47204

Report No. 21

South Asia: Human Development Unit

Findings from the Bhutan Learning Quality Survey

January 2009

Discussion Paper Series

ACKNOWLEDGEMENTS

LIST OF ACRONYMS

B. Ed.   Bachelor of Education
BLSS   Bhutan Living Standard Survey
GER   Gross Enrolment Rate
IRT   Item Response Theory
MDG   Millennium Development Goal
MoE   Ministry of Education
NEA   National Education Assessment
NER   Net Enrolment Rate
OLS   Ordinary Least Squares Regression
PP   Pre-Primary
PTR   Pupil Teacher Ratio
RGoB   Royal Government of Bhutan
SBIP   School Based Improvement Program
TCERT   Teacher Certificate for Primary Education
VHW   Village Health Worker

EXECUTIVE SUMMARY

1.   This report presents findings of a nationally representative learning survey conducted in grades 2 and 4 of public and private schools in Bhutan. The report presents observed learning levels and reports on various school, teacher and child related characteristics that are correlated with test scores as an indicator of learning achievement.

2.   A sample of approximately two thousand and four hundred students in grades 2 and 4 was tested in three subjects – Dzongkha (the national language), English and Mathematics. Both grades were given the same tests. Information on child, school, teacher and village characteristics was collected for the purposes of correlating factors influential for learning.

3.   The typical child in grade 2 has mastered the basic competencies that are expected of that grade within the context of the Bhutanese curriculum in Dzongkha, English and Mathematics. The typical child in grade 4 has attained average or mastery level competence in all competencies expected to be attained at the end of grade 4 in Dzongkha, English and Mathematics.

4.   In Bhutan, school and teacher as well as student characteristics are important for education outcomes. This analysis shows that variation in school and teacher quality is correlated with a maximum of about 50 percent of variation in test scores, even after controlling for child and family background characteristics. The remaining variation in performance is within schools and relates to students' background heterogeneity or ability.

5.   Characteristics of schools matter along a number of different dimensions. Teachers play a particularly important role. Students in schools with a higher share of female teachers have significantly higher test scores in grade 2. A higher share of teachers who have attended the School Based Improvement Program training or the upgrade training is associated with higher scores.

6.   Among observable child related characteristics, gender is not significantly correlated with test scores. The difference in test scores between wealthier or better educated families is small once school characteristics are controlled for, but does remain to a certain extent. Father's literacy is not significantly correlated with any test scores and mother's literacy is only significantly and positively correlated with math scores in grade 2. Household wealth is significantly correlated with higher test scores for English and Mathematics in grade 4 only.

7.   A child's age is negatively correlated with learning outcomes. For an older child, the opportunity cost of a child's time becomes higher, and many children work. For girls in particular, social norms become more constraining. These factors put pressure on children to be less devoted to school and eventually to leave school.

8.   Teacher absence is a pervasive problem in public schools of developing countries. This study asked parents whether teachers attended school regularly and came to school on time to judge teacher presence in schools. Seventy percent of the parents in the survey said that teachers attended school regularly and ninety percent of the parents said that teachers came to school on time. Further analysis showed that there is a clustering of parental response at the school level – there are some schools with more severe problems with teacher absenteeism.

9.   The following policy implications emerge from this study: (a) educational attainment of children can be improved by interventions aimed at schools at the teacher level as well as at the household level; (b) performance can be improved by ensuring more teachers undergo the SBIP training and by taking the upgrade training for the higher level classes; (c) performance can be improved by hiring more female teachers, (d) performance can be increased by helping children to attend the right grade for their age; and (e) the issue of teacher absence may be of concern in some schools.

TABLE OF CONTENTS

LIST OF TABLES

I. Introduction

1.   In a globalizing world, knowledge and skills are the drivers of economic and social well-being. Ensuring universal participation in education has been the primary objective of developing countries in the past decades but now education quality is gradually moving towards centre-stage. Evidence shows that the quality of education – usually analyzed by test scores results as a proxy for quality – contributes to higher rates of economic growth and personal incomes; education policy reformers in developing countries are increasingly seeking to improve education quality. While the gaps in years of schooling completed are narrowing between children in developing and developed countries, gaps in actual knowledge of children are large and growing (Hanushek and Woessman, 2006).

2.   The education sector in Bhutan has been growing steadily since the 1960s and concomitantly the literacy rates of the population have also been steadily going up over time. The mostly mountainous country regards education as central to its national development. Every cohort has seen an increasing share of children going to school and the education system now strains to keep up with the speed with which enrolment has expanded over the last ten years, in-line with Bhutan's commitment to meet the education Millennium Development Goals (MDGs).

3.   The need to improve education quality has become a priority for education policy-makers and reformers in the country and there is widespread public concern over a perceived decline in education quality. The Ministry of Education (MoE) is making concerted efforts to improve education quality along a number of dimensions, including: teacher quality; infrastructure; facilities; and curricula. To measure and monitor education quality, Royal Government of Bhutan (RGoB) has established a new assessment system called the National Education Assessment (NEA). In 2003, grade 6 students were tested on a pilot basis in English and Mathematics, and in 2005, another set of grade 6 students were tested in Dzongkha, the national language. Similarly, grade 10 students were tested on a pilot basis in English and Mathematics in 2006 and in Dzongkha in 2007. The two grades will again be tested in each subject five years later to determine changes in learning achievement and to assess how that change relates to improvements in education quality undertaken by RGoB between the two cohorts.

4.   Early grades of primary school (and early childhood education) are critical years for the development of cognitive skills among children (Heckman 2007, Heckman and Cunha, 2007). At the time of this report, the quality for primary education earlier than grade 6 (the terminal primary school grade) cannot be assessed on a system-wide basis.

5.   The Bhutan Learning Quality Survey (BLQS) of schools that is discussed in this report provides an opportunity to examine quality of education in early grades in primary school for the first time. The survey includes students test scores in Dzongkha, English and Mathematics, and information on the characteristics of the schools, teachers, and child and family background characteristics of the students who are being tested. This allows us to measure the extent of correlation of the learning outcomes of students with a wide variety of factors.

6.   More specifically, the survey allows us to:

     (a) to estimate learning levels in primary education – in particular, to test children in grades 2 and 4 in Dzongkha, English and Mathematics;
     (b) to identify factors correlated with differences in student achievement; and
     (c) to understand the extent to which each source contributes to difference in learning achievement.

7.   A large body of research in both developed and developing countries robustly conclude that the main factors involved in the production of education are school, teacher, child and family characteristics. Empirical methods used in this paper allow for a break down of the total variation in scores attributable to each factor. Differences in school/teacher quality explain a fairly large share of variation in test scores. This underscores the importance of instituting appropriate school- and teacher-based policies to raise achievement. The survey also tries to answer the question of the extent to which observable characteristics of schools and teachers explain school and teacher quality. Apart from school and teacher related factors, a child's family background characteristics are also systematically correlated with learning to a large extent in Bhutan - more so than in many other developing countries.

8.   This report is structured as follows: **Section II** presents the background and context of Bhutan's education system; **Section III** discusses previous theoretical and empirical literature on education quality; **Section IV** describes the sampling design methodology, the sample and empirical methodology used in this study; **Section V** presents findings on students' actual knowledge in three subjects and their corresponding scaled scores; **Section VI** presents the results of multivariate regression analysis for estimating school, teacher and child related correlates of learning outcomes; **Section VII** profiles teachers in grades 2 and 4 and the education process; and **Section VIII** concludes with brief summary, discussion of policy implications, and recommendation for future research.

II. Background and Context

Overview of Bhutan's Educational Progress and Current Challenges[1]

9. Education has historically been a priority sector for the Royal Government of Bhutan. Bhutan, located between India and China, is a small country with a mostly mountainous terrain and thinly dispersed population. Providing universal education of good quality in this context is a challenging task.

10. Since the country's first Five-Year Plan in 1961, RGoB has made considerable investments to promote and expand modern education alongside monastic education. Participation levels in education have progressively risen as a result and literacy rates have increased tremendously over the last half-century. According to the Bhutan Living Standard Survey (BLSS) 2003, the overall literacy rate for the population aged 6 years and above was 42.9 percent. The male literacy rate was 53.9 percent, whereas the female literacy rate was 32.8 percent. Bhutan's remarkable progress in education participation can be inferred from the fact that according to the BLSS 2003, the literacy rate for the 10-14 years age-group was 75.3 percent, whereas it was only 12.8 percent for the population over age 60.

11. The speed with which Bhutan has increased its stock of human capital has been remarkable, especially compared to its neighbors in the South Asia region. The percentage of 15-19 year olds that have completed at least grade 5 was 57 percent for Pakistan (2001), 65 percent for Nepal (2002-03) and 77 percent for India (2004) (Riboud, Savchenko and Tan, 2007). In 2003-04, nearly half of all 15-19 year olds in the country had completed at least grade 5. As early as twenty years ago, only a tiny portion of all children attended school in Bhutan.

Enrolment in Primary School

12. The primary school cycle in Bhutan consists of seven years from pre-primary (PP) to grade 6. The official age of entry for children into PP is six years and graduation from the primary cycle is at age 12. Since 1991, school enrolment has increased at the rate of six to seven percent annually. The primary gross enrolment rate (GER) increased by 21 percent from 2003 to 2006 and the net enrolment rate (NER) increased by nearly 18 percent in the same period (World Bank; 2005, 2007). The gender gap in school participation has narrowed considerably over the years. Since 2001, girls have constituted over 46 percent of those in school across all levels of schooling (World Bank 2005).

13. Lower NER in primary education is due to several endogenous factors: (a) schools are not always located close to children's homes, given Bhutan's mountainous terrain; many children must walk considerable distances to reach school each day, so they do not start school at the official age of six years; and (b) there are high repetition rates. The primary repetition rate in 2002 was 12.9 percent overall -- 13.5 percent for boys and 12.3 percent for girls (UIS Global Education Database, 2006).

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[1] Information for this section is mostly taken from *Current Human Development Outcomes in Bhutan: Analysis Using the 2003 BLSS*, Report No: 32273-BT, The World Bank, 2005.

Schools and Teachers

14.   Bhutan provides free basic education for its children from PP to grade 10. Primary grades are offered in community schools, primary schools, and lower and middle secondary schools. The majority of schools in Bhutan are owned and run by the government, but there is a small sector of privately-owned schools. At present, under the general education system in Bhutan, there are:

- ③ 249 community primary schools;
- ③ 83 primary schools;
- ③ 87 lower secondary schools; and
- ③ 37 middle secondary schools.
- ③ There are also 16 private primary schools (MoE, RGoB, 2007).

15.   The official norm for deployment of teachers in Bhutan is a pupil-teacher ratio (PTR) of 32:1. As of 2007, there were 5,027 teachers in community, primary, lower and middle secondary schools teaching 146,046 students that implies an average pupil-teacher ratio (PTR) of 29:1. This ratio is lower than the norm, but is also inclusive of all students and teachers, including those grades above the primary level (grades 7 to 12) (MoE, RGoB, 2007). This ratio may not, however, be reflective of true class sizes.

16.   The share of trained teachers in public schools is relatively high, while female teachers constitute considerably less than half of all teachers. In 2002, the percentage of teachers with training was 91.6 percent; female teachers comprised 36.1 percent of all teachers (UIS Global Education Database, 2006).[2]

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[2] In the data on which this report is based, average share of female teachers is 42 percent of primary level teachers.

III. Theoretical and Empirical Literature on Education Quality

17.   World-wide experience with education reforms shows that there is no 'one-size-fits-all' approach to improve education quality. There are, however, some elements that are widely accepted as basic to any well-functioning education system. These elements interact with the social, political and economic context in which the system operates to produce education outcomes.

18.   Research from both developed and developing countries show that education policy that focuses *only* on increasing school resources has not succeeded in improving education quality. Simply increasing school budgets, reducing class-sizes or providing more teacher-training has not delivered the desired increases in learning outcomes. The implication of this research is that the level and distribution of resources are key in determining ease of access to schools equipped with adequate infrastructure and materials, located in close proximity to children's homes, staffed with adequate numbers of qualified teachers. The absence of conveniently located schools and a lack of teachers in sufficient numbers act as deterrents to participation in education, especially for girls and young children. If the institutional structure and accountability systems within which schools operate are weak, increased resources will not achieve the desired impact at the margin. The quality of service delivery is as much, if not more important, than levels of financial and material resources.

19.   The quality of service delivery is a complex issue, and especially contingent on the behavior and performance of education providers, particularly teachers. The role of teachers in ensuring that children learn is critical. Education policy concerning teachers mostly focuses on teacher education and training, teacher reward systems that determine who becomes and remains a teacher, and teacher performance in the classroom. The challenge for policy-makers is to attract qualified and motivated individuals who will consistently perform well in the classroom over the years they remain in the profession.

20.   In general, public education systems in developing countries reward teachers on the basis of their education, training and experience. In most empirical research, findings show that the correlation between these teacher characteristics and students' learning outcomes are either weak or non-existent. It is generally agreed that teacher incentives for improved performance in public education systems are weak (Dixit et al, 2002). These are reflected in the very high rates of absenteeism for teachers that have been reported from a large group of developing countries. Performance is also affected by the large amounts of time spent by teachers on non-teaching activities (Chaudhury et al 2004; PROBE 1998). The onus to perform, therefore, largely resides with teachers that are motivated to perform. Teacher motivation alone, however, may not be sufficient or reliable to sustain or improve teacher performance and, consequently, student learning achievement.

21.   No education system has been able to devise the perfect reward system to align the objectives of teachers and children. Performance or merit-pay systems have generated mixed results. It is argued by some that pay increases to compensate the teacher for the extra risk undertaken by them to improve outcomes may not be cost-effective, given that the child plays a large role in producing results (Eberts et al, 2002). In a randomized

experiment in the southern Indian state of Andhra Pradesh, performance bonuses for teachers led to an increase of 0.15 of a standard deviation in test scores. Moreover, the incentive program was highly cost-effective compared to the status-quo (Muralidharan and Sundararaman, 2006). Professional status and social prestige associated with one's profession also act as incentives for entry into and performance in a profession. Prestige and status associated with teaching, in general, rank lower than other professions requiring similar qualifications. Increasing prestige and status accorded to the teaching profession poses challenges that cannot be addressed quickly or easily.

22.   There are examples of education systems that have proved better than others in teacher performance and education outcomes. A new report by McKinsey and Co. looks at common factors that characterize the best education systems in the world (such as education systems in Finland, Canada, Japan, Singapore and South Korea). The systems are very different from each other in many respects, yet appear to have the following common features with regard to teachers:

    (a)   they recruit the brightest graduates as teachers;
    (b)   admission into teacher training is very competitive; and
    (c)   there are early and frequent intervention to bring lagging students up to par with others.

23.   The recruitment of the best graduates as teachers does not seem to require higher salaries. Due to stringent selection criteria, teaching is a high status profession in these countries. These countries also focus on teacher professional development that takes place largely in schools.

24.   Children's individual, family and community background characteristics are also key inputs into the production of learning outcomes. Some research in developing countries has found that girls are less likely to enroll in schools at the appropriate age. Age at first entry can also have an effect both on completed years of education and on learning outcomes. Some cognitive skills are best developed early on and children may miss out on establishing solid foundations for learning due to late entry. The age-grade combination for a child may also deviate from the norm due to grade repetition. Late entry and grade repetition can induce children to drop-out due to: (a) the increasing opportunity cost of the child's time with age; and (b) disaffection with learning.

25.   Among household characteristics that influence educational outcomes in developing countries, children with literate parents generally tend to have better learning outcomes (Filmer, King and Pritchett, 1997), as is the case for children who come from economically better-off households.

IV. Sampling Design, Sample Description and Empirical Methodology

26.   The study is based on analysis of a school survey conducted in May-June 2007. The survey tested children in grades 2 and 4 in three subjects – Dzongkha, English and Mathematics. It also collected information on the characteristics of villages, schools, teachers, students and their family background.

27.   The school survey was designed to be nationally representative and covers all dzongkhags (districts) in the country. It covers a total of 120 schools, including 42 community primary schools, 32 primary schools, 32 lower secondary schools, 10 middle secondary schools and 4 private primary schools. Schools are located in urban areas (37), semi-urban areas (32), semi-rural areas (36), rural areas (12) and remote rural areas (3). The sample is representative of small schools and large schools and was approved by the Ministry of Education. The survey collected data in every primary school (or secondary schools having primary grades) of the selected village clusters in rural areas.

28.   Each dzongkhag was officially informed of the schools selected to facilitate data collection. District Education Officers informed head teachers of schools of the survey team's visit to solicit their cooperation. However, head teachers were not informed of the specific date of the visit to avoid bias introduced by prior preparation.

29.   In each school in the sample, 20 students were randomly selected from grades 2 and 4, ten students from each grade. If a school had more than one class for a grade, first a class was randomly chosen and then students were randomly selected from that class. While the desired sample size was 2,400 child-level observations, the achieved sample had 2,359 observations. In cases where schools had fewer than ten children in either grade 2 or grade 4, enumerators implemented a within school adjustment by including more children from other classes of the same grades if that was possible. Children in schools with a total number of students lower than 20 were not replaced (however, there were very few such schools). Tables A1-A4 in the annex provide complete descriptive statistics of the sample data.

30.   Students from both grades 2 and 4 were administered the same tests in the three subjects and the tests were conducted for the whole group of students in the sample in each school. Apart from testing the students, the survey collected information on the school facility and interviewed teachers of students who were part of the sample. Data was also collected on the family background and other personal characteristics of the students in the sample.

31.   The empirical methodology for this study consists of multivariate analysis with learning outcomes as the dependent variable and village, school, teacher and student characteristics as the independent variables. The statistical model used is Ordinary Least Squares Regression (OLS); and a series of models are developed for estimating the correlations between school, teacher and student characteristics and student learning outcomes.[3]

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[3] Data analysis was conducted using STATA 9.0 which is a statistical analysis software package.

V. Objectives, Competencies and Learning Outcomes

32. This section examines what children in grades 2 and 4 actually know by looking at how well they do on various competencies. Each subject is examined by:

    a. The percentage of children by grade who answer specific test items (aligned to a competency) correctly.

    b. Learning outcomes by grade in terms of summary scaled scores. These are scores for aggregate performance on a test which lie on a scale that corresponds to underlying ability of the student.

Curriculum Objectives and Tests

33.   Bhutan's general education system prescribes the acquisition of basic skills in literacy and numeracy in grades PP to grade 3. Three subjects are taught in these grades – Dzongkha, English and Mathematics. A fourth subject, Science, is added for Grades 4 to 8.

34.   For this study, children were tested in three subjects – Dzongkha, English and Mathematics. Tests were based on basic competencies in these three subjects for grade 2 and grade 4 as prescribed by the Bhutan National Curriculum. A local Bhutanese technical expert assisted the lead consultant responsible for developing the test instruments. Two rounds of piloting were completed before the test instruments were finalized.

35.   The test in each subject covered the range of competencies from the simple to the complex. Some test items were beyond the curriculum for grade 2 but within the bounds of prescribed competencies for grade 4. To minimize biases and distortions in administering and marking tests, it was decided that test items would be multiple-choice questions. Due consideration was given to the lack of familiarity of Bhutanese school children with the multiple-choice test format. The members of the survey field team were given intensive training and guided on how to explain the test format to the children when administering the tests.

36.   The tests used in this study fall in the category of criterion-referenced tests that are designed to test a student's achievement of particular skills in different areas of knowledge. Information generated by criterion-referenced tests can be used to describe students' mastery of a particular skill such as, for example, spelling or long division. Criterion referenced tests (see Box 1) can tell school administrators how many students in a particular grade have mastered skills prescribed in the curriculum.

Box 1: Criterion Referenced Tests

Criterion-referenced tests use the objectives and goals set by the curricular framework as a guide for the development of test items for each grade and subject. The objectives and goals of the curriculum are analyzed to determine the subordinate skills that are required to achieve them. Subordinate skills are further separated into prerequisite and enabling categories. Other types of tests include norm-referenced tests and scholastic aptitude tests.

What Do Children Know?

37.   This sub-section examines what children actually know by looking at how well they do on various competencies in Dzongkha, English and Mathematics.

What do children know in Dzongkha?

38.   Dzongkha is the national language of Bhutan and also the language of instruction for some subjects at lower primary levels in public schools. The items used for Dzongkha tested six competencies: word recognition; word construction; vocabulary; grammar; sentence construction; and reading comprehension. Table 1 below shows what percentage of children in each grade answered particular test items correctly. It also shows the grade for which the competency is prescribed by the curriculum.

39.   *Grade 2:* For test items corresponding to grade 2 curricula, between 88 to 91 percent of students can circle the names of pictures. Between 76 to 82 percent of students can identify the missing letter in a word corresponding to a picture shown. A greater percentage of students are able to circle missing words or correct words where pictures are shown; between 31 to 77 percent of students respond correctly to these items. Students do less well when they have to fill in a missing like word where pictures are not shown – between 31 to 45 percent of students answer such test items correctly. In items prescribed for grade 4, students perform better at circling correct verb tense (between 64 to 81 percent correct) than at circling correct names or the letter or missing words (between 13 to 36 percent). A third of students (30 percent) are able to read a simple passage and answer questions; a fourth (26 percent) of students can see a picture and match it with the correct sentence.

40.   *Grade 4:* A higher percentage of grade 4 students respond correctly to all the questions than grade 2 students. Between 80 to 99 percent of the students respond correctly to picture-related questions, for circling the name of the picture and circling missing letters. For questions without pictures, between 56 to 82 percent of students respond correctly. For items corresponding to the grade 4 curriculum, between 84 to 94 percent of students circled correct verb tenses and the correct name of a letter. Only 40 percent of students were able to correct the missing word in the sentence "The cat eats oranges". Only around 60 percent of students are able to read a simple passage and

answer questions; around 58 percent of students can see a picture and match it with the correct sentence.

Table 1: Children's Knowledge in Dzongkha

Subject	Test Question	Percentage Answering Correctly		Corresponding Grade of Curriculum
		Grade 2	Grade 4	
Dzongkha	Circle the name of the picture (picture of a hen)	91%	99%	Grade 2
	Circle the name of the picture (picture of scissors)	88%	94%	Grade 2
	Look at picture and circle the missing letter (picture of rabbit)	82%	88%	Grade 2
	Look at picture and circle the missing letter (picture of book)	76%	80%	Grade 2
	Circle the missing word (Apple *Orange* Banana)	45%	82%	Grade 2
	Circle the missing word (Bear *Lion*Tiger)	31%	56%	Grade 2
	Look at picture and circle the missing word (picture of a flute)	77%	84%	Grade 2
	Look at picture and circle the missing word (picture of a star)	49%	85%	Grade 2
	Look at the picture and circle the correct word (picture of boy *digging* with a hoe)	63%	92%	Grade 2
	Look at the picture and circle the correct word (picture of girl *boiling* tea)	31%	34%	Grade 2
	Circle the correct verb tense (goes from go)	81%	94%	Grade 4
	Circle the correct verb tense (teaches from teach)	64%	84%	Grade 4
	Circle the correct name of the letter (whether prefix, post suffix or root letter)	36%	87%	Grade 4
	Circle the correct missing word (The cat eats *oranges)*	13%	40%	Grade 4
	Read Passage and Answer Questions	30%	60%	Grade 4
	Look at the picture and circle the correct sentence (Picture of a hen on a chair)	26%	58%	Grade 4

What do children know in English?

41.   The six competencies tested in the English language are the same as those tested for Dzongkha. These competencies include: word recognition; word construction; vocabulary; grammar; sentence construction; and reading comprehension. The percentage of students responding correctly to a test item by grade is set out in Table 2.

Table 2: Children's Knowledge in English

Subject	Test Question	Percentage Answering Correctly		Corresponding Grade of Curriculum
		Grade 2	**Grade 4**	
English	Circle the name of the picture (picture of a cube)	68%	90%	Grade 2
	Circle the name of the picture (picture of yolk)	29%	37%	Grade 2
	Look at picture and circle the missing letter in a word (picture of snake)	67%	93%	Grade 2
	Look at picture and circle the missing letter in a word (picture of number seventeen)	68%	87%	Grade 2
	Circle the missing word in a sequence (Mother Father *Son*)	36%	70%	Grade 2
	Circle the missing word in a sequence (Wrist *Knee* Ankle)	33%	43%	Grade 2
	Look at the picture and circle the correct word in a sentence (picture of frog *jumping*)	28%	40%	Grade 4
	Look at the picture and circle the correct word in a sentence (picture of elephant *having* big ears)	46%	79%	Grade 4
	Circle the correct sentence (variations of "I wash my hands")	37%	75%	Grade 4
	Circle the correct missing word (I *weigh* 40 kilograms*)*	20%	38%	Grade 4
	Read Passage and Answer Questions	38%	59%	Grade 4

42.   *Grade 2:* 68 percent of grade 2 students correctly pick the right word for the picture of a cube but only 29 percent do so for the picture of yolk. About 67-68 percent correctly picked out the right letter to complete words naming pictures shown. Between 33-36 percent were able to correctly complete a sequence of related words. In items prescribed for grade 4, between 28-46 percent correctly responded to items that included pictures. Between 20-37 percent were able to correct sentences and missing words. More than a third of students, or 38 percent, was able to read a passage and answer questions.

43.   *Grade 4:* A higher percentage of grade 4 students responded correctly to all test items compared to grade 2. Around 90 percent were able to correctly pick the right word and letter in a word for pictures shown. Only 37 percent were able to pick the right word for yolk (which may be an unfamiliar word for the total sample as only 29 percent of grade 2 students got this correct). Between 87-93 percent correctly picked out the right letter to complete words naming pictures shown. Between 43-70 percent were able to correctly complete a sequence of related words. For items prescribed for grade 4, between 40-79 percent correctly responded to those that included pictures. Between 38-

75 percent were able to correct sentences and missing words. Only 59 percent of students were able to read a passage and answer questions about it.

What do children know in Mathematics?

44.   Nine competencies were tested in Mathematics, ranging from the simple to the more complex. These competencies were: counting; addition; subtraction; multiplication; division; fractions; data; deductive; and measurement analyses. Table 3 provides the results.

45.   *Grade 2:* 90 percent of grade 2 students are able to count and circle the right number of objects in the picture but only 37 percent correctly responded to counting and circling the highest number of objects. 65 percent of students could circle the correct missing number in a sequence. 65 percent of students were able to pick out the correct number in words when the number was 15 (in words) but only 37 percent could do so when the number was 150 (in words). Between 53-82 percent of students were able to correctly do simple addition, subtraction and multiplication. More complicated questions – all prescribed for grade 4 – were correctly answered by between 22-39 percent of students.

46.   *Grade 4:* A higher percentage of students in grade 4 correctly responded to all test items compared to grade 2. 75-97 percent of students are able to count and circle the correct number of objects in the picture. Only 71 percent of students are able to pick out the right word when the number shown is 150. Between 56-95 percent of students are able to correctly do simple addition, subtraction and multiplication. More complicated questions – all prescribed for grade 4- were correctly answered by between 46-91 percent of students.

Table 3: Children's Knowledge in Mathematics

Subject	Test Question	Percentage Answering Correctly		Corresponding Grade of Curriculum
		Grade 2	**Grade 4**	
Mathematics	Count the number of objects and circle the correct answer (basket with 6 eggs)	90%	97%	Grade 2
	Circle the box with most objects (box with stars)	37%	75%	Grade 2
	Circle the correct missing number (*64* 65 66)	65%	88%	Grade 2
	Circle the correct answer (15 in words)	65%	90%	Grade 2
	Circle the correct answer (150 in words)	37%	71%	Grade 2
	Add and circle the correct answer (picture of 3 balls plus 5 balls)	82%	95%	Grade 2
	Add and circle the correct answer (15+6=)	55%	79%	Grade 2
	Subtract and circle the right answer (19-6=)	53%	80%	Grade 2
	Multiply and circle the correct answer (5x2=)	57%	95%	Grade 2

Subject	Test Question	Percentage Answering Correctly		Corresponding Grade of Curriculum
	Multiply and circle the correct answer (11x?=110)	23%	56%	Grade 2
	Divide and circle the correct answer (4÷2=)	29%	49%	Grade 2
	Circle the correct answer for the shaded part of the picture (a circle with a quarter shaded)	39%	68%	Grade 4
	Circle the correct answer (1/4 ÷ 1/4=)	25%	58%	Grade 4
	Look at the picture and circle the correct answer (clock face showing 9 0' clock)	63%	91%	Grade 4
	Circle the heaviest of weights below (picture of balances)	22%	46%	Grade 4
	Area Questions (The length of a picture shown)	32%	52%	Grade 4

Scaled Scores

47. Scaled scores are a useful way of summarizing performance compared to raw scores (percentage correct). Scaled scores take into account the difficulties of the various test items that were answered correctly by a student and therefore successfully discriminate between the actual knowledge differences between students. For this study, the raw scores of the student were converted into scaled scores using the methodology prescribed by Item Response Theory (IRT) for weighing the various test items and assigning an aggregate score to each child based on questions correctly answered. (See Box 2 below for a brief explanation of IRT). The IRT scores have been constructed so that the average child will have a score of 500 and the standard deviation of the distribution of the scores is 100.

Box 2: Item Response Theory (IRT)

IRT is a body of theory that describes the use of mathematical models on data from test questionnaires to measure skill achievement. The models of IRT allow computation of the probability of correct response on an item based on person and test-item parameters. Person related parameters can be underlying ability or aptitude. Test-item related parameters can include characteristics such as item difficulty, how well the item discriminates between low and high ability persons for a given level of difficulty, and a probability of guessing the correct answer.

Learning Outcomes in Terms of Scaled Scores

48. The mean and standard deviations of ability scores by grade and subject are shown in Table 4 below for all students in the sample. The mean ability score in grade 2 ranges from 438-443 for the three subjects with standard deviations ranging from 82-94

points; the mean ability score for grade 4 ranges from 554-559 for the three subjects with standard deviations ranging from 71-81 points.

49.   The IRT scores for students in the two grades for all the subjects are consistent with findings on how students perform on actual competencies. A t-test of the differences in the mean scores across the two grades was significant at the 5 percent level; this implies that moving up grades makes a significant difference to learning levels.

<p align="center">Table 4: Mean Ability Scores (All Schools)</p>

	Dzongkha	English	Math
Grade 2	443	439	438
Standard Deviation	(82)	(94)	(88)
Grade 4	558	554	559
Standard Deviation	(81)	(71)	(71)
(Mean Grade 4) – (Mean Grade 2)	115*	115*	121*

*Significant at 5% level

Distribution of Students on Scaled Scores

50.   The scaled scores also provide a basis for making comparisons of the distribution of achievement levels across grades. Grade-to-grade comparisons are made by examining both the growth in scaled scores and the percentage of students in different proficiency categories across the two grades. It is important to keep in mind the fact that this is a comparison of different groups of students across two grades. A shift in the distribution of scores in the higher grade will be the net result of low ability students dropping out before they reach the higher grade and greater learning that takes place as students reach higher grades.

51.   Table 5 on the next page shows the IRT ability scores achieved by students at different percentiles of the student distribution. The percentiles shown in the table are 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th and 99th. The 50th percentile is the median of the distribution. The mean and standard deviation of scores are also shown in the table. The relationship of the median to the mean and the size of the standard deviation describe skew and degree of heterogeneity of performance.

52.   The patterns of score distributions are similar across subjects for each grade. The lowest 1 percent of grade 2 students scores more than 3 standard deviations below the average student and the top 10 percent score more than 1 standard deviation above the average student. For grade 4, the lowest 1 percent of students scores less than 1 standard deviation below the average student and the top 25 percent score more than 1 standard deviation above the average student.

53.   The distribution of scores shifts to the right for grade 4 compared to grade 2. The first percentile of grade 4 has scores comparable to the 10th percentile of grade 2 (at around the 300 mark, or 2 standard deviations below the average student in grade 4). A student situated between the 75th and the 90th percentile of grade 2 has scores at about the

500 mark; this compares to a student of grade 4 who crosses the 500 mark between the 10th and the 25th percentile.

Table 5: Distribution of Scaled Scores for each Subject and Grade

Dzongkha											
Percentiles/Grade	**1%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**	**Mean**	**SD**
2	128	303	352	406	455	490	524	550	606	443	82
4	354	439	475	516	558	598	648	674	749	558	81
English											
Percentiles/Grade	**1%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**	**Mean**	**SD**
2	26	305	355	405	449	490	528	559	615	439	94
4	379	444	472	513	554	595	633	659	720	554	71
Mathematics											
Percentiles/Grade	**1%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**	**Mean**	**SD**
2	34	305	355	402	447	487	529	552	605	438	88
4	412	467	485	515	555	597	638	669	741	559	71

VI. Findings from Multivariate Regression Analysis

Analytical Framework for Multivariate Analysis

54.   In this section, multivariate regression analysis is used to identify the correlates of learning outcomes in schools. The analysis is done at the level of the individual child with the IRT score as the dependent variable.

55.   The analysis is done separately for each grade and subject. Two principal models have been estimated with: (1) ability scores regressed on school attended as the only independent variable (school fixed effect); and (2) ability scores regressed on dzongkhag in which the school is located, village characteristics, school characteristics and child and family background characteristics. The results for (1) and (2) are set out in Tables R1-R2 in the annex.

In the second model, achievement of student i in school j Y_{ij} is modeled as a function of individual and family background characteristics X_{ij}, a vector of school and teacher characteristics S_j which is constant across students from the same school, and a random error term ε_{ij} such that

$$Y_{ij} = \alpha + \beta X_{ij} + \lambda S_j + \varepsilon_{ij} \text{; where } \varepsilon_{ij} \sim N(0, \sigma^2)$$

Empirical Results

School Effects

56.   It is now widely accepted that differences in school and teacher quality are the most critical factors in determining differences in student achievement. A standard way of estimating school quality is to use school fixed effects in regression equations. Coefficients on school dummies are interpreted as estimates of school quality. The explanatory power of the equation (measured by the adjusted R-square) is the total variation in test scores explained by variation in school quality. The remaining unexplained variation is due to within school heterogeneity and noise in the data.

57.   School quality differences account for a maximum of about half of the total variation in test scores. Figure 1 below represents graphically the extent of variation in test scores due to differences in quality between schools; the remaining that is 'within' school variation is attributable to within school heterogeneity among students and to noise in the data[4]. The figure shows that differences in school quality explain 25-45 percent of variation in test scores. Note that the explanatory power of a model with school fixed effects to which some child and family background characteristics are added is not much higher, although we do not show such regression results in this paper. Figure

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[4] Figure 1 is drawn from regression results presented in the annex tables R1 to R2, where only the school attended is used as control.

1 also shows that school quality differences for both grades 2 and 4 are more important for English and Mathematics. To compare quality differences across grades by subject: (a) for Dzongkha and Mathematics, between school differences decline marginally from grade 2 to grade 4; and (b) for English, differences in school quality become more important in the higher grade.

Figure 1: Between and Within School Variation in Test Scores
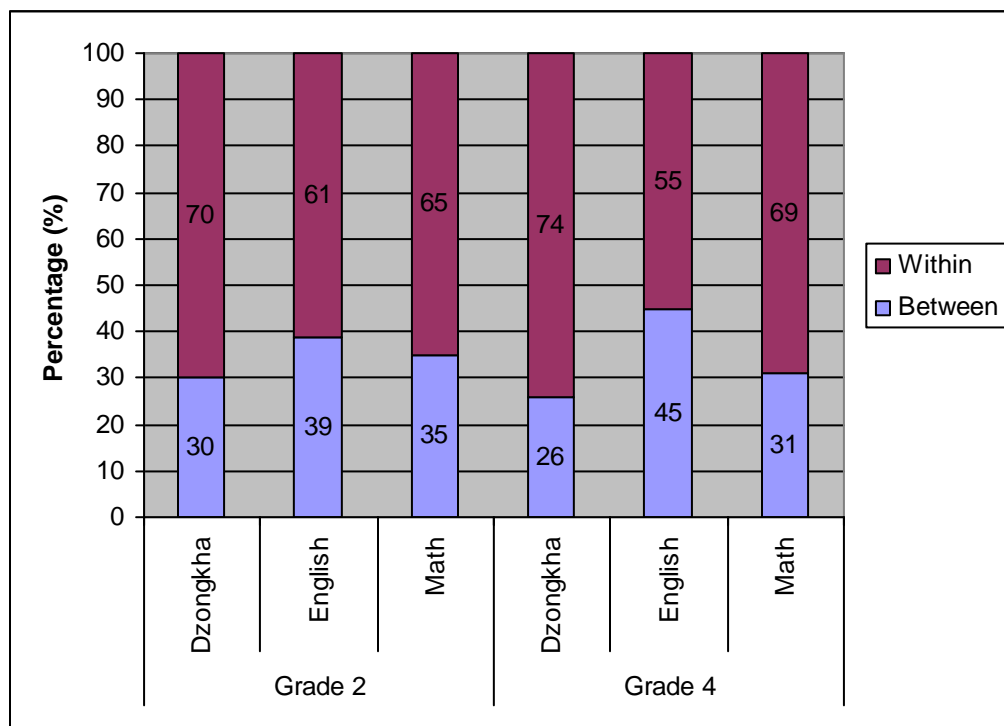
58.   This result is different from the findings from studies conducted in other developing countries, such as India and Pakistan. Differences in school quality account for a much higher share of the variation in test scores - between 60-70 percent in the case of India, and more than 70 percent in the case of Pakistan (World Bank, 2007; Goyal 2006a, Goyal 2006b, Siaens, 2008). While between-school variation is substantial in Bhutan, within school variation in test scores tends to be the dominant factor in all three subjects. The policy implications should necessarily take into account both sources of variation for raising educational attainment.

What Constitutes School Quality? The Impact of Observable School Characteristics

59.   It is necessary to go a step further than determining that the school is an important factor for educational attainment and identify characteristics of schools that make them more or less effective. In this analysis, school fixed effects were replaced by a set of observable school characteristics: average pupil-teacher ratio (PTR) in the primary sections of the school; a school infrastructure index; the availability of school mid-day-meals; and average teacher characteristics in primary classes, including gender, the nature of teacher contracts, education, experience and training. This analysis was carried out separately for each subject and grade.

60.   Regression results for the relationship between school quality and learning outcomes are presented in the annex in the two tables labeled R1-R2. In Table R1, results for all the tests in grade 2 are provided and in Table R2, results for all the tests in grade 4 are provided. For each test in each grade, the two models (1) and (2) described in paragraph 55 above are analyzed.   For each grade and each test, model (1) controls for school fixed effects (Figure 1 above); and model (2) controls for child and family background characteristics, school characteristics, geographical location of the school as well as characteristics of the village in which the school is located. Table 6 below summarizes findings from columns 2, 4 and 6 from each of the Tables R1-R2 (model 2). Only coefficients that are significant at the 1 percent or 5 percent level of significance are reported in this table. A positive sign before a coefficient signifies a positive (and significant) effect; a negative sign denotes a negative (and significant) effect.

61.   The last two rows of Table 6 compare the explanatory powers of the two models (1) and (2).   It is important to note that the explanatory power of the model falls considerably when observable school (and child or village) characteristics are substituted for school fixed effects (the school quality indicator). It falls by nearly 50 percent in grade 2 and by around 35 percent in grade 4. As said earlier, the explanatory power of a model with school characteristics with and without child and village characteristics is very similar. This means that observable school characteristics can explain only half to two-thirds of the variation in school quality. It is *a priori* unclear what would explain the rest of the variation in school quality.

62.   The filled in cells in the table below show which school characteristics are significantly correlated with test scores:

   a. ***Share of female teachers***: The share of female teachers has significant positive correlation with English and Math test scores in grade 2, but not in grade 4.
   b. ***Share of teachers who have not attended the School-Based Improvement Programme (SBIP)***: In both grades 2 and 4, the higher is the share of teachers who have attended the SBIP, the higher are Dzongkha (and math in grade 2 only) scores. This input does not have a significant correlation with test scores in English.
   c. ***Share of teachers with more than 28 years experience***: This variable has a large and negative impact on Dzongkha and Math scores in grade 2 and in Dzongkha in grade 4. The share of these teachers in the sample is very small, and therefore the coefficients have been less precisely estimated.
   d. ***Share of teachers with Upgrade Training Completed***: Schools with a higher share of teachers who have completed this training have higher test scores in English and Math in grade 4.
   e. ***Share of teachers with post-graduate qualifications***: This input seems to have a negative impact on English in grade 2 and Math in grade 4.

   Other variables that also have a significant impact are shown in the table below, although their influence is not robust across subjects or grades. The main lesson of Table 6 is that none of the observable school characteristics (including teacher characteristics summarized at the school level) appears to have a robust relationship

with learning outcomes. This finding is consistent with conclusions drawn from similar empirical work done in neighboring countries such as India and Pakistan.

Table 6: Coefficients of school characteristics

	Grade 2			Grade 4		
	Dzongkha	**English**	**Math**	**Dzongkha**	**English**	**Math**
School Characteristics						
School Ownership (Base: Government)						
Private School						
School Type (Base: Community School)						
Primary School						
Lower Secondary School	-24.06*					
Middle Secondary School	-38.73*					
Other School Characteristics						
Pupil Teacher Ratio						
School Infrastructure Index[5]						
Mid-Day Meal						
Teacher Characteristics						
Female (%)		81.85**	63.05*			
BED/TCERT (%)						
Permanent (%)						
Pre-Qualification (%)						
6-12 Years Experience (%)						17.29*
Post-Graduate Teachers (%)		-197.57*				-124.69*
28 or more Years Experience (%)	-91.45**		-92.77**		-21.95*	
SBIP Not Attended (%)	-45.20*		-46.89**	-27.81*		
Upgrade Training Completed (%)					34.28**	37.67*
School Location	Yes	Yes	Yes	Yes	Yes	Yes
Village Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
R-Square (Village, Child, School and Teacher characteristics)	**0.16**	**0.28**	**0.20**	**0.20**	**0.34**	**0.23**
R-Square (School Fixed Effects)	**0.30**	**0.39**	**0.35**	**0.26**	**0.45**	**0.31**

* 5% level of significance; **1% level of significance.

Child and Family Background Effects

63.   Students' characteristics are also critical inputs for student achievement. Learning outcomes, for example, may differ by gender due to cultural norms; children of literate parents are likely to have better outcomes due to greater parental motivation, interest and support to their children's education; and children belonging to better-off households are likely to have access to more resources that enhance education. These factors not only influence learning outcomes directly but also indirectly through selection into type of school. For example, parents may prefer to send their children to private schools because they think that it provides better quality education than public schools. If they have

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[5]The construction of the school infrastructure index is described in the Annex.

access to more than one public school, they may actively choose to send their children to the one perceived as a better quality public school.

64. By comparing mean scores of students along any one of these dimensions – gender, parental literacy status and others - it is possible to get estimates of differences that are *unadjusted* for the influence of other factors. *Unadjusted* differences are likely to be under- or over- stated due to the fact that they disaggregate only along one factor without removing the influence of others. Multivariate regression analysis keeps the value of other factors constant so that we can get estimates of the *adjusted* differences along the dimension of interest. Formally, in model (2) as set out in paragraph (55), the coefficients β in the multivariate regressions are estimates of the extent of correlations of child and family background characteristics variables collected in **X** with the test scores. The values of these coefficients can be found in columns (2), (4) and (6) of the regression tables R1-R2 in the annex.

65. The adjusted differences are estimates of the extent of correlation and not causality because we cannot control for selection bias with our data. Selection bias occurs due to characteristics of children and parents that are observable and *unobservable*. More literate and wealthier parents may choose a certain school that their children attend, and the characteristics that are correlated with school choice are most likely to also be correlated with test scores. Multivariate analysis of one-time data can account for selection on observed characteristics such as parental wealth and literacy. But we cannot keep constant unobserved characteristics such as parental valuation of education and a child's innate ability for example, both of which are likely to affect school choice and learning outcomes.

Gender

66. **Differences in test scores are negligible between girls and boys.** Table 7 shows the mean ability scores by subject and grade for boys and girls. The last two columns of the table show the unadjusted and adjusted mean differences between the scores for boys and girls. Unadjusted gender differences are small across subjects and grades. Mean scores for girls are higher in Dzongkha and English in both grades and mean scores are higher for boys in Mathematics in both grades. T-tests of unadjusted mean score differences by gender were not significant. Adjusted coefficient values were also not significant as can be seen from the last column of Table 7 that controls for school attended and other student background characteristics.

Mean Ability Scores (all Schools) Grade 2			Unadjusted Difference = Mean Girl - Mean Boy	Adjusted Difference = Coefficient value
	Girls	Boys		
Dzongkha	444	442	2	1.84
English	441	437	4	3.33
Math	435	440	-5	-3.91
Grade 4				
	Girls	Boys		
Dzongkha	561	556	5	-0.07
English	554	553	1	-1.88
Math	556	563	-7	-7.82

*Significant at the 5% level; **Significant at the 1% level

Parental Literacy

67. **Children whose parents are literate have higher scores in English and Mathematics but not in Dzongkha.** Table 8 shows unadjusted and adjusted mean ability scores by mother's and father's literacy status. Children with literate mothers have significantly higher unadjusted mean scores in English and Mathematics in both grades 2 and 4. Children with literate mothers tend to do worse in Dzongkha in grade 4. Similarly, children with literate fathers have significantly higher unadjusted mean ability scores in English and Mathematics in both grades. Father's literacy status is associated with greater mean differences than mother's literacy status for children's achievement in English. The last column in table 8 shows the estimate of the difference in scores adjusted for the school attended and other socio-economic characteristics of the child. There is a significant reduction in the magnitude of the mean differences in almost all the cases except two. Having a literate mother continues to be significantly and positively correlated to math scores in grade 2 and negatively and significantly correlated with Dzongkha scores in grade 4. Having a literate father is not significantly correlated with any test scores.

Table 8: Mean Ability Scores by Parental Literacy Status

			Not Literate	Literate	Unadjusted Difference = (Mean Literate) – (Mean Not Literate)	Adjusted Mean Difference (Coefficient Value)
Mother	Grade 2	Dzongkha	446	440	6	3.55
		English	454	428	26*	0.16
		Math	449	430	19*	13.40*
	Grade 4	Dzongkha	548	562	-14*	-18.7**
		English	565	547	18*	-5.48
		Math	572	553	19*	0.36
Father			Not Literate	Literate	Unadjusted Difference = (Mean Literate) – (Mean Not Literate)	Adjusted Mean Difference (Coefficient Value)
	Grade 2	Dzongkha	448	436	12*	4.88
		English	455	419	36*	8.91
		Math	449	425	24*	2.82
	Grade 4	Dzongkha	554	564	-10	-10.25
		English	567	539	28*	5.50
		Math	567	550	16*	1.33

*Significant at the 5% level; **Significant at the 1% level

Household Assets

68.   Children belonging to households with more assets perform better, especially in English and Mathematics. Children in better-off households have access to greater resources, such as educational materials and better health and nutrition that are correlated with better learning outcomes. Table 9 below shows unadjusted and adjusted mean ability scores of children by the asset status of their households. The household index has been constructed by adding up points for possession of a list of household assets (see Annex 3). Households whose index is below the median are categorized as low asset households; conversely households with assets no less than the median household are categorized as high asset households. Children that belong to households with a high asset index have higher scores in all subjects and in both grades; mean differences in scores are significant only for English in grade 2, and English and Mathematics in grade 4.

69.   The last column of table 9 shows how much of the mean differences in scores across low and high asset households remain after controlling for school specific effects and other socio-economic characteristics of the child. The adjusted mean differences are much smaller than the unadjusted differences across low and high asset households. For

grade 2, the adjusted differences are no longer significant for all subjects. For grade 4, however, children that belong to a wealthier household continue to be significantly correlated to higher English and Mathematics scores, though the magnitude of the difference is half and less.

Table 9: Mean Ability Scores by Household Asset Index

Mean Scores by Household Asset Index				
Grade 2				
	High	Low	Unadjusted Difference = (Mean High Asset Index) – (Mean Low Asset Index)	Adjusted Mean Difference (Coefficient Value)
Dzongkha	445	439	6	-1.86
English	448	421	27**	4.37
Math	444	425	19	2.94
Grade 4				
	High	Low	Unadjusted Difference = (Mean High Asset Index) – (Mean Low Asset Index) (Mean High) – (Mean Low)	Adjusted Mean Difference (Coefficient Value)
Dzongkha	559	556	3	7.19
English	566	527	39*	17.72**
Math	568	539	29*	14.41**

*Significant at the 5% level; **Significant at the 1% level

Some other characteristics such as age and disability status of children are also significantly correlated with test scores. Age has a negative correlation with test scores in English in both grades and in Dzongkha in grade 2. Disabled children also have significantly lower scores in math in grade 2 and in English in grade 4. In the case of the latter, our sample though representative is small to draw any precise conclusions. Though we report the findings, they need to be interpreted with caution.

Dzongkhag and Village Effects

70.   It is useful to know how much of the variation in test scores is correlated with the dzongkhag and village on their own. This we have done by including first the dzongkhag as the only control, and then with village characteristics as the only set of controls. The regressions for these have not been reported in the tables in the annex because of school dominance in effects, and also because we are only interested in reporting the extent of explained variation (the values in the 'between' columns in tables 10 and 11).

Dzongkhag Effects

71.   When the dzongkhag in which the school is located is the only variable which is controlled for, the explained variation in test scores ranged between 4-11 percent for grade 2, and between 4-10 percent in grade 4, as can be seen in Table 10 below. Dzongkhag effects were highest for English in both grades. Overall, however, the dzongkhag by itself explains little, and once school identities were included, it was not possible to distinguish between school and dzongkhag effects.

72.

Table 10: Dzongkhag Effects

Grade 2		
	Within	**Between**
Dzongkha	96%	4%
English	89%	11%
Math	95%	5%
Grade 4		
	Within	**Between**
Dzongkha	94%	6%
English	90%	10%
Math	96%	4%

Village Effects

72.   At a lower level of disaggregation (the village), the explanatory power of geographical location is higher, but once school specific effects are included, village effects cannot be separately identified.. In this study, since village identifiers were not available, villages were controlled for by using the following village characteristics: the presence of roads; electricity; bank; BHU; hospital; VHW; shop; TV and telephone lines. These plausibly influence school characteristics, such as ownership and type, and are also correlated with the geographical location of the school, whether rural, urban or remote.

73.   For grade 2, the set of village characteristics explained between 8-17 percent of the variation in test scores, and for grade 4, the set of village characteristics explained between 5-22 percent of the variation in test scores. The effects are highest for English in both grades, followed by effects on Mathematics; the effects on Dzongkha show the lowest variation in test scores. Village-level characteristics that seem to matter as

correlates with higher test scores were: the presence of a paved road; phone lines; and a bank. However, as in the case of dzongkhags, differences in school quality overwhelm any differences arising from these characteristics.

Table 11: Village Effects

Grade 2		
	Within	**Between**
Dzongkha	92%	8%
English	83%	17%
Math	88%	12%
Grade 4		
	Within	**Between**
Dzongkha	95%	5%
English	78%	22%
Math	87%	13%

VII. Teachers and the Education Process

74. Teachers play a critical enabling role in the teaching-learning process; they also represent the largest expenditure item in public education budgets. They are the main instrument through which instruction is imparted to students in schools. Any reforms aimed at quality improvement of the education system will therefore need to keep a central focus on teachers.

75. The effectiveness of the teaching force is influenced by the recruitment, preparation, motivation and deployment processes used by the education system. These processes determine: who the teachers are; their educational and training qualifications; who they teach and where; and how committed they are to teaching.

76. In this section, the rich data on teacher characteristics collected by the survey is used to describe the profile of teachers who were part of the sample and relate them to findings on teacher effects from the multivariate analysis. Data are also examined to infer levels of teacher motivation among the sample.

Who Are Bhutan's Teachers?

77. RGoB recruits both Bhutanese nationals and non-nationals as teachers. The recruitment of nationals for the post of teacher takes place annually and is conducted by a panel from the Ministry of Education (MoE). The percentage required to pass for eligibility to teach varies, depending on the number of teachers sought and the pass percentages of graduates. For non-nationals, usually from neighboring India, recruitment tours are carried out in various Indian cities.

78. The discussion on teacher effects noted some of the observable teacher characteristics that have a significant and substantive impact on test scores. The most robust of these characteristics appears to be that of gender; female teachers typically have a large positive effect. Among other characteristics, teacher training, years of experience and contractual status also influence test scores more or less robustly across subjects and grades.

79. Table 12 below shows the distribution of teachers by gender, education, training and experience across school types – community, primary, lower secondary and middle secondary and school ownership – public and private. The share of female teachers is higher in primary, lower and middle secondary schools, as compared to community schools. Female teachers constitute nearly three-quarters of the teaching force in the private schools in the sample, against only two-fifths of the teaching force in public schools. A higher share of teachers in private schools has only pre-qualification education status. Three-quarters of the teaching force in public schools has a B.Ed. or some form of teaching certificate against only one third in private schools has a B.Ed.. The share of teachers with a university graduate degree is lowest in community schools, and highest in middle secondary schools; teachers with university graduate degrees are otherwise similarly distributed in primary and lower secondary schools, and across public and private schools.

80.   About three quarters of public school teachers have attended school-based improvement training (SBIP). While 80 percent of lower secondary school teachers have gone through this training (higher than the average), only two thirds of middle secondary school teachers have gone through this training (lower than the average). For community and primary schools, the share of teachers that have attended SBIP is similar to the average for public schools. A higher share of private school teachers has undergone this training (nearly 90 percent). The share of teachers who have completed upgrade training is smaller, on average; only about half of the public school teachers have completed upgrade training. A higher percentage of private school teachers has completed upgrade training (65 percent), compared to public schools (54 percent).

81.   A higher share of teachers in community schools and public schools has less than one year of experience, on average. In community schools, teachers with less than one year of experience constitute nearly a quarter of the teaching force. Nearly half of the teachers in all school categories have 3-12 years of experience. A third of teachers have more than 13 years of experience in all school categories; the exception is community schools, where less than a fifth of teachers have more than 13 years of experience.

82.   The profile of teachers in private schools is consistent with evidence from other developing countries in terms of observable teacher characteristics, except for training. There are no data available on teacher salaries, so it is not possible to compare salaries across the public and private sector teacher markets. In terms of contractual status, teachers with permanent contracts dominate in all school categories including private schools. Permanent contractual status does not, however, mean the same thing across these school types. Among public schools, community schools have the lowest share of teachers with permanent contracts, and primary public schools have the highest share of teachers with permanent contracts. (Non-permanent contractual teachers in the public schools include temporary/guest teachers and interns). On average, permanent teachers are 85 percent of the teaching force.

Table 12: Profile of Teachers across School Categories

Teacher Characteristics	Mean Share (%)					
	Community	Primary	LSS	MSS	Public	Private
Female	31	47	41	40	39	75
Permanent	83	91	88	90	87	94
Pre Qualifications	12	8	4	0	7	20
BED/TCERT	77	75	76	69	76	31
University Graduate	9	13	18	28	15	16
Training						
SBIP Training	74	76	80	62	74	88
Upgrade Training	54	48	57	68	54	65
Experience						
<1 Yr	24	12	11	12	16	5

	Mean Share (%)					
Teacher Characteristics	Community	Primary	LSS	MSS	Public	Private
1-2 Yrs	9	12	13	12	11	18
3-5 Yrs	18	17	20	20	19	20
6-12 Yrs	32	31	28	25	33	20
13-20 Yrs	9	13	16	17	13	17
21-27 Yrs	5	10	9	10	5	12
>28 Yrs	3	5	3	4	3	8

Teacher Motivation in Bhutan

83.   Teacher motivation towards work is an important factor in the quality of education. Studies show that there are very high rates of teacher absenteeism and low rates of teacher activity in public sector schools in many developing countries (Chaudhury et al, 2004). These factors indicate poor teacher motivation and weak teacher accountability. Poorly motivated teachers are not likely to be committed to teaching, especially in difficult rural environments where most schools are located. Public school teachers are civil servants – they typically do not face censure for poor or non-performance. In combination, the two factors of teacher absenteeism and low rates of teacher activity have a negative impact on the quality of teaching taking place in schools.

84.   There were no available data for directly computing rates of teacher absenteeism and activity. Multiple unannounced visits to sample schools to check teacher presence and activity status were not part of the survey design. There are parents' responses on teacher attendance and arrival in schools as part of the survey. Parents were asked whether (a) their child's teacher attended school regularly and (b) whether their child's teacher came to school on time. The results are set out in Table 13 below. Over 70 percent of all parents in the sample say that their child's teacher attends school regularly, and over 90 percent of all parents in the sample say that the child's teacher arrives on time to school. A higher share of parents in grade 2 report attendance (by 4 percent) and on-time arrival (by 6 percent) of teachers compared to grade 4 parents.

Table 13: Parents' Responses on Teacher Attendance and Arrival

Parents Saying Yes	Total (%)	Grade 2 (%)	Grade 4 (%)
Teacher Attends School Regularly	71.02	73.11	68.89
Teacher Arrives on Time	91.3	94.05	88.05

85.   A cluster analysis seems to indicate that teacher absenteeism and late arrival are clustered at the school level. Some schools tend to perform markedly worse than others in terms of teacher absenteeism and late arrival.

86.   A key challenge for any government is to ensure an adequate supply of good quality teachers. More research and analysis is required to link teacher certification and training, child preparedness and pedagogical styles to determine their influence on rates

of learning in different grades and students' grasp of lower and higher order concepts in different subjects.

VIII. Summary, Policy Implications and Research Recommendations

Summary of Findings of the Study

87.   In this report, an education production function approach was used to link observable inputs to learning outcomes to identify robust and significant correlates of learning. This method of variance disaggregation allows estimations of the magnitude of differences in learning outcomes that can be attributed to differences in quality across schools and teachers and how much can be attributed to heterogeneity within schools or among students taught by a particular teacher. A set of observable school and teacher characteristics was used to determine what constitutes school and teacher quality.

88.   The findings of this study indicate the following about the quality of primary education in Bhutan:

> i. The typical child in grade 2 has mastered the basic competencies that are expected of that grade within the context of the Bhutanese curriculum in Dzongkha, English and Mathematics.

> ii. The typical child in grade 4 has attained average or mastery level competence in all competencies expected to be attained at the end of grade 4.

> iii. School and teachers are very important for learning achievements. Variation in school and teacher quality is correlated with a maximum of about 50 percent of the variation in test scores, even after controlling for child and family background characteristics.

> iv. Achievement is significantly and systematically correlated with some observable school characteristics, mainly related to teachers. Female teachers have a large and significantly positive impact on test scores in grade 2. Trained teachers have a large and significantly positive impact on scores in both grades.

> v. Household resources, including human capital such as parental literacy, have small effects: once school quality is taken into account, household resources lose much of their explanatory power for learning achievements, but still explain some of the variation in children's performance. Gender is not significantly correlated with test scores.

> vi. A child's age is negatively correlated with learning outcomes: older children have worse learning outcomes. For an older child, the opportunity cost of a child's time becomes higher, and many children work. For girls in particular, social norms become more constraining. These factors put pressure on children to be less devoted to school and eventually to leave school. Additionally, later

development of cognitive skills is likely to have an impact on further learning due to weaker foundations for learning.

vii. This study is the first of its kind for primary grades in Bhutan. It can be considered as an example or pilot for the establishment of mechanisms for regular country-wide assessment of learning outcomes. Given that the sample of students tested in the study was nationally representative, the study provides a credible measure of what students know in grades 2 and 4.

viii. Due to the cross-sectional nature of the data, it was not possible to control for selection effects such as unobservable characteristics of students that may be correlated with both choice of attending particular schools and better learning outcomes. It is therefore not possible to make robust claims of causality, given biases due to selection and omitted variables effects. To be able to counter these biases, it is critical to track student performance over time, and also to keep a good record of changes that take place at the school and teacher levels.

Policy Implications and Recommendations for Future Research

89.   Schools and teachers form the core of any education system and any particular school. Analysis in this report shows that nearly half the variation in test scores is due to differences between schools and teachers. Improving schools and teacher quality is therefore likely to raise educational outcomes in the country. However, in Bhutan, unlike some of its neighbor countries, a significant share of the variation in performance is within schools and relates to student background heterogeneity or ability. This means that policy interventions should also be aimed at the household level.

90.   In this report, differences in some school and teacher characteristics contribute to greater school and teacher effectiveness. The most important factors among these characteristics are female teachers and teacher training. The report also suggests that late entry and repetition are associated with lower performance. To the extent that this is due to the increase in the opportunity cost of studying or to the pervasive impact of aging on the learning process, the report encourages policies that would support children in starting school at the appropriate age and reduce or eliminate grade repetition.

91.   The report only takes account of a sub-set of observable school and teacher characteristics. Other factors such as classroom processes and the quality and relevance of teaching methods (that have not been included for study in this report) need to be explored in future research as many empirical studies suggest their importance in influencing learning outcomes.

92.   Classroom Processes: Learning effectiveness depends on what tasks students and teachers do in classrooms, how they do them and how much time is spent doing them. Research shows that at the primary level, effective learning time, class organization and management, teaching strategies and instruction, assessments and teacher expectations are significant factors in improving student performance (Stallings, 1985).

93.   Exploring Teacher Quality Further: Teacher quality is difficult to define and measure. It depends not only on observable characteristics – education, training and experience - but also on the behavior of teachers and the nature of their interaction with children in classrooms. Teacher training, pedagogical support systems, recruitment standards and pay relative to equivalent professional groups determine both the kinds of people who become teachers and their incentives and motivation to perform within the system. Policy makers will have to think about and initiate changes along these dimensions to improve teacher effectiveness to attain acceptable learning outcomes. As a monitoring and evaluation strategy, impact evaluations of innovations in these areas can be useful in providing information on which strategies are effective and also cost-efficient.

94.   The task of education policy-makers is multi-fold and complex as they seek to universalize quality primary education. Pritchett (2006) lists the following interventions for increasing primary education opportunities:

(a)   physical expansion;
(b)   specific interventions and introduction of new techniques for improving quality;
(c)   raising returns from education;
(d)   cost reduction by reducing fees or by providing cash/other incentives; and
(e)   systemic reforms, especially improving accountability.

95.   The interventions listed above include both the demand and supply sides of education. As RGoB continues to expand the reach of education, education quality should also continually improve. The challenge of improving educational quality must include the development of monitoring and evaluation systems to measure the multiple outputs and outcomes of the education system. This is critical for steering the system in the right direction over time.

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Annex 1: Descriptive Statistics

Table A1: School Characteristics – Descriptive Statistics

	Number	Share (%)
Total	120	100
School Owner		
Public	114	95
Private	4	3.3
Not Recorded	2	2.6
School Type		
Community	38	32
Primary	33	27
Lower Middle	36	30
Lower Secondary	13	11
School Location		
Urban	25	21
Semi-Urban	38	32
Semi-Rural	32	27
Rural	17	14
Very Rural	6	5
Not Recorded	2	1
Other school characteristics		
Serves Mid-Day Meal	32	26.5
School Infrastructure Index (Range: 0-5)	Mean = 4, Median = 4	

Table A2: Teacher Characteristics – Descriptive Statistics

Mean Age (Years)	32
Female (%)	42
Permanent (%)	90
With Pre-Qualifications (%)	8
B.Ed./Teaching Certificate (%)	61
Post-Graduate Teachers (%)	15
SBIP Attended (%)	69
Upgrade Training Completed (%)	48
Received textbooks on time (%)	79
Experienced salary delay (%)	25

Table A3: Village Characteristics – Descriptive Statistics

	Percentage (%)
Electricity	
None	11.4
Partially Electrified	20.18
Fully Electrified	68.42
Health Facility	
None	20.35
Hospital	28.32
BHU	42.48
VHW	8.85
Shop	83.33
Motor Road	
None – Footpath	9.57
Unpaved Road	40
Paved Road	50.43
Other Facilities	
Phone Line	91.3
TV Access	62.61
Bank	32.17

Table A4: Child Characteristics – Descriptive Statistics

	Number	Share
Total Children Sample	**2359**	**100 %**
Grade 2		
Total	1191	51
Boys	594	50
Girls	597	50
Average age (Years)	8.8	-
Grade 4		
Total	1168	49
Boys	559	48
Girls	609	52
Average age (Years)	11.1	-
Language		
Dzongkha	643	27
English	23	1
Sharchop	865	37
Lhotsamkha	403	17
Bhumthang	79	3
Other	345	15
Other characteristics		
Disabled	15	<1
Child Works (%)	1776	76
Parental Illiteracy (%)		
Mother	1672	72
Father	1241	53
Household Size		
Below Median (<6) (%)	1425	60
Distribution of students across schools		
Community	713	31
Primary	671	28
Lower Secondary	715	30
Middle Secondary	260	11
Private	80	4

Annex 2: Regression Results

Table R1: Ordinary Least Squares Analysis of Grade 2 Ability Scores on Child and School Characteristics

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Dzongkha Scores		English Scores		Math Scores	
School Fixed Effects	Yes	No	Yes	No	Yes	No
Dzongkhag Fixed Effects	No	Yes	No	Yes	No	Yes
Village Characteristics						
Electricity		-19.10		-3.35		-23.05
		(2.71)**		-0.46		(3.34)**
Health Facility		12.81		2.46		2.30
		(2.59)*		-0.49		-0.44
Shop		0.95		0.32		1.30
		-0.05		-0.03		-0.12
Motor Road		22.55		6.65		20.28
		(2.25)*		-0.85		(2.75)**
Phone Line		-5.17		9.63		-3.20
		-0.2		-0.44		-0.15
TV Access		9.66		12.59		6.78
		-0.92		-1.06		-0.64
Bank		34.38		40.64		27.90
		(2.82)**		(2.90)**		(2.06)*
Semi-Urban		7.70		9.28		1.33
		-0.53		-0.67		-0.09
Semi-Rural		-0.93		13.01		-17.34
		-0.04		-0.58		-0.78
Rural		18.10		14.67		16.25
		-0.72		-0.65		-0.61
Very Rural		46.26		-0.50		12.86
		-1.24		-0.02		-0.39
Child and Family Characteristics						
Age		-19.55		-23.83		-19.52
		(2.20)*		(2.23)*		-1.64
Age Square		1.32		1.33		1.04
		(3.01)**		(2.56)*		-1.75
Female		1.84		3.37		-3.91
		-0.33		-0.66		-0.73
Disabled		-19.45		11.21		-36.13
		-0.93		-0.6		(2.94)**
Home Language						
English		-6.12		9.52		9.88
		-0.44		-0.79		-0.83
Sharchop		-14.08		-1.60		4.93
		-1.43		-0.18		-0.59
Lhotsamkha		-24.13		11.17		26.62
		(2.40)*		-1.24		(2.58)*
Bhumthang		-74.42		-12.93		-5.98
		(3.39)**		-0.68		-0.29
Other		-4.99		6.80		29.63

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Dzongkha Scores		English Scores		Math Scores	
School Fixed Effects	Yes	No	Yes	No	Yes	No
Dzongkhag Fixed Effects	No	Yes	No	Yes	No	Yes
		-0.37		-0.57		(2.51)*
Family Size (<6)		6.43		3.8		4.10
		-1.32		-0.83		-0.79
Mother Literate (Yes)		3.55		0.16		13.40
		-0.56		-0.03		(2.31)*
Mother Literate (Don't Know)		-13.61		-7.41		-6.19
		-0.75		-0.41		-0.33
Father Literate (Yes)		4.88		8.91		2.82
		-0.71		-1.50		-0.44
Father Literate (Don't Know)		7.82		15.01		8.13
		-0.60		-1.36		-0.62
Child Works		-4.69		1.19		-3.10
		-0.82		-0.21		-0.52
Household Asset (High)		-1.86		4.37		2.94
		-0.37		-0.71		-0.50
School characteristics						
Private School		-32.26		26.49		26.57
		-0.61		-0.42		-0.59
Primary School		-15.82		-11.49		-4.46
		-1.02		-0.89		-0.36
Lower Secondary School		-24.06		1.56		-19.16
		(1.99)*		-0.13		-1.87
Middle Secondary School		-38.73		25.22		1.65
		(2.00)*		-1.51		-0.08
School Infrastructure Index		6.95		1.98		3.22
		-1.41		-0.39		-0.70
Pupil-Teacher Ratio		-0.32		0.26		-0.24
		-1.03		-0.84		-0.98
Mid-Day Meal		9.21		14.58		9.37
		-0.87		-1.30		-0.87
Female Teachers (%)		32.35		81.85		63.05
		-1.05		(2.66)**		(2.13)*
Permanent Teachers (%)		-39.82		19.86		1.72
		-0.67		-0.33		-0.03
Teachers with Pre-Qualifications (%)		-101.75		-104.27		-17.17
		-1.63		-1.55		-0.32
Teachers with B.Ed/Tcert (%)		-83.41		-106.64		6.62
		-0.97		-1.14		-0.09
Post-Graduate Teachers (%)		-39.56		-197.57		-16.98
		-0.47		(2.23)*		-0.26
Teachers with Experience of 6-12 Years		3.88		4.79		0.21
		-0.47		-0.56		-0.03
Teachers with 28+ Years Experience		-91.45		-15.64		-92.77
		(2.66)**		-0.48		(3.05)**
SBIP Not Attended (%)		-45.20		-19.89		-46.89
		(2.51)*		-1.16		(2.87)**

Dependent Variable	(1) Dzongkha Scores	(2) Dzongkha Scores	(3) English Scores	(4) English Scores	(5) Math Scores	(6) Math Scores
School Fixed Effects	Yes	No	Yes	No	Yes	No
Dzongkhag Fixed Effects	No	Yes	No	Yes	No	Yes
Upgrade Training Completed (%)		38.87		40.91		15.44
		-1.75		-1.78		-0.71
Constant	456.70	558.42	417.90	513.48	454.40	475.60
	(3.93e+12)**	(6.25)**	(8.47e+12)**	(5.27)**	(3.15e+12)**	(5.44)**
Observations	1181	1001	1180	1000	1181	1001
R-squared	0.30	0.16	0.39	0.28	0.35	0.20

Robust t statistics in parentheses. * significant at 5%; ** significant at 1%

Table R2: Ordinary Least Squares Analysis of Grade 4 Ability Scores on Child and School Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Dzongkha Scores		English Scores		Math Scores	
School Fixed Effects	Yes	No	Yes	No	Yes	No
Dzongkhag Fixed Effects	No	Yes	No	Yes	No	Yes
Village Characteristics						
Electricity		-1.63		2.05		0.20
		-0.25		-0.36		-0.03
Health Facility		1.62		0.04		1.311
		-0.43		-0.01		-0.35
Shop		14.82		18.80		23.09
		-1.43		(2.02)*		(2.54)*
Motor Road		9.95		17.73		12.91
		-1.73		(3.00)**		(2.06)*
Phone Line		-26.82		-9.87		5.37
		-1.56		-0.64		-0.32
TV Access		-6.93		3.42		-0.02
		-0.89		-0.38		0.00
Bank		30.71		31.83		15.98
		(3.03)**		(2.71)**		-1.09
Semi-Urban		18.76		13.7		6.11
		-1.64		-1.13		-0.44
Semi-Rural		31.34		17.39		5.03
		(2.03)*		-1.03		-0.27
Rural		22.36		24.63		11.39
		-1.18		-1.26		-0.53
Very Rural		24.26		73.95		36.93
		-1.00		(3.66)**		-1.37
Child and Family Characteristics						
Age		-18.08		-22.74		9.27
		-1.09		(2.04)*		-0.86
Age Square		0.64		0.72		-0.47
		-0.95		-1.58		-1.08
Female		-0.07		-1.88		-7.82
		-0.02		-0.45		-1.80
Disabled		-158.12		-54.97		-143.17
		-1.74		(3.97)**		-1.90
Home Language						
English		-15.47		4.92		6.13
		-1.34		-0.53		-0.74
Sharchop		-12.30		6.67		-3.27
		-1.44		-0.96		-0.51
Lhotsamkha		-51.41		6.21		6.20
		(6.29)**		-0.95		-0.95
Bhumthang		-26.85		-1.79		9.35
		(2.08)*		-0.13		-0.76
Other		1.74		11.64		11.19
		-0.12		-1.19		-1.29

Dependent Variable		(1)	(2)	(3)	(4)	(5)	(6)
		Dzongkha Scores		English Scores		Math Scores	
School Fixed Effects		Yes	No	Yes	No	Yes	No
Dzongkhag Fixed Effects		No	Yes	No	Yes	No	Yes
Family Size (<6)			-0.98		-4.15		0.92
			-0.18		-1.08		-0.19
Mother Literate (Yes)			-18.70		-5.48		0.36
			(2.97)**		-1.2		-0.07
Mother Literate (Don't Know)			-10.75		-27.33		-31.62
			-0.72		(2.05)*		(2.03)*
Father Literate (Yes)			-10.25		5.49		1.33
			-1.62		-1.17		-0.23
Father Literate (Don't Know)			-22.54		-22.41		-18.62
			-1.45		-1.31		-1.31
Child Works			15.30		5.10		-0.24
			-1.70		-0.67		-0.03
Household Asset (High)			7.19		17.72		14.41
			-1.24		(3.64)**		(2.85)**
School Characteristics							
Private School			2.51		58.07		24.70
			-0.08		-1.86		-0.68
Primary School			-4.04		0.76		-10.82
			-0.39		-0.07		-1.01
Lower Secondary School			-12.80		-3.25		1.56
			-1.53		-0.42		-0.20
Middle Secondary School			14.98		18.75		16.77
			-1.27		-1.35		-1.14
School Infrastructure Index			5.70		2.34		3.90
			-1.38		-0.68		-0.99
Pupil-Teacher Ratio			0.42		0.137		0.17
			-1.69		-0.66		-0.69
Mid-Day Meal			4.95		-7.60		-2.17
			-0.57		-0.97		-0.25
Female Teachers (%)			20.38		29.08		28.67
			-0.96		-1.21		-1.18
Permanent Teachers (%)			-60.88		60.03		69.37
			-1.54		-1.59		-1.49
Teachers with Pre-Qualifications (%)			-20.67		-6.33		-34.91
			-0.40		-0.12		-0.82
Teachers with B.Ed/Tcert (%)			24.12		2.06		-68.57
			-0.48		-0.03		-1.14
Post-Graduate Teachers (%)			-115.02		-56.8		-124.69
			-1.92		-0.87		(2.10)*
Teachers with Experience of 6-12 Years			6.87		11.73		17.29
			-1.07		-1.62		(2.10)*
Teachers with 28+ Years Experience			-18.42		-21.95		-15.43
			-1.55		(2.19)*		-1.27

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Dzongkha Scores		English Scores		Math Scores	
School Fixed Effects	Yes	No	Yes	No	Yes	No
Dzongkhag Fixed Effects	No	Yes	No	Yes	No	Yes
SBIP Not Attended (%)		-27.81		-23.32		-22.84
		(2.29)*		-1.69		-1.57
Upgrade Training Completed (%)		21.28		34.28		37.67
		-1.39		(2.65)**		(2.48)*
Constant	538.10	641.30	488.30	532.01	520.9	402.24
	(2.39e+13)**	(5.85)**	(3.85e+12)**	(5.92)**	(6.99e+12)**	(4.58)**
Observations	1158	970	1158	970	1158	970
R-squared	0.26	0.20	0.45	0.34	0.31	0.23

Robust t statistics in parentheses. * significant at 5%; ** significant at 1%

Annex 3: Construction of the Household Asset and School Infrastructure Indices

The *household asset index* has been constructed on a fourteen point scale where the household gets 1 point for the presence of each of the following:

- Water
- Electricity
- Phone
- Computer
- Radio
- TV
- Refrigerator
- Animal
- Bicycle
- Motorcycle
- Tractor
- Car
- Clock
- VCR

The *school infrastructure index* has been constructed on a five point scale with a school getting 1 point for the presence of each of the following:

- Water
- Wall
- Electricity
- Playground
- Library