available data to identify single-shift schools in urban and semi-urban areas that could take a second shift
- conducting feasibility studies to ensure students are able to get to their schools
- creating plans to create second shifts at single-shift schools, including hiring principals and teachers and assigning students
- using available data to identify crowded schools and nearby less crowded schools
- creating plans to transfer students from crowded to less crowded schools
- communicating with parents about transferring their children among schools.

Subcommittee on building of schools. This subcommittee would be tasked with

- deciding on the number of schools to be built
- planning and overseeing repairs and additions to current schools
- creating a phased-in plan for building schools in each sub-district over time in order to meet current and projected demand for school places. The plan should rely on population data and trends in each district and sub-district
- securing capital budget commitments for the next four to five years
- deciding on the most appropriate specifications and mode of construction for schools, given needs and budget limitations
- creating requests for proposals, selecting contractors, and overseeing contracts and construction with school builders
- coordinating with the governorates, districts, and municipalities to ensure that the proper infrastructure is in place to support the schools to be built (for example, water, sewage, electricity, and roads)
- updating the building plans on an annual basis to account for actual growth in number of students
- setting yearly goals and targets so that progress toward these targets can be monitored.

Subcommittee on new teachers. This subcommittee is responsible for planning for the new teachers needed in the coming decade and will need to coordinate closely with the teacher training task force. It would be tasked with

- determining the total numbers of teachers necessary each year to staff new schools
- determining the numbers of teachers with various kinds of specializations in order to staff new schools and fill current shortages in key specializations
- coordinating with the Ministry of Higher Education and teacher colleges so that they can plan the needed numbers of new graduates from teacher colleges
- creating a plan to assign teachers to each newly opened school as it opens
- creating and staffing second shifts at some existing schools
- setting yearly goals and targets so that progress toward these targets can be monitored.

The Teacher Training Task Force

The task force for teacher training will create and implement a plan to ensure that teachers have the expertise needed to teach the new curriculum and deliver high-quality education. This task force may need to be in place for several years. It should include representatives from

the MOE, the Ministry of Higher Education, the teacher colleges, and perhaps advisors from international teacher colleges, in addition to principals, teachers, and supervisors.

This task force will need to coordinate with all the other task forces: the accountability and incentives task force's subcommittee on teacher evaluation policies, to ensure there is coordination between how teachers are trained and how they are evaluated and that measures used are consistent; and the subcommittee on retention policy, to ensure that teachers are uniformly trained to identify which students may need additional help and which ones should be retained.

This task force has three main areas of responsibility—training new teachers, certifying university graduates as teachers, and professional development for practicing teachers—each of which should have a subcommittee.

Subcommittee on training new teachers. Responsible for improving the training of new teachers in the teacher colleges, this subcommittee would be tasked with

- revising the curriculum of the teacher colleges. Areas to consider for revision are increased training in instructional methods, requiring experience in teaching as part of the degree, ensuring that new teachers have the knowledge necessary to teach the new curriculum, and requiring both a major and a minor specialization
- setting policy for the kinds of teaching methods taught, to ensure that teachers use methods appropriate to Kurdistan's classrooms
- coordinating with the school system capacity task force on the numbers of new teachers with various kinds of specializations needed each year
- coordinating with the Ministry of Higher Education to raise admission requirements for teacher college entry.

Subcommittee on certifying university graduates as teachers. This subcommittee, which is responsible for upgrading the training for new teachers who have graduated from university programs other than teacher colleges, would be tasked with

- creating a plan to provide increased training in teaching methods and student-teacher work experience for university graduates who become teachers. The kinds of teaching methods would need to be coordinated with those taught in the basic teacher colleges.

Subcommittee on professional development for practicing teachers. This subcommittee, which is responsible for planning how to train practicing teachers to better teach the new curriculum, would be tasked with

- setting up teacher training institutes in all three governorates
- establishing and implementing a plan to hire and train professional teacher trainers. Trainers can be selected from the best teachers, supervisors, and others using a pre-defined selection process. This can be done in collaboration with the teacher colleges or by training new trainers by sending them to other countries for master's degrees in teaching
- creating standardized training materials based on priorities (such as prioritizing subject-matter content and teaching methods appropriate to KRI classrooms)
- setting a plan to rotate current teachers through longer periods of standardized training

- creating curriculum maps to provide ongoing support to teachers in content and teaching methods.

The Instructional Time and Retention Policy Task Force

The task force for instructional time and retention policy will plan and implement increases in instructional time and changes in retention policy for students. It may need to be in place for a short period of time—just long enough to make decisions and carry them out. After that, it can be dissolved, with occasional checks to monitor progress. Representatives on the task force should be drawn primarily from the MOE and should include some principals, supervisors, and teachers as advisors.

Subcommittee on instructional time. Responsible for increasing instructional time in KRI classrooms, this subcommittee would be tasked with

- making decisions about the most appropriate ways of increasing instructional time—increasing shift time, increasing numbers of school days, or both, and setting the start and end time of the school day
- writing up policies about the new amounts of time required and communicating them to the schools
- setting a communication plan to communicate to the public why these changes are important in order to support the implementation and mitigate criticism or resistance to the additional time.

Subcommittee on retention policy. This subcommittee, which is responsible for making decisions and setting policies about retention of students, will have to coordinate with the teacher training task force on policies and training. It would be tasked with

- making decisions about policies concerning which students should be retained and when, and about targets for reducing student retention over time
- creating policies and providing resources to supply additional learning support to students who need it, especially to improve the achievement of the lowest performers
- creating and using metrics to monitor progress in reducing retention rates and improving the achievement of the lowest-performing students though additional learning support
- communicating changes in policies to schools.

The Diverse Opportunities Task Force

The task force for diverse opportunities will plan and implement ways of providing more opportunities for high-performing students. Members should be drawn primarily from the MOE, with advisors including teachers, supervisors, and principals of typical schools and elite private schools. Its responsibilities would include

- making decisions about the kinds of academic programs the KRI will provide for high performers, whether at separate schools or integrated within schools
- creating plans to implement these decisions, which will include negotiating to have additional school buildings allocated for these schools, selecting and training high-quality teachers, and creating a plan to select students in a way that is transparent to the public

- creating a communications strategy so that the public understands the reasons for providing different learning opportunities for higher-performing or talented students and is confident that student selection for these programs is fair and transparent
- creating targets to enroll about 10 to 15 percent of students in these programs over the next ten years.

The Accountability and Incentives Task Force

The accountability and incentives task force will plan and implement improvements in accountability and incentives for schools, teachers, principals, and students. It may be useful to keep it in place for at least five years so that it will have ample time to design these changes, implement them, and then work to continually improve them over time. Members of the task force should be drawn primarily from the MOE, with additional representatives drawn from the ranks of principals, teachers, and supervisors.

This task force has three main areas of responsibility, each of which should have a subcommittee: evaluating teachers, developing achievement indicators, and disseminating public information about education. In the teacher evaluation area, it should coordinate with the teacher training task force.

Subcommittee on teacher evaluation policies. Responsible for revising policies for teacher evaluation, this subcommittee would be tasked with

- creating clear policies for evaluating teacher performance in alignment with the new curriculum and with teacher training
- revising teacher and principal evaluation criteria and directives
- making decisions about who evaluates teachers and how much—whether it be the principals, supervisors, or a combination of both. This may include restructuring the role of the supervisors so that they focus mainly on evaluation, and increasing the importance of principals' evaluations
- considering ways of rewarding high-performing teachers and principals, through recognition and/or through monetary award
- considering ways of offering training and incentives to improve the performance of low-performing teachers

Subcommittee on achievement indicators. Responsible for developing indicators to measure the KRI school system's progress on priorities and student achievement, this subcommittee would be tasked with

- planning ways of continuing to collect data about student achievement through KRI exams in grades 5, 8, and 11
- developing a system to gather the data electronically so that they can be analyzed at different levels—at a system level, a school level, a regional level, and a student level
- analyzing data over time so that they can be used to measure progress
- arranging for KRI to participate in an international assessment to benchmark performance of the KRI school system against world standards
- finding ways to identify and provide rewards for high-performing schools.

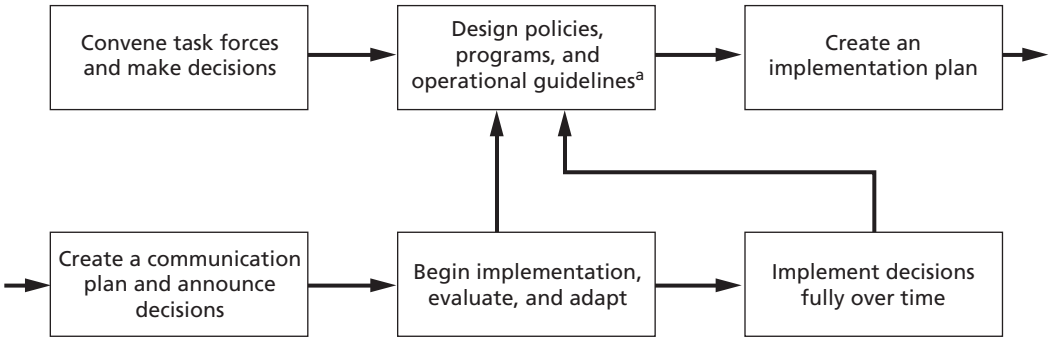
Subcommittee on public information about education. Responsible for transparent sharing of information about school performance and student achievement, this subcommittee would be tasked with

- creating a plan to share data about performance of the school system as a whole over time with the public
- creating a plan to share data with principals on how their schools are performing in a variety of areas in comparison with other schools
- designing policies and mechanisms to promote parental involvement with the school system
- institutionalizing MOE consultations with principals and teachers about decisions before key decisions are made and carried out
- creating a communication plan to raise the awareness of the importance of education in building civil society, and educating parents about their roles in supporting their children's learning.

Implement Recommendations in Phases Over Time

Studies of change in large organizations have shown that implementation is most successful when done in phases. A meta-analysis of studies on implementation identified six common phases in change initiatives within the public sector: exploration and adoption, program installation, initial implementation, full operation, innovation, and sustainability.[1] We adapted this model into a six-phase approach, shown in Figure 6.1, for use in the KRI.

Figure 6.1
Phases for Implementing Changes to KRI's Education System



[a]This may require conducting feasibility, cost, and other studies.

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[1] Fixsen et al. (2005) conducted a meta-analysis of over 6,000 papers on public-sector implementation of change initiatives. Also see Harman and Harman, 2003; Nadler and Tushman, 1997.

Phase I: Convene Task Forces and Make Key Decisions

In phase I, the MOE should create the five task forces, which report to the Minister of Education. The first duty of the task forces will be to review the RAND recommendations, weigh their advantages and disadvantages, and make final decisions about what changes to adopt and implement over which periods of time. The task forces will then be responsible for guiding their parts of the implementation process through the subsequent five phases.

Phase II: Design Policies, Programs, and Operational Guidelines

Phase II should involve setting up the detailed policies, programs, and operational practices that will define (1) what should be provided programmatically and (2) what the educational staff (including administrators, principals, and teachers) should be doing to implement the desired change(s) and how they should be doing it. For instance, the task force charged with expanding school capacity would define the number of schools by number of classrooms that should be built each year, how they should be built (for example, by traditional or prefabricated methods), and who should be responsible for what. The task force on training would define the functions of the regional training centers, whether they will be affiliated with the teacher colleges, how many professional trainers they will have, how many teachers they will train every year, what the general content of the training program will be, and so on.

In brief, this phase should entail conducting all preparatory policy and program design and writing guidelines that define the functions and expected behavior of staff that will eventually be called upon to implement the changes. Funding should also be secured for eventual implementation.

Phase III: Create an Implementation Plan

Phase III should involve creating detailed plans for implementing the policies, programs, and operational guidelines defined in phase II. These plans should lay out specific tasks, the person(s) responsible for accomplishing each task, and timelines for completion. For example, the plans should define who is going to design and build the schools or develop the new programs and over which periods of time, how and when to train staff who may need training on the changes they will have to implement, who is going to hire the new staff and on what timetable, and what measurable goals are going to be set to measure and monitor progress.

Also in this phase, each task force should identify stakeholders and strategize how best to address stakeholder interests,[2] creating a stakeholder management plan.

Finally, each task force should analyze potential challenges, barriers, and risks to implementation and be prepared to address them as necessary. This should result in creation of a risk management plan.

Phase IV: Create a Communication Plan and Announce Decisions

In phase IV, the MOE should create a communication plan to cultivate support for the changes to be made. This is an important step, necessary to ensure that the people who will be responsible for making the reforms successful (such as parents, principals, and teachers) understand the reasons for the changes and back them. Each task force should meet with stakeholders to gather their feedback and input. Involving staff is critical to facilitating and ensuring effec-

[2] Delannoy, 2000.

tive implementation of policy or programmatic changes, particularly those staff most likely to be affected by the changes.[3] After that, the Ministry might create a communications strategy coordinated across all five task forces, with plans to address challenges and negative feedback.

The Ministry might also hold a conference with stakeholders to announce decisions and explain goals and actions. The goals of the conference would be to demonstrate that the actions being taken have continuity with the 2008 reforms; involve education leaders, teachers, and principals; and provide momentum and a launching point for change.

Phase V: Begin Implementation, Evaluate, and Adapt

Phase V should begin the actual implementation of the prescribed changes. These changes may be either phased in over time (for example, starting with piloting them in a few schools) or implemented all at once. For instance, the recommendation to increase instructional time from four to five hours per day in double-shift schools could either be tried in a limited number of urban and rural schools or be implemented in all schools all at once. Principals and teachers should be notified and provided written guidelines on what they are expected to do. The advantage of piloting the changes in a few schools is that implementers can learn about possible negative reactions to the change on the part of students, parents, principals, and/or teachers, as well as identify logistical or scheduling problems that might arise. These issues can then be taken into account and remedied before full-scale implementation.

This phase should include implementing decisions on a small scale where desirable; collecting data and monitoring progress; creating a culture of learning from experience; evaluating how to improve; and making changes to plans, targets, policies, and procedures based on lessons learned. At the same time, it will be important to balance improvements and innovation with maintaining consistency of policy for a set period of time. Studies have shown that continuity of policy is important for success of long-term implementation of public-sector reforms.[4]

Phase VI: Implement Decisions Fully Over Time

In phase VI, the MOE should expand implementation according to the implementation plan prepared in phase III. This includes carrying decisions through to the full extent planned and fully integrating new policies and programs with the MOE administration, the Ministry of Higher Education and Teacher Colleges, school administration, teachers, students, parents, and the media. This last phase should also involve ensuring the sustainability of programs so that they can continue to have an impact over time. It will include determining longer-term budgetary needs, ensuring that management and staff are fully trained over time, stabilizing policies, and establishing and maintaining communications with stakeholders.

Coordinate Implementation Among All the Task Forces

As emphasized above, coordination among the task forces will be important for successful implementation of the recommendations. Some of the task forces will have overlapping respon-

[3] Bikson and Eveland, 1998; Nadler and Tushman, 1997; Mankin, Cohen, and Bikson, 1997.

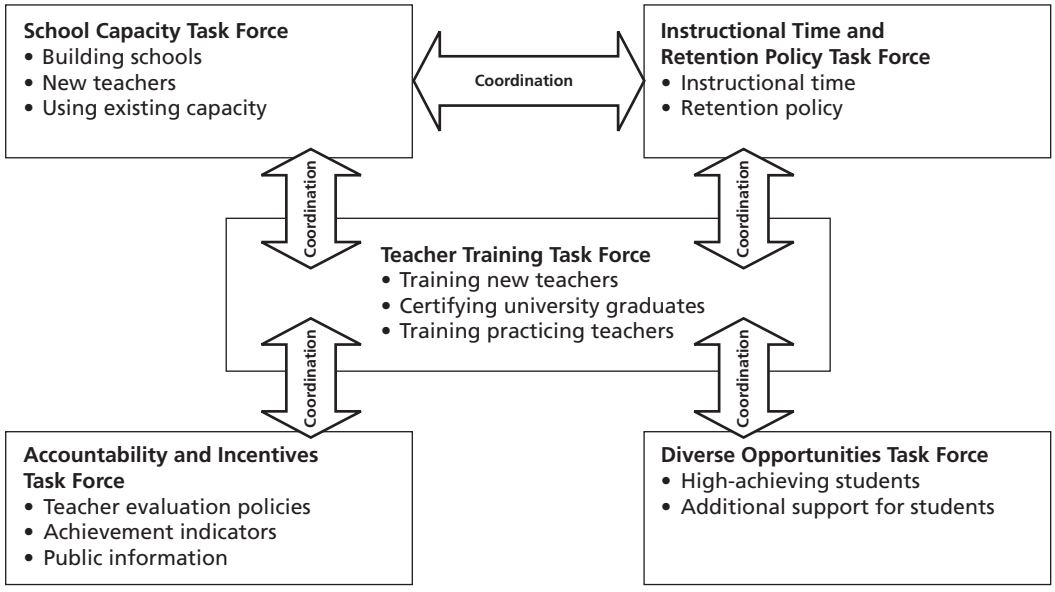
[4] Zellman, 2009; Winter and Szulanski, 2001; Contreras and Talavera Simoni, 2003; Georgescu and Palade, 2003.

sibilities or will make decisions that affect the work of other task forces. For example, the school capacity task force will make recommendations for how many new teachers will be required each year, while the teacher training task force will be responsible for making sure there are enough teachers with the right skills to meet demand. We recommend that the Minister of Education or his designee coordinate the work of the task forces to ensure that they function smoothly together. Figure 6.2 is a diagram of which task forces will need to coordinate with each other.

Communications is an area that will require general coordination. The success of the changes made will depend on good communications—with parents, students, principals, teachers, district office administrators, and other stakeholders. Good communications will help to ensure support from these parties. The support of the people who will be affected and on whom the MOE will rely to carry out the changes is important to ensuring that the changes are made in the ways envisioned. Studies have also found that implementing organizational change can often create conflict and resistance.[5] A strong communications effort can help mitigate some of the challenges that occur during this period of transition.

Determining and securing resources is another area that will require general coordination. Some of the recommendations will require substantial resources, whereas others will require fewer resources. The resource needs of all of the task forces should be gathered, prioritized, and budgeted. This will entail collaboration among the task forces, the Minister of Education, the Ministry of Finance, and the governorates.

Figure 6.2
Task Forces, Subcommittees, and Coordination Links



RAND *MG1140-6.2*

[5] Nadler and Tushman, 1997; Harman and Harman, 2003.

AFTERWORD

Longer-Term Issues for Education in the Kurdistan Region—Iraq

In this report, we explained the problems that the KRI currently faces in providing Kurdish children access to high-quality basic and secondary education. We also recommended measures the KRG can take to increase access to and improve the quality of education, with a particular focus on basic schools. Our recommendations build on the sweeping education reforms the KRG began in 2007.

In the course of our research, we identified two important issues that fell outside the scope of this project, but which we want to highlight for the MOE because of both their complexity and long-term significance. The first issue involves how KRI education can best help meet the demands of the future labor market. This issue specifically concerns vocational education at the secondary-school level for students who may not be headed to college. The second issue involves the governance and administration of the K–12 education system, and the incentives it provides for principals, teachers, and parents to work together toward educational improvements.

Preparing Students for the Labor Market

All students in the KRI need some type of educational preparation to enable them eventually to participate in the labor market and be gainfully employed. Many Kurdish students graduating from secondary school today continue on to higher education, but many more either are not able or do not want to go to university. The KRI's economy is developing rapidly. It will create many jobs that will require not a post-secondary education, but, instead, technical and other skills. This will be particularly true in the industrial sector (e.g., oil and gas, manufacturing), the business and services sector (e.g., information technology, tourism), and the trade sector (e.g., carpentry, electrical contracting). Students can prepare for these jobs through some form of vocational education or apprenticeship. The most-effective vocational systems not only prepare job-seekers for blue-collar employment relevant to the labor market, but also enable them to enter higher education as well, should they opt to go that route.

In the KRI, vocational education has long been perceived as a second-choice option for students who lack the ability to succeed in secondary school. This is in part because vocational training has not created the desired job opportunities for graduates. One indicator of its "second-class" status is the fact that over the past five years, enrollment in secondary-level vocational education has decreased by half, with less than 3 percent of Kurdish students taking this path into the labor market. From what we can tell, there is at present a mismatch between the quality of vocational students' preparation and the needs of the labor market: Among our

interviewees were individuals from the private sector who felt that some members of the KRI's labor force lack the skills needed for jobs, the background to learn new skills, and motivation.[1] Indeed, the curriculum taught in vocational schools is often decades old, out-of-step with the current labor market and new technologies.

Over the long-term, if the KRI wants its economy to grow and diversify, this situation will not be sustainable. The KRG will need to address the current lack of opportunities for a large number of KRI youths to be trained with the skills and competencies they can use in the labor market after completing secondary school. This will involve carefully assessing the demands of the future economy and creating options that make vocational education not only more attractive to secondary school students, but also more effective in equipping them with needed skills.

Strengthening the Governance Structure and Incentive System to Make Administration More Efficient and to Raise the Quality of Education

Pivotal to a strong education system is a well-functioning governance and management structure that balances three key elements: an education leadership that is empowered to manage the system; responsibilities and authority that are distributed at the appropriate levels; and principals, teachers, and parents that have incentives to continually seek educational improvements. But in the KRI, many of the current education policymaking and administrative procedures work against efficient management, effective accountability, and successful incentives.

We have identified and addressed a limited number of these issues in this study. But we have not addressed the broader question of whether the current structure for distributing the functions of the MOE, the governorates, the education districts and sub-districts, and the schools is the most effective and efficient.

As we have shown, basic and secondary education in the KRI is likely to experience significant growth in the coming decade and beyond. Anticipated changes include further reforms of the curriculum, additional teacher training, and considerable expansion of the numbers of schools and students. Given these prospects, the MOE may need a more effective administrative structure for the future.

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[1] Hanson et. al., 2010.

APPENDIX A

Tool for Forecasting the Demand for Primary, Middle, and Secondary Education in the KRI

Titus Galama
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To understand the future demand for primary, middle, and secondary education (grades 1–12) in the KRI, the RAND team built a causal forecasting model. A broad range of analytic techniques are generally classified as forecasting models.[1] For the phenomenon we were trying to forecast—the number of primary, middle, and secondary students in Kurdistan over the next decade—we were in a modeling environment in which we had sufficient objective data to create a mathematical model, good knowledge of relationships between the dependent and independent variables, and information on potential changes in portions of the current system. This led us to choose what is generally termed a causal model, with elements of an extrapolation model.

Extrapolation models assume that past behavior is a good predictor of future behavior.[2] In Kurdistan, there is sufficient knowledge of the historical relationship between the number of students entering grade 1 and the numbers of students entering subsequent grades, graduating and transitioning from primary to middle and from middle to secondary school. From these historical patterns, we can derive historical average transition rates between grades and between primary, middle, and secondary school. In addition, there is information on historical population growth rates. These historical patterns provide us with a baseline scenario—a version of the future if everything remained the same and historical trends continued.

Extrapolation models also assume that nothing is relevant other than prior values. Often, however, knowledge of the future is available that suggests historical patterns may not continue to hold. Accordingly, we combined the projection principle of the extrapolation model with the allowance for change in causal models. Causal models relate a dependent variable to various causal variables based on a specified theory, prior research, or expert domain knowledge.[3] This allowed us to construct scenarios of the future that were guided by knowledge of the con-

[1] Methods include the Delphi method, or prediction markets; judgmental bootstrapping; conjoint analysis; intentions or expectations of decisionmakers; role playing; structured analogies; quantitative analogies; expert systems; rule-based forecasting; extrapolation, or data mining; and causal models. Each of these types of forecasting methods has a large, well-developed literature associated with it. (See Armstrong, 2001, for explanations of these types of methods.)

[2] Armstrong, 2001.

[3] Armstrong, 2001.

sequences of potential changes to the primary, middle, and secondary education system as a result of policy reform, demographic changes and other changes in Kurdistan. These changes were modeled as deviations (perturbations) from the baseline scenario.

As with all forecasting models, there is no way to describe future states with complete certainty. Still, we believe our model is sufficiently accurate to provide policymakers with useful insights for formulating policy. We wish to emphasize that our aim was not to provide accurate forecasts; rather, we present a tool that can be used to model the potential demand for primary, middle, and secondary education and the change in this demand resulting from potential changes to the system. The tool is most helpful in distinguishing drivers that matter from those that do not, thereby guiding policymakers to focus on those elements of policy that have the greatest potential to achieve desired outcomes.

Forecasting Tool

Our forecasting tool consists of a series of spreadsheets, which we present here as tables

Data

The first spreadsheet (Table A.1) contains the historical number of pupils enrolled in primary (grades 1–6), middle (grades 7–9), and secondary (grades 10–12) education. Enrollment numbers for boys are shown on the top half of the table; for girls, on the bottom half. Historical enrollment rates were available for the years 2004–05 to 2009–10. Aggregate numbers for total enrollment at primary, middle, and secondary school were calculated for each year and sex.

Assumptions

The second and third spreadsheets (Tables A.2 and A.3) contain the main assumptions made about boys and girls, respectively. Because the spreadsheets for boys and girls are identical, we focus here on the boys' spreadsheet (Table A.2).

There are three main assumptions:

1. *The annual rate of population growth (percentage) of the population eligible for enrollment in primary school (grade 1).* The number is shown in the top-left corner of the spreadsheet. In the example, a rate of 5 percent is assumed.
2. *The enrollment rate at grade 1 and the assumed subsequent growth in this rate over the next 11 years (from 2010–11 to 2020–21).* This number is shown on the left of the third line. In the example, no growth in the enrollment rate is assumed (the multiplicative factor is 1 for all years).
3. *The transition probabilities between grades for the next 11 years (until 2020–21).* These probabilities are shown in the remainder of the table. In the example, the probability of a grade 1 student transitioning to grade 2 in the year 2010–11 shows a multiplicative factor of 1.017 (or 1.7 percent growth). The transition probabilities were obtained from historical data. In the spreadsheet, the transition probabilities are the average rate of

Table A.1
Historical Number of Students Enrolled, by Gender and Grade, 2003–04 to 2009–10

ASSUMPTIONS

Year		2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Year Number (2009/10=0)								1	2	3	4	5	6	7	8	9	10
BOYS																	
PRIMARY	1	65589	69119	70407	71935	69340	66374										
	2	61554	61720	70094	68838	77266	69355										
	3	57112	58029	61420	67404	75622	76228										
	4	58674	57626	62430	65246	74777	81556										
	5	64156	65348	63683	66774	71480	70875										
	6	53575	55178	53246	54041	64423	64189										
Aggregate Primary		360660	367020	381280	394238	432908	428577										
MIDDLE	7	59739	61795	60036	60939	61540	68567										
	8	51708	54063	55311	55051	53504	60634										
	9	33108	43752	49245	50889	49347	49804										
Aggregate Middle		144555	159610	164592	166879	164391	179005										
SECONDARY	10	28248	32922	25931	26459	38811	44167										
	11	18703	21352	26924	24821	26401	34063										
	12	19749	23391	26719	29942	32833	36870										
Aggregate Secondary		66700	77665	79574	81222	98045	115100										
GIRLS																	
PRIMARY	1	62587	61936	65460	67186	64559	61095										
	2	55790	56294	62068	63444	70558	64437										
	3	52120	51847	55491	59144	69221	70562										
	4	49809	48458	53648	56374	66520	70345										
	5	51903	51225	51593	55299	61895	62372										
	6	42620	44799	43870	45130	55286	56150										
Aggregate Primary		314829	314559	332130	346577	388039	384961										
MIDDLE	7	43744	46954	47204	47439	46052	51702										
	8	39244	42199	46063	45052	42504	46127										
	9	26214	34384	40719	42862	39034	39664										
Aggregate Middle		109202	123537	133986	135353	127590	137493										
SECONDARY	10	28733	32062	22169	24873	35610	38202										
	11	16685	18713	25061	22973	23677	31350										
	12	17044	19823	23463	26742	30034	33989										
Aggregate Secondary		62462	70598	70693	74588	89321	103541										

Table A.2
Assumption—Boys: Eligible Population Growth Enrollment Rate and Transition Probabilities for Boys, 2010–11 to 2020–21

Population growth rate	5.00%											
			2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
			1	2	3	4	5	6	7	8	9	10	11
Enrollment at grade 1		90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%
Implied enrollment factor			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Transition probabilities	1		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	2		1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017
	3		1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016
	4		1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083
	5		1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038
	6		0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904
	7		1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116
	8		0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927
	9		0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916
	10		0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732
	11		0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944
	12		1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277

Table A.3
Assumption—Girls: Eligible Population Growth Enrollment Rate and Transition Probabilities for Girls, 2010–11 to 2020–21

Population growth rate	5.00%											
			2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
			1	2	3	4	5	6	7	8	9	10	11
Enrollment at grade 1		90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%	90.00%
Implied enrollment factor			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Transition probabilities	1		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	2		1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
	3		1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015
	4		1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052
	5		1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022
	6		0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927
	7		1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012
	8		0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951
	9		0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910
	10		0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807
	11		0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956
	12		1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270

growth over the period from 2004–05 to 2009–10 in the number of students enrolled from one grade to the next.[4]

Flow Model

The fourth and fifth spreadsheets (Tables A.4 and A.5) contain the actual model calculations. Here, again, because the spreadsheets for boys and girls are identical, we focus on the boys' spreadsheet (Table A.4).

The top of the spreadsheet contains the historical number of students enrolled in grades 1–12 for the years 2004–05 to 2009–10 and the forecasted numbers of male students enrolled from 2010–11 to 2020–21.[5]

Below these forecasted numbers are four equal-size matrices—called the total factor, the population growth, the enrollment grade 1, and the transition matrices—that were used to arrive at the final forecast. Next, we discuss each matrix in turn.

The population growth matrix presents the population growth rate derived from the model assumptions (Table A.2). In the example, the first row of the matrix is a factor of 1.05 for all years (2010–11 to 2020–21), whereas the remainder of the matrix is a factor of 1.00. The 5 percent growth is applied to all years for grade 1; i.e., it is assumed that the number of students enrolled in grade 1 grows by 5 percent per year as a result of population growth at this rate. Since individuals entering grade 1 subsequently transfer to higher grades (which are modeled by transition probabilities), no further increases due to population growth are modeled for subsequent grades (2–12) and the remainder of the matrix contains factors of 1.00.[6]

The enrollment grade 1 matrix presents the rate of increase in enrollment derived from the model assumptions (Table A.2). In the example, a factor of 1.00 is used for all years and all grades—i.e., no changes in the rate of enrollment are assumed.[7]

The transition matrix presents the transition probabilities between grades for the years 2010–11 to 2020–21 and for each grade transition derived from the model assumptions (Table A.2). In this example, these transition probabilities were obtained from historical data (the average rate of growth in the number of students enrolled between grades for the years 2004–05 to 2009–10), and it is assumed that such historical transition probabilities will remain unchanged in the future.

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[4] Because we had access to individual student information, the transition probabilities calculated in this manner represent a mixture of the probability of transition (from grade 1 to grade 2 in this example), the probability of a grade 2 student failing to transition (i.e., being retained), and the probability that a student enters grade 2 directly (e.g., arrives from outside of Kurdistan). As a result, while attrition implies gradual loss of students, we found an increase rather than a decrease in the number of students because of the other contributing factors, including retention and lateral reentry into the education system.

[5] In this example, an exception was made for the numbers in grade 1 from 2010–11 to 2015–16; these values were extrapolated based on the actual number of births reported for years 2005 to 2010. These cohorts of newborns are expected to begin grade 1 in years 2010 to 2016.

[6] Even though the remainder of this matrix is not used in the current example, it would allow one to model more-complicated growth scenarios in which the growth of subsequent cohorts may be influenced by different factors (e.g., immigration). At this time, greater complexity is not warranted given the limitations of the available data.

[7] Again, the matrix structure allows one to model not only complicated scenarios in which the enrollment rate of grade 1 primary education changes with respect to the baseline scenario, but also scenarios in which subsequent enrollment in middle or secondary school changes over time.

Table A.4
Flow Model—Boys: Projections, Total Factor, Population Growth, Enrollment Grade 1, and Transition for Boys, 2010–11 to 2020–21

Year	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Year Number (2009/10=0)							1	2	3	4	5	6	7	8	9	10	11
BOYS																	
PRIMARY/Boys	65,589	69,119	70,407	71,935	69,340	66,374	70,947	70,947	74,800	80,860	90,560	94,980	99,729	104,715	109,951	115,449	121,221
	61,554	61,720	70,094	68,838	77,266	69,355	67,525	72,178	72,178	76,098	82,263	92,131	96,628	101,459	106,532	111,859	117,451
	57,112	58,029	61,420	67,404	75,622	76,228	70,436	68,577	73,302	73,302	77,283	83,544	93,566	98,133	103,040	108,192	113,601
	58,674	57,626	62,430	65,246	74,777	81,556	82,584	76,309	74,296	79,414	79,414	83,727	90,510	101,368	106,316	111,631	117,213
	64,156	65,348	63,683	66,774	71,480	70,875	84,626	85,693	79,182	77,093	82,404	82,404	86,879	93,918	105,184	110,318	115,834
	53,575	55,178	53,246	54,041	64,423	64,189	64,056	76,485	77,449	71,564	69,676	74,476	74,476	78,521	84,883	95,065	99,705
MIDDLE/Boys	59,739	61,795	60,036	60,939	61,540	68,567	71,626	71,478	85,346	86,422	79,855	77,748	83,105	83,105	87,618	94,717	106,079
	51,708	54,063	55,311	55,051	53,504	60,634	63,544	66,379	66,242	79,094	80,091	74,005	72,053	77,017	77,017	81,200	87,778
	33,108	43,752	49,245	50,889	49,347	49,804	55,526	58,191	60,787	60,662	72,432	73,345	67,771	65,983	70,529	70,529	74,360
SECONDARY/Boys	28,248	32,922	25,931	26,459	38,811	44,167	36,440	40,626	42,576	44,476	44,384	52,995	53,663	49,586	48,277	51,604	51,604
	18,703	21,352	26,924	24,821	26,401	34,063	41,703	34,407	38,360	40,201	41,995	41,908	50,039	50,670	46,820	45,585	48,725
	19,749	23,391	26,719	29,942	32,833	36,870	43,503	53,261	43,943	48,992	51,343	53,633	53,523	63,907	64,713	59,795	58,218
TOTAL FACTOR							1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
							1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017
							1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016
							1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083
							1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038
							0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904
							1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116
							0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927
							0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916
							0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732
							0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944
							1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277
POPULATION GROWTH							1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
ENROLLMENT GRADE 1							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TRANSITION							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
							1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017
							1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016	1.016
							1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083	1.083
							1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038
							0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904
							1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116	1.116
							0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927
							0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916	0.916
							0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732
							0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944	0.944
							1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277	1.277

Table A.5
Flow Model—Girls: Projections, Total Factor, Population Growth, Enrollment Grade 1, and Transition for Girls, 2010–11 to 2020–21

Year		**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**
Year Number (2009/10=0)								1	2	3	4	5	6	7	8	9	10	11
GIRLS																		
PRIMARY/Girls		62,587	61,936	65,460	67,186	64,559	61,095	65,750	65,750	69,320	74,940	83,930	88,020	92,421	97,042	101,894	106,989	112,338
		55,790	56,294	62,068	63,444	70,558	64,437	61,451	66,134	66,134	69,724	75,377	84,420	88,534	92,960	97,608	102,489	107,613
		52,120	51,847	55,491	59,144	69,221	70,562	65,382	62,353	67,104	67,104	70,747	76,483	85,658	89,832	94,324	99,040	103,992
		49,809	48,458	53,648	56,374	66,520	70,345	74,252	68,801	65,613	70,612	70,612	74,446	80,482	90,137	94,529	99,256	104,218
		51,903	51,225	51,593	55,299	61,895	62,372	71,901	75,894	70,323	67,064	72,174	72,174	76,093	82,262	92,130	96,620	101,451
		42,620	44,799	43,870	45,130	55,286	56,150	57,833	66,668	70,371	65,205	62,184	66,922	66,922	70,555	76,275	85,426	89,589
MIDDLE/Girls		43,744	46,954	47,204	47,439	46,052	51,702	56,842	58,545	67,490	71,238	66,008	62,950	67,746	67,746	71,424	77,215	86,478
		39,244	42,199	46,063	45,052	42,504	46,127	49,152	54,038	55,657	64,160	67,723	62,752	59,844	64,404	64,404	67,901	73,406
		26,214	34,384	40,719	42,862	39,034	39,664	41,977	44,730	49,176	50,650	58,388	61,631	57,107	54,461	58,610	58,610	61,793
SECONDARY/Girls		28,733	32,062	22,169	24,873	35,610	38,202	32,000	33,866	36,087	39,674	40,864	47,106	49,722	46,072	43,938	47,285	47,285
		16,685	18,713	25,061	22,973	23,677	31,350	36,528	30,598	32,383	34,506	37,936	39,073	45,042	47,544	44,054	42,013	45,214
		17,044	19,823	23,463	26,742	30,034	33,989	39,814	46,390	38,859	41,125	43,822	48,178	49,622	57,203	60,380	55,948	53,355
	TOTAL FACTOR							1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
								1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
								1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015
								1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052
								1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022
								0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927
								1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012
								0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951
								0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910
								0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807
								0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956
								1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270
	POPULATION GROWTH							1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	ENROLLMENT GRADE 1							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	TRANSITION							1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
								1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
								1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015
								1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052
								1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022
								0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927
								1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012	1.012
								0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951
								0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910
								0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807
								0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956	0.956
								1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270	1.270

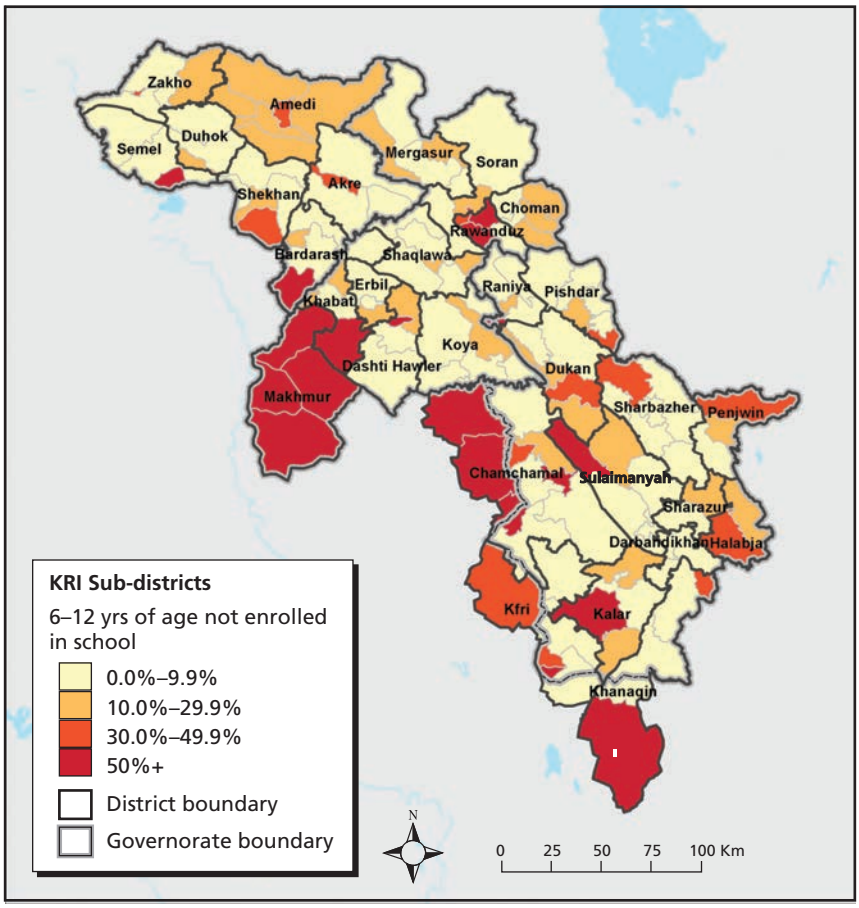
The total factor matrix is simply the product of the other three matrices (population growth, enrollment grade 1, and transition) and is the final factor applied to the historical number of students enrolled in grades 1–12 for the years 2004–05 to 2009–10.

The resulting forecasted number of students enrolled in grades 1–12 is shown at the top of the table.

APPENDIX B

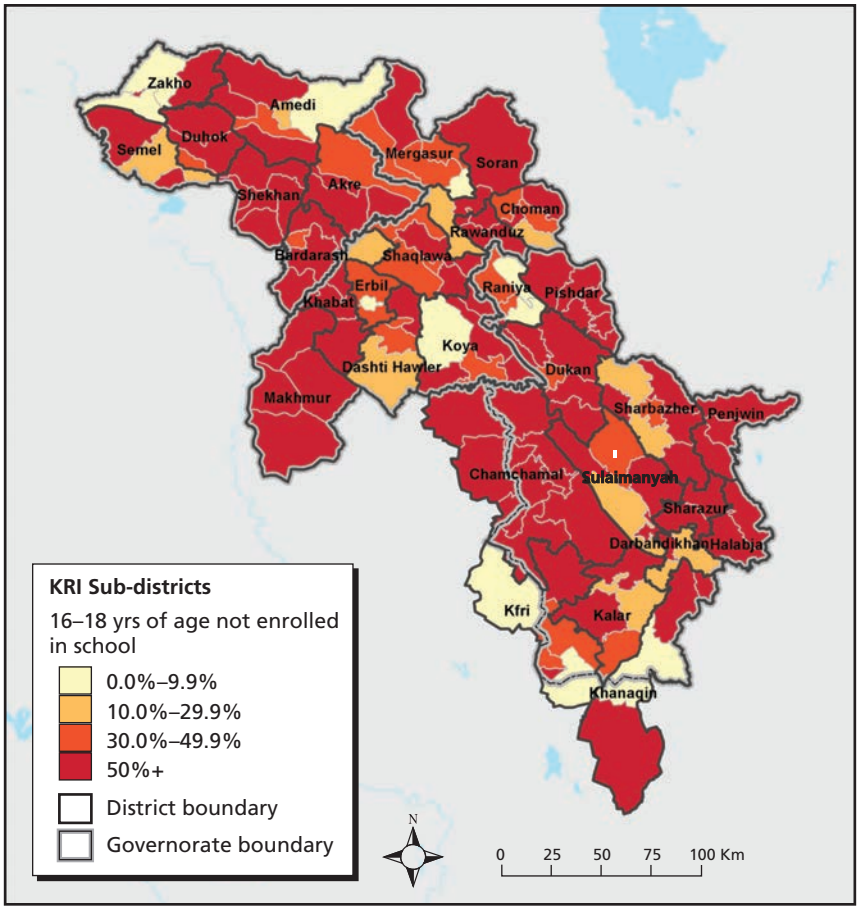
Distribution of Out-of-School Students by Sub-District

Figure B.1
Percentage of Out-Of-School Youths Age 6–12, 2009–10



RAND *MG1140-B.1*

Figure B.2
Percentage of Out-Of-School Youths Age 16–18, 2009–10



RAND *MG1140-B.2*

APPENDIX C

Analysis of Alternatives for School Construction in the KRI

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The KRG is reevaluating the provision of local primary and secondary education with a goal of improving access and quality. There is currently an inadequate supply of school buildings to serve the existing demand, and conventional construction methods are generally time- and cost-intensive. This appendix outlines some of the challenges and benefits of using prefabricated school construction as a potential strategy for reducing the expense and time of school construction.

There are presently reported to be 4,468 primary schools serving grades 1–9 in the KRI (KRG, 2010a).[1] More than 65 percent of these schools are in rural and village areas; the remaining schools are in urban environments (Table C.1). The schools generally serve small local populations, with 60 percent of village schools serving fewer than 50 students, and 50 percent of all schools serving fewer than 100 students.

Because of the high demand for schools in the KRI and the inadequate supply, many schools operate with multiple shifts, reducing classroom time and causing disruption and scheduling issues for students. New school construction is under way in the KRI, and there were plans in the 2010 budget to begin building 46 schools. However, the funding request submitted represents only 37 percent of the school construction expenses for the 46 schools, so many schools will not be completed within the funding cycle (KRG, 2010b). In addition,

Table C.1
Number and Location of Primary Schools (Grades 1–9) in the KRI, 2010

Location	Rural/Village	Urban
Erbil	1,013	551
Suli	797	539
Duhok	916	385
Gamyan	205	62
Total	2,931	1,537

SOURCE: KRG, 2010a.

[1] All data on specific school numbers, conditions, and shifts were provided to RAND and are assumed to be largely representative. However, because the data have not been independently verified, they should be treated as preliminary.

6 percent of existing primary schools require reconstruction, adding to the challenges of meeting the growing demand for schools. The proportion of regional schools requiring reconstructions varies, from 0.5 percent in Erbil to more than 17 percent in Suli.

Given the challenges of rapidly improving education access in Kurdistan, different approaches for constructing or rehabilitating schools may be needed, depending on the size and location of schools and demand. Five options for improving education access in the KRI are as follows:

1. Use lower-cost and rapidly constructed prefabricated buildings when possible.
2. Add prefabricated science laboratory facilities to existing schools.
3. Use a standard set of construction designs and contracts to eliminate the time and cost of the initial design and specifications phase of school construction. For example, the School Construction Authority of the New York City Department of Education freely publishes a rich set of architectural plans for school construction (New York City Department of Education, 2010).
4. Create a plan to maximize school construction and students served while minimizing multiple-shift schools, ensuring the right balance of building cost, schedule, and quality.
5. Reallocate students from multiple-shift schools using spatial logistics planning methods.

These strategies are not mutually exclusive and could be implemented nationally or regionally. Here, the concept of prefabricated schools and science laboratories is briefly introduced and its benefits and challenges discussed. The KRG could consider the remaining three strategies in future analyses.

Conventional and Prefabricated School Construction

Conventional School Construction

Most primary and secondary schools constructed in the United States utilize conventional construction methods. These include on-site labor and time-intensive activities, such as construction of wall and roof structures. Primary schools are typically 50,000 to 100,000 square foot 1-story buildings built of brick and/or concrete block walls. School costs vary, as does construction time, typically requiring about 14 to 26 months. Depending on the location, regional permitting, agency approvals, engineering and architectural designs, and other non-construction activities can lengthen the process, with total time from land purchase to school opening sometimes approaching 34 to 50 months (Wake County Public School System, 2006).

Costs of primary-school conventional construction are largely affected by regional labor rates; typical U.S. primary-school costs range from about $140 per square foot to more than $350 per square foot (RSMeans, 2010; Saylor, 2010). Typical classroom sizes in the United States are 960 square feet, with additional area needed for common and non-classroom spaces and facilities. Typically, primary schools are designed for at least 100 total square feet per pupil; however, some schools are designed for 150 to 250 square feet per pupil. General construction costs for on-site labor typically make up about 65 percent of total project costs. Different types of specialized labor, such as for air-conditioning and ventilation, plumbing, and electrical

work, each typically make up about 10 percent of general construction costs. Other costs that add to construction costs include those for classroom equipment and architect/engineering design fees.

Prefabricated School Construction

Prefabricated construction employs a standard set of design modules that can be arranged and customized for each application. Major components, or sometimes entire modules, are assembled in a fabrication plant and shipped to the job site for assembly, which considerably reduces wasted material at the construction site. This method reduces costs by 25 percent to 60 percent, largely due to a reduction in the need for custom engineering or architectural services and the high cost of labor involved with traditional on-site construction. Labor costs per unit are lower, as are total labor costs. Since the buildings are predesigned with standard drawings, the project architect solely has to determine the application's needs and choose modules to fit together. The potential for expensive construction change orders and other unplanned events during construction is considerably reduced. After the design is finished (one to four months) and the contract is signed, the building's concrete foundation is poured while the modules are assembled at the fabrication plant. Then the structural steel is erected on-site, and modules are delivered to the job site, assembled, and equipped with systems. The entire process can take six months to one year.

Prefabricated construction is widely used in the United States, primarily to rapidly expand existing schools, but also for new school construction. The quality, design, features, and expense of prefabricated schools can vary widely (Figure C.1). U.S. costs for high-performance modern prefabricated classrooms in the United States range from $200 to $300 per square foot, with basic prefabricated designs having a reduced cost.

Many prefabricated schools are designed with "green" elements, such as energy and water efficiency, sustainable materials, or on-site renewable energy, as shown in Figure C.2. Depending on climate and site conditions, buildings can be designed and oriented for passive heating and cooling as well as day lighting to maximize the use of solar energy for lighting and air-conditioning. Some school systems include optional photovoltaic panels to provide some or all of a building's electricity needs.

Figure C.1
Examples of Various Types of Prefabricated Schools

SOURCE: American Modular Systems, 2011a (left); Yorkon, 2011 (right).
NOTE: At left, basic prefabricated school in California, U.S.; at right, advanced prefabricated school in York, UK.
RAND *MG1140-C.1*

Figure C.2
Examples of High-Performance Prefabricated Schools with Green Features

SOURCE: American Modular Systems, 2011b (left); Project Frog, 2011 (right).
NOTE: At left, outside of a prefabricated classroom with solar panels; at right, interior of a prefabricated classroom for which natural lighting was maximized.

Prefabricated Science Laboratories for Existing Schools

Prefabricated Labs Are an Attractive Option for Schools

Current schools in the KRI often do not have science laboratories, and equipping both existing and new schools with science labs has been identified as a priority by KRG. Modular construction of science labs is a way to augment existing structures with new facilities without having construction disrupt current educational activities. Science classrooms are specialized classrooms requiring additional systems and expenses relative to standard educational classrooms. The level of science lab expense and customization is an option for the KRG. In the United States, labs range from basic amenities for some primary schools through expensive advanced research laboratories for some U.S. secondary schools. Science classrooms in the United States often require expenses for specialized plumbing and utilities, ventilation hoods, safety and emergency equipment, acid resistant furniture, and other items that are not incurred in traditional classrooms. (See Figure C.3.) A new modular science classroom could cost between $180 per square foot for a basic science classroom and $350 per square foot for an advanced classroom, and an advanced modular science classroom sometimes adds $100,000 more to the cost of a new school building.

If an existing school building property is adequate for siting a modular science classroom, building the classroom is likely to be less expensive and faster than constructing an addition to the existing building. Constructing an addition for a science lab requires a structural and architectural design to modify the existing structure, as well as the possible disruption of educational activities around the site of the addition. For proposed newly constructed schools, it would likely be less costly to integrate science classrooms into the standard design for the schools, rather than constructing separate modular structures. However, there may be instances in which a design has been finalized without a science classroom, so a modular classroom could be a good choice at some time in the future. Modular science classrooms should be evaluated as an option for the construction of science laboratories for KRG schools.

Figure C.3
Examples of Prefabricated Science Classrooms

SOURCE: American Modular Systems, 2011c (left); Grayson, 2010 (right).
NOTE: At left, science classroom in California, U.S.; at right, three science and global studies classrooms in Connecticut, U.S.
RAND *MG1140-C.3*

Initial Cost Estimates of Prefabricated Schools in Kurdistan

We contacted several providers of prefabricated schools, both in the United States and in Turkey, to discuss technology and costs (see below for contacts). One firm in Turkey, Vefa Prefab, had previously constructed a prefabricated school in Iraq—see the picture on the right in Figure C.4. Also pictured in Figure C.4 is the interior of an eight-room prefabricated school, built in Iraq by the Iraqi firm Cosmopolitan Company, which was constructed in 120 days at a cost of $312,000 (U.S. Forces–Iraq, 2010).

As an illustration, Vefa Prefab provided us with preliminary cost estimates for prefabricated school construction in Kurdistan. Their initial cost estimate was about $275,000 for a 12-classroom school and about $400,000 for a 20-classroom school, with construction times varying between three and six months. Additional costs not included would be land purchase, site preparation, building foundation, heating, air-conditioning, and utilities, all of which

Figure C.4
Examples of Prefabricated Schools in Iraq

SOURCE: Scheck, 2010 (left); Nestavilla, 2011 (right).
NOTE: At left, school constructed by Iraqi firm Cosmopolitan Company; at right, school constructed by Turkish firm Vefa Prefab.
RAND *MG1140-C.4*

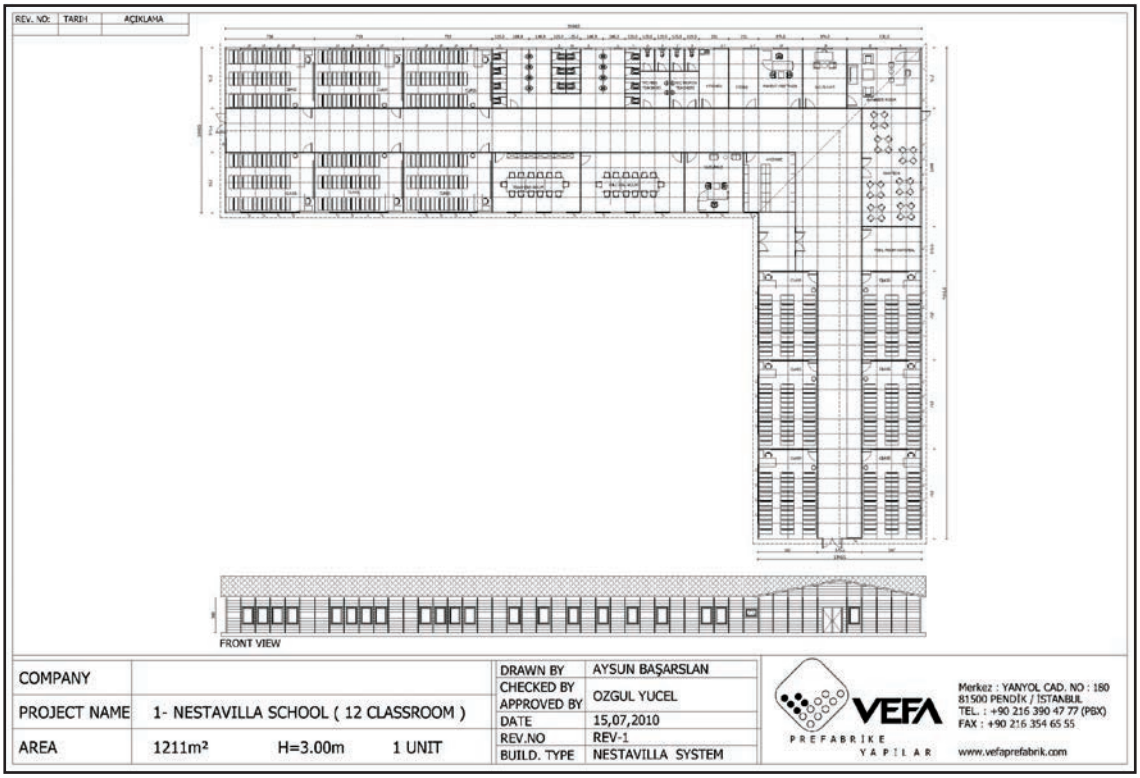
could add another 25 percent to 50 percent to project costs. Figures C.5 and C.6 depict architectural plans provided by Vefa Prefab for a 12- and 21-classroom school, respectively.

Benefits and Challenges of Using Prefabricated Construction

Prefabricated construction is gaining popularity in the United States largely because of the rapid construction time for new schools and expansions and the cost savings realized by manufacturing major portions of the building in an off-site centralized warehouse, thereby avoiding local prevailing wage regulations. Construction of building portions in a controlled warehouse off-site eliminates the costs and delays of working in adverse weather conditions, reduces material waste, and allows for greater productivity and coordination among subcontractors (Engineering News-Record, 2010).

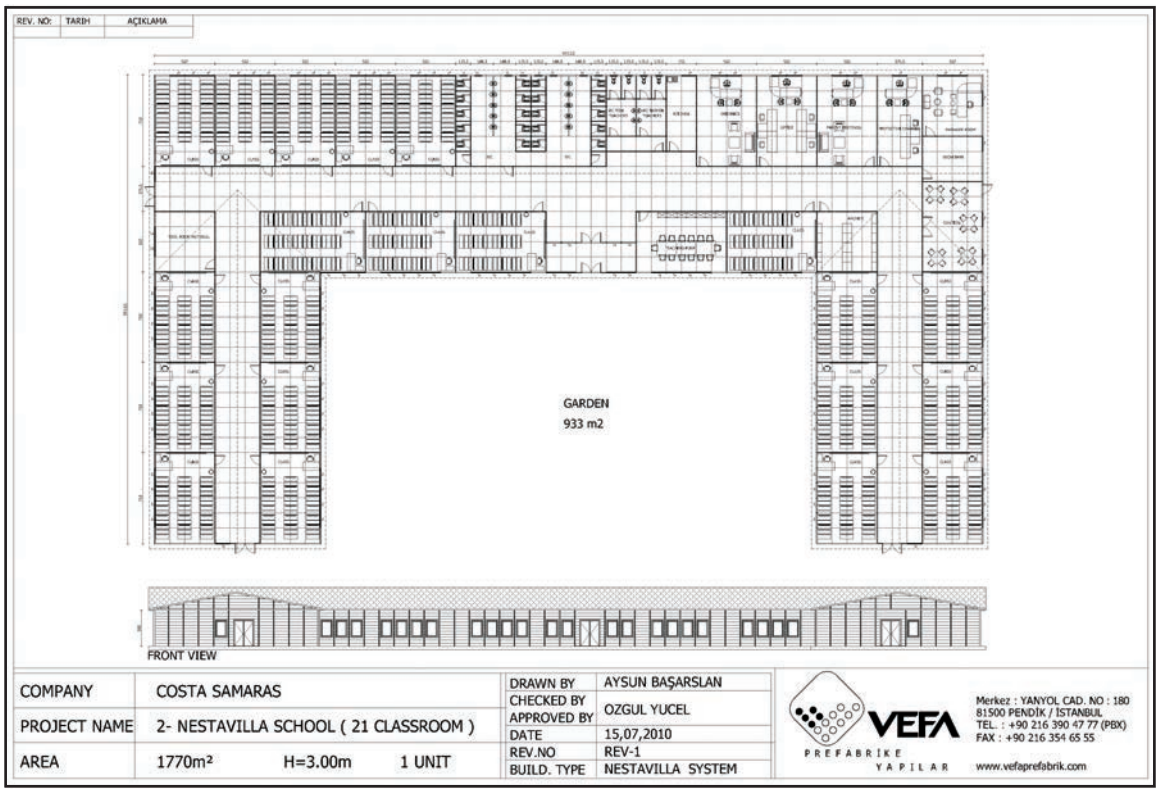
The costs of school construction vary considerably with site selection and local labor conditions. A survey of case studies, trade publications, and informal discussions with U.S. designers and construction management firms that specialize in prefabricated school construction was employed to arrive at bounding estimates for construction costs. Table C.2 lists potential ranges of conventional and prefabricated construction costs for schools in the United States.

Figure C.5
Example of Architectural Plans for a 12-Classroom Prefabricated School in Iraq



RAND *MG1140-C.5*

Figure C.6
Example of Architectural Plans for a 21-Classroom Prefabricated School in Iraq



RAND *MG1140-C.6*

However, since labor rates in the KRI are likely to be relatively low, prevailing wage savings will be considerably lower than in the United States for prefabricated buildings. The KRG estimates for new schools range from $1.2–2.6 million, considerably lower than the estimates in Table C.2. Hence, decisionmaking on prefabricated buildings in the KRG is likely to be influenced by schedule gains rather than large cost savings.

If we assume the cost estimates given in the proposed 2010 KRG budget, 30 students per classroom, and 100 total square feet per student, the 81,000 square foot 27-classroom building and the 54,000 square foot 18-classroom building will have costs below $40 per square foot.

Table C.2
Potential Approximate Costs of U.S. Primary Schools Using Conventional and Prefabricated Construction

	Cost (millions of $)			
	Conventional Construction		Prefabricated Construction	
No. of Classrooms	Low ($140/ft²)	High ($350/ft²)	Low ($200/ft²)	High ($300/ft²)
12	5.0	12.6	7.2	10.8
18	7.6	18.9	10.8	16.2
27	11.3	28.4	16.2	24.3

NOTE: Numbers assume 30 students per classroom and 100 total square feet per student, including all common spaces and facilities.

It is unclear whether a prefabricated structure could be cost competitive in this environment. However, as noted above, the initial estimates for prefabricated construction could be considerably less than the KRG estimates for conventional school construction, and further detailed evaluation by KRG of prefabricated construction is warranted.

Table C.3 highlights some of the initial benefits and challenges of prefabricated school construction. Prefabricated school construction utilizing a set of standard designs may be highly beneficial for smaller rural schools in the KRI, whereas other applications may be potentially relevant for larger and urban schools.

International Experiences in School Construction: UK Case Study

United Kingdom

The UK embarked on an effort—called Building Schools for the Future (BSF)—to rebuild or refurbish all primary or secondary schools in England. The goal was to rebuild approximately half of the schools and to refurbish the other half.[2] This program employed public-private partnerships and regional-local cooperation for school construction, and differed from the KRG's proposed actions. Yet the experiences and lessons learned from BSF may help the KRG in designing an RFP and standard drawings, as well as in its risk management plans (Partnerships for Schools, 2010).

A small portion of new schools in the UK were constructed using prefabricated methods, and a 2006 study examined a sample of cost differences between prefabricated and conventional construction (French, 2006). The study found that saved time was generally the largest benefit of prefabricated construction, which is consistent with earlier findings. Prefabricated costs were generally lower, except when large halls and special-purpose rooms were required. Table C.4 shows the benefits and challenges of prefabricated school construction in the UK experience.

Finally, the KRI should evaluate the risk of seismic activity in regions where schools are constructed and evaluate the cost of designing buildings to withstand earthquakes. In the 2008 earthquake in Sichuan, China, which killed as many as 80,000 people, inadequately designed schools were cited as a major concern (British Broadcasting Corporation, 2008).

Table C.3
Benefits and Challenges of Prefabricated Construction in the KRI

Benefits	Challenges
More schools can be built cheaply and quickly	Tradeoff between cost and quality?
Foreign firms can train locals in fabrication and assembly	May invest more money in foreign firms than in local economy?
Reduction of pressure on current schools is faster	Fewer on-site construction jobs available
Green design can reduce energy and water use over building's lifetime	Disruptive with current contractors and designers
Standard contracts and designs speed up projects and reduce surprises	Design options limited and may not suit all regions

[2] This effort has been abandoned by the current government because of budget constraints.

Table C.4
Benefits and Challenges of Prefabricated Construction in the UK Experience

Benefits	Challenges
Total construction time decreased	For large halls, prefabricated buildings were more expensive than conventional construction
On average, a 10% lower construction cost vs. traditional construction cost was observed for classrooms	Large prefabricated structures were difficult and expensive to transport
A small reduction in cost uncertainty and construction changes was provided	Quality could be variable; risk management strategy and high level of coordination/planning were needed
Classrooms were typically constructed in 4 months vs. 7 to 8 months for traditional projects	Contractor should have experience with prefabricated assembly to increase likelihood of successful outcomes
Since project durations were shorter, any observed schedule overruns were shorter in time then those observed with traditional construction methods	
Components being manufactured indoors avoided some adverse climate conditions during construction	

SOURCE: French, 2006.

Costs and Commodities Affecting School Construction

International Construction Rates

Labor Rates. Construction costs are highly influenced by local labor rates, which vary widely across and within countries. As long as an adequate supply of local labor is trained and available, Kurdistan will likely experience labor rates considerably lower than those of European and Central Asian nations. Table C.5 lists sample labor rates by skill type and country.

In addition to potential skilled labor supply shortages, the KRI may have to pay premiums for security and housing of foreign workers, which could considerably increase labor costs for school construction in the KRI. Security for personnel and material can cost 6 to 8 percent of contract costs, and housing can cost 4 to 6 percent of contract costs (Engineering News-Record, 2003).

Table C.5
Illustrative World Labor Rates, 2009

	Total Billing Rate, U.S. $/Hour		
Country	Unskilled Labor	Apprentice Labor	Skilled Labor
Qatar	2.33	2.61	2.75
U.A.E.	4.79	5.39	5.99
Turkey	6.54	7.19	8.17
Romania	4.57	6.68	8.80
Germany	27.64	39.57	46.07
China	1.96	2.49	2.94
U.S.: New York	75.00	89.00	110.00
U.S.: Los Angeles	48.49	56.66	62.76

SOURCE: Engineering News-Record, 2009.

Commodity and Material Costs. Commodity and material costs also vary considerably by region, so the KRG should seek to use regionally available and economic materials for school construction whenever possible. Table C.6 shows illustrative construction commodity costs.

Total Delivered Facility Costs. Ultimately, the sum of the local design, materials, and labor costs will reflect the total building costs, generally represented in costs per unit of floor space: dollars/square foot or dollars/square meter. Table C.7 shows commercial building costs in selected countries.

Because of fluctuations in commodities, labor, and currencies, it is challenging to accurately assign cost multipliers for different countries. Documented experiences in the KRI will thus be the best predictors of the expected range of construction costs.

List of Firms and Contacts

Table C.8 presents a list of the firms we contacted and the information for contacts at each firm.

Table C.6
Illustrative Construction Commodity Costs, 2009

Country	Cement (U.S. $/ton)	Blocks (U.S. $/yard^3)	Glass (U.S. $/yard^3)
Qatar	124	20	138
U.A.E.	84	10	17
Turkey	85	7	19
Romania	174	38	32
Germany	305	26	23
China	48	3	4
U.S.: New York	150	18	79
U.S.: Los Angeles	110	19	71

SOURCE: Engineering News-Record, 2009.

Table C.7
Illustrative Commercial Building Costs, 2009

	Office Building		Business Park	
Country	Low (U.S. $/ft^2)	High (U.S. $/ft^2)	Low (U.S. $/ft^2)	High (U.S. $/ft^2)
Qatar	179	223	191	230
U.A.E.	101	132	96	132
Turkey	112	158	N/A	N/A
Romania	119	137	98	116
Germany	226	314	165	235
China	84	119	N/A	N/A
U.S.: New York	325	720	181	307
U.S.: Los Angeles	285	735	170	355

SOURCE: Engineering News-Record, 2009.

Table C.8
Firm and Contact Information

Firm	Location	Primary Contact and Website	Notes
Vefa Prefab	Istanbul, Turkey	Özgül Yücel (Mimar / Architect) Marketing and Sales Director ozgulyucel@vefagroup.com Merkez / Head Office Alt Kaynarca Yanyol Cad. No:180 34896 Pendik/Istanbul,Turkey T: +90 216 390 47 77 F: +90 216 354 65 55 http://www.vefagroup.com	Experience with prefab schools in Iraq and Turkey
Dorce Prefab	Ankara, Turkey	Asagi Öveçler Mahallesi 1325. Sokak No: 6 Çankaya, 06460 Ankara / Turkey T: +90 312 472 82 10 (pbx) F: +90 312 472 82 18 - 19 dorce@dorce.com.tr http://www.dorce.com.tr/eng/Projeler/3/schools.html	Experience with prefab schools in Turkey
Gen7 Schools, American Modular Systems	Manteca, CA	Rick Torres Vice President Sales / Marketing 787 Spreckels Ave. Manteca, CA 95336 T: 209.993.1590 rick.t@americanmodular.com http://www.gen7schools.com/	
Comark Building Systems	DeSoto, TX	Sandy Hanna Marketing Director Comark Building Systems, Inc. T: 908-361-1843 SHanna@comarkbuilding.com http://www.comarkbuilding.com/modular-building-industries/education.shtml	
Project Frog	San Francisco, CA	Matt Reilly, reilly@projectfrog.com 1500 Sansome Street San Francisco, CA 94111 T: 415.814.8506 http://www.projectfrog.com/	
Office of Mobile Design	Venice, CA	Office of Mobile Design 1725 Abbot Kinney Blvd. Venice, CA 90291 T: 310-439-1129 info@designmobile.com http://www.designmobile.com/countryschool.html	
SEED (Sustainable Education Environments Delivered) Designers	San Francisco, CA	SEED 665 Third Street, Suite 400 San Francisco, CA 94107 T: 412-499-6995 info@seededspaces.com http://www.seededspaces.com/	
ZETA Communities	San Francisco, CA	ZETA 1550 Bryant Street, Suite 820 San Francisco, CA, 94103 T: 415-946-4084 info@zetacommunities.com http://www.zetacommunities.com/	
Yorkon	York, UK	Yorkon Limited Huntington, York YO32 9PT http://www.yorkon.co.uk/york-high-school.html	

NOTE: This list is illustrative. RAND does not endorse or recommend any of these companies.

Appendix C References

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APPENDIX D

Number of New Classrooms Needed, by Urbanicity and by Level of Education

Table D.1
Number of New Classrooms Needed to Meet Enrollment Growth and Reduce Overcrowding, by Urbanicity, Type of Estimate, and Type of Option, 2010–21

	Urban			Rural		
	Type of Estimate					
	Low	Medium	High	Low	Medium	High
Total classrooms needed	21,869	25,774	32,243	4,777	5,875	7,721
Options						
Use of available capacity	251	251	251	300[a]	300	300
Add shift to single-shift schools	3,665	3,665	3,665	600[b]	600	600
Reduce retention	1,500	1,500	1,500	300	300	300
Subtotal	5,416	5,416	5,416	1,200	1,200	1,200
New classrooms needed	16,453	20,358	26,827	3,577	4,675	6,521

SOURCE: RAND student-flow model and estimates based on MOE's Office of Statistics school data, 2007–08.
[a] Assumes that only 5 percent of excess capacity in uncrowded classrooms can be used.
[b] Assumes that 7.5 percent of single-shift schools can be used for adding a second shift.

Table D.2
Number of New Classrooms Needed to Meet Enrollment Growth and Reduce Overcrowding, by Type of Estimate, Grade Level, and Type of Option, 2010–21

	Low Estimate			Medium Estimate			High Estimate		
	Grades 1–6	Grades 7–9	Grades 10–12	Grades 1–6	Grades 7–9	Grades 10–12	Grades 1–6	Grades 7–9	Grades 10–12
Total classrooms needed	17,854	5,770	3,022	19,705	7,588	4,376	20,732	11,627	7,625
Options									
Use of available capacity	420	34	97	420	34	97	420	34	97
Add shift to single-shift schools	2,591	886	788	2,591	886	778	2,591	886	778
Reduce retention	1,800	N/A	N/A	1,800	N/A	N/A	1,800	N/A	N/A
Subtotal	4,811	920	885	4,811	920	875	4,811	920	875
New classrooms needed	13,043	4,850	2,137	14,894	6,668	3,501	15,921	10,707	6,750

SOURCE: RAND student-flow model and estimates based on MOE's Office of Statistics school data, 2007–08.
NOTE: N/A = not applicable.

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ISBN 978-0-8330-8410-1
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MG-1140-1-KRG