Primary Schooling, Student Learning, and School Quality in Rural Bangladesh

Mohammad Niaz Asadullah and Nazmul Chaudhury

Abstract

Using a primary school curricular standard basic mathematics competence test, this paper documents the low level of student achievement amongst 10-18 year old rural children in Bangladesh and tests the extent to which years spent in school increases learning. Our sample includes children currently enrolled in school as well as those out of school. About half of the children failed to pass the written competence test, a finding that also holds for those completing primary schooling. Even after holding constant a wide range of factors such as household income, parental characteristics, current enrollment status, and a direct measure of child ability, there remains a statistically significant correlation between schooling attained and basic mathematics competence above and beyond primary school completion. This pattern is more pronounced for girls who have lower competence compared to boys despite higher grade completion.

We further show that the schooling-learning gradient and the gender gap therein are not explained by common differences in family background. Aggregate institutional indicators of school quality matters for overall learning outcomes, however, does not mitigate against the gender gap. These findings have wide implications for anti-poverty policies that emphasize on quantitative expansion of education in developing countries, without concurrent improvements in learning.

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Primary Schooling, Student Learning, and School Quality in Rural Bangladesh

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Foreword by Lant Pritchett

The Center for Global Development is committed to the expansion of education as a key component of development. But while the focus on expanding education has been on the expansion of schooling the Center has been an early promoter of the pivot from an exclusive emphasis on schooling to greater emphasis on learning (see Filmer, Pritchett, and Hasan 2006). As part of that effort, CGD is publishing *The Rebirth of Education: Schooling ain't Learning* in September 2013. One of the key concepts in this book is a "learning profile" which is the association between years of schooling and mastery of skills. Unfortunately there are, as yet, very few empirical estimates of learning profiles as most assessments are done in school and for limited ranges of grades (or ages). This means that while we can examine how much 15 year olds can do from the PISA or what sixth graders can do from SACMEQ or what eighth graders can do from TIMSS these are static pictures and do not show the trajectory of learning over time as students progress through grades.

This present paper, by Mohammad Niaz Asadullah and Nazmul Chaudhury therefore makes an important contribution to the literature in a key area of CGD concern. Using a representative sample of 2400 households producing data on 3323 children aged 10 to 17 they assess ability to answer simple arithmetic question (either oral or written). The striking finding of their paper is just how little having completed an additional year of school increases the likelihood the child has mastered basic skills. Of children who had completed primary school (but no more) the percent who could get 3 or more of 4 questions correct on the oral assessment was only 56 percent for males and 42 percent for females. Even more striking is that regressions show the likelihood of getting 3 or more correct is only 9 percentage points higher for children with grade 5 complete than for children with no schooling at all. Taken at face value this suggests that five full years of primary school taught less than 1 in 10 children how to do simple math.

The accumulation of results like this is central to keeping the pressure on for a new set of development goals in education that focus on learning outcomes and particularly on early mastery of key literacy and numeracy skills.

Introduction

In recent years, many developing countries have succeeded in rapidly expanding the primary education system. Most governments in these countries however continue to maintain a single focus approach emphasizing on increasing school enrolment, with little attention to the question of quality of learning. This is justified by the fact that compared to developed countries where universal school attainment has been ensured up to secondary schooling, developing regions are still grappling with the challenge of universal provision of primary education. Moreover, it is argued that increased years of schooling embodies gains in human capital stock which in turn aid economic growth and reduce poverty. This is despite strong evidence from recent cross-country studies that the cognitive skills of the population, rather than mere school attainment, are powerfully related to long-run economic growth (Hanushek and Woessmann, 2007; Hanushek and Woessmann, 2010).

South Asia currently hosts a significant part of the world's out-of-school children and unsurprisingly, governments in this region largely focus on raising enrolment and school completion. However, within South Asia, Bangladesh has improved its position ahead of India and the region as a whole, in female primary and secondary enrolment rates (Mahmud, Asadullah and Savoia, 2013; Asadullah, Savoia and Mahmud, 2013). Even amongst 15-19 years old, primary school completion rate of girls in Bangladesh is not only significantly higher than boys, it is also higher than that for girls in India and Pakistan (Riboud, Yevgeniya and Hong; 2007). If time spent in school creates cognitive skills, then Bangladesh's recent progress promises reasons for hope and optimism. Given that the share of girls is greater than the share of boys in both primary and secondary schooling, this might also imply a "twin gender gap" to the extent female advantage in schooling translates into an advantage in cognitive skill.

Because of the lack of systematic and comparable survey data on school quality, the link between schooling and learning is seldom addressed in the developing country context. As internationally comparable test scores data covering both developed and developing countries are becoming available (e.g. surveys such as TIMSS, PIRLS and PISA), evidence is emerging on the relatively low level of learning in the latter (e.g. see Pritchett, 2004; Hanushek and Woessmann, 2008; Das and Zajonc, 2010). Alas, none of the existing international assessment exercises covers any South Asian country, given that no country in that region has expressed any interest to participate in international testing.[1] Furthermore, these international assessments neither aim to measure basic competence nor minimal learning achievement. In recent years, a number of studies have attempted to document the level of basic learning in South Asia (e.g. see Greaney, Khandker, and Alam, 1998; Das, Pandey, and Zanoj, 2012; Goyal, 2007a; 2007b; Das and Zajonc, 2010; Pandey, Goyal, and Sundararaman, 2010). However, beyond documenting the low levels of achievement, these studies do not explain the sources of low learning in terms of years spent in school.

The objective of this paper is to formally test whether years spent in school helps attain basic competence in the context of Bangladesh. We further test whether this translates into a skill gap in favour of girls given that girls in Bangladesh have more schooling compared to boys. The cross-sectional association between school completion and student achievement may suffer from omitted variable and sample selection biases, rather than being a causal relationship. To this end, we exploit new survey data on the performance of secondary school age children in an elementary test that was designed to assess basic competence in primary school standard mathematics. To avoid selection bias owing to early dropout from school and/or attendance of schools unrecognized by the state, the test was administered to

[1] There are some exceptions. For example, two States in Indian, Himachal Pradesh and Tamil Nadu, participated in PISA (Programme in International Student Assessment).

all children at home irrespective of their current schooling status. Furthermore, to minimize omitted variable bias, the effect of years of schooling on test outcome is examined with controls for a host of household and child specific controls including a direct measure of innate ability of children.[2]

A number of findings follow from our analysis. First, each year spent in school is positively correlated with test outcome. Second, there remains a statistically significant correlation between schooling attained and basic competence gained above and beyond primary school completion. In particular, we find a linear pattern of increase in the probability to pass the primary standard tests with respect to each year of schooling up to grade 8. Third, achieving primary level competency requires further secondary schooling, and this is more pronounced for girls. The latter observation is consistent with the finding that girls have lower maths scores than boys despite their advantage in school completion.

The above findings are striking considering the fact that majority of the children in our sample completed at least primary school. Depending on the assessment tool used, 38% to 48% amongst these children failed to achieve basic competence in mathematics, requiring additional schooling beyond primary grades to equalize pass rate across children. Overall, our findings highlight the inefficiency in educational production in developing countries and lend support to the extant literature on the superiority of cognitive skills as a proxy of human capital (e.g. see Behrman, and Birdsall, 1983; Pritchett, 2001; Filmer, Hasan, and Pritchett, 2006; Pritchett, 2004; Hanushek and Woessmann, 2007; Hanushek, Jamison, Jamison, and Woessmann, 2008; Hanushek and Woessmann, 2010).

The rest of the paper is organized as follows. Section 2 explains the study context and presents some basic facts about the Bangladeshi education system. Section 3 describes the data used. Section 4 presents the results whilst our conclusions are made in section 5.

Background

School participation in Bangladesh

Bangladesh has seen a significant improvement in primary school participation[3] in the last two decades (Government of Bangladesh, 2011). Public expenditure on primary education as a percentage of total public expenditure on education has gone up to 45% (in 2010) from 37% (in 2005). According to Annual School Census (ASC) records on all government and non-government formal primary schools, gross enrolment rate is currently over 100. Under the second Primary Education Development Programme (PEDP), the government undertook a wide range of supply-side initiatives that led to improved access to and greater participation in primary education. Between 2005 and 2010, gross (net) enrolment rate

[2] One developing country study with ability data on all children is Akresh, Bagby, de Walque and Kazianga (2012). However, the authors did not test children in terms of cognitive outcomes.

[3] Primary education in Bangladesh spans grades 1 to 5 while secondary education spans grades 6 to 10.

increased from 93.7% (87%) to 103.5% (94%). Whilst drop out still remains an issue, it is not very high amongst children who complete primary schooling. Overall, 97.5% children who complete primary schooling upon passing the terminal examination enrol in grade 6 (Government of Bangladesh, 2011). However, this does not imply that primary school completion rate is nearing 100% in Bangladesh. The exact situation is unclear in the absence of reliable data. When assessed in terms of administrative data on children who were enrolled in primary schools in 2010, completion rate is between 58%-60%. However, the completion rate is much higher when calculated using household survey data.[4] Overall, not only gender parity has been reached in enrolment, girls in Bangladesh also enjoy higher completion rate in primary schooling. These improvements in school participation have been accompanied by significant changes in the overall schooling environment. For instance, student absenteeism rate has dropped from 23 to 16 while student-teacher ratio (STR) has also improved (from 54 in 2005 to 47 in 2010). Whether these improvements have translated into gains in learning however remains unknown. Whilst primary school (grade 5) terminal examination pass rate is high, assessment of student performance in the National Student Assessment (NSA) sample survey 2008 indicates that basic competence achieved remains low[5] and is particularly so amongst girls.

School participation has also increased at the secondary level. In particular, female secondary schooling has experienced significant growth in Bangladesh following introduction of the Female Secondary School Assistance Program (FSSAP) in the early 1990s. Under the program, stipends were given to girls irrespective of household wealth conditional upon enrolment in secondary school. The program has been associated with an exponential increase in female schooling, reversing the gender-gap in secondary education in less than a decade and across all income groups (Khandker, Pitt and Fuwa, 2003; Asadullah and Chaudhury, 2009). Despite these gains in school participation and access, however, the rate of completion of secondary school cycle remains low for both boys and girls. Moreover, low quality of learning remains a major pitfall that undermines any endeavour to increase enrollment.

School attendance and student achievement

Recent evaluation reveals that the level of student learning in school is low in rural areas and it is particularly so for girls. For instance, Nath, Mohsin and Chowdhury (1997) tested a large sample of 11-12 years old rural children in a total of 13 mathematics questions. Only 28.7 per cent of the children could answer all the question items correctly, and on average the interviewed children answered only nine items correctly. Moreover, boys always had a higher score than girls. These figures indicate that the overall performance of the children in

[4] As per 2009 UNICEF Multiple Cluster Indicator Survey (MICS), 76.4% children of 15 years old completed primary schooling and the rate is even higher for girls (82.5%).

[5] For instance, the percentages of students who mastered all learning outcome categories by subject were 13.7% for Grade 5 Bangla and 3.1% for Grade 5 Maths (Government of Bangladesh, 2011).

arithmetic education was not satisfactory. These findings are confirmed by more recent evaluation of gender-wise student learning outcomes across various types of primary schools. For instance, the 2008 Education Watch CAMPE survey tested more than 7,000 Grade 5 students in 440 schools and found that (a) there has been a small improvement in the mean number of competencies achieved compared to earlier assessment carried out in 2000 using the same instrument and (b) girls systematically underperform across all school types (Government of Bangladesh, 2011).

The level of learning is also very low in secondary grades as well. Two recent studies measured learning using student answers to publicly released mathematics questions from an international testing agency (Asadullah, Chaudhury and Dar, 2007; World Bank, 2010). The percentage of correct answers ranged between 36% and 38% - this is only marginally better than the scores that would have obtained through random guesswork. Given that students were given a choice of 4 answers for each question, random guessing would have yielded 25% correct on average.

Researchers are also gathering similar evidence on the low level of student achievement for other South Asian countries. Das and Zajonc (2010) focused on secondary school students from two Indian states--Orissa and Rajasthan. When compared in terms of performance in an international test in mathematics, these two states fall below 43 of the 51 countries for which data exist. The bottom 5% of Indian children rank higher than the bottom 5% in only three countries--South Africa, Ghana and Saudi Arabia. On the other hand, Das, Pandey, and Zajonc (2012) tested primary school children (at the end of the third grade) in Pakistan and found absolute learning to be low compared with curricular standards and international norms. A striking finding is that only 31 percent of the sample children could correctly form a sentence with the word "school" in the vernacular (Urdu). Based on an additional school based sample, the authors also report similar evidence of low achievement for the state of Uttar Pradesh in India. The poor quality of schooling and flat grade-learning profile has been amply documented in the rigorous multi-year sample studies from the Indian State of Andhra Pradesh.[6]

The above studies together confirm that absolute learning in South Asian schools is low compared with curricular standards and/or international norms. This conclusion is consistent with emerging evidence for other developing regions. In their comprehensive review of learning achievement in developing countries, Hanushek and Woessmann (2008) note that in many developing countries, the share of any cohort that completes lower secondary education and passes at least a low benchmark of basic literacy in cognitive skills is below one person in ten. This view is also supported by Filmer, Hasan, and Pritchett (2006) – they show that even in countries meeting the Millennium Development Goal (MDG) of primary completion, the majority of youth are not reaching even minimal

[6] Andhra Pradesh Randomized Evaluation Studies (APRES) included a series of innovate randomized studies in the education sector by researchers Karthik Muralidharan and Venkatesh Sundararaman, in partnership with the State official of Andhra Pradesh and the Azim Premji Foundation.

competency levels. For instance, even though Brazil is on track to the meet the MDG, 78 percent of Brazilian youth lack minimally adequate competencies in mathematics and 96 percent do not reach what Filmer, Hasan, and Pritchett consider as a reasonable global standard of adequacy. Pritchett (2004) also documents extremely low educational performance of children in a sample of developing countries. In the absence of actual measure of basic competence, Pritchett uses achievement deficit as students being more than 1 standard deviation below the median OECD country. Using this as a proxy for basic competencies, Pritchett points out that in two Asian countries, Philippines and Indonesia, between 48% and 71% children complete grade 9 without adequate learning achievement. In other words, the education deficits in developing countries seem even larger than generally appreciated once actual cognitive skill acquired for a given level of education is taken into account. According to Hanushek (2009), focus on school attainment goals without close attention to school quality might even have hurt developing countries.

In general, studies assessing basic competence are rare for developing countries. An exception is Greaney et al. (1998). According to Greaney et al., the majority of those who had completed primary schooling in Bangladesh failed to attain minimum standard in four basic skill areas: reading, writing, written mathematics and oral mathematics. Slightly over one-third of those who had just completed primary school achieved the minimum competency level in all four basic skill areas. The level of competency in basic mathematics skills was particularly low, even when focusing on graduates of primary school enrolled in secondary schools.

Precisely why learning level is low despite years spent in school is unclear. There is a paucity of studies from the developing world that explicitly examine the link between time spent in school and learning outcomes.[7] It is generally believed that children in higher grades enjoy higher levels of achievement. Therefore it's puzzling that school children in developing countries continue to perform poorly in cognitive tests even when enrolled in higher grades. A number of explanations are available for the weak correlation between years spent in school and student achievement. First, schools in many developing countries maintain a lenient grade promotion policy to ensure high grade retention rates. It is assumed that the promotion of children with lower achievement does not hamper their ability to perform at

[7] For instance, Bedi and Marshall (1999) discuss the link between school attendance and test scores in Honduras. In particular, they report that an increase in school attendance by 5 days increases grade 2 mathematics and Spanish test scores by about 1.5 points. On the other hand, Bedi and Marshall (2002) examine the influence of test scores on school attendance in Honduras. They find that increases in the expected benefits of attending school (measured in terms of test score and obtained from the production function estimates) exert a strong impact on the school attendance decision. Gottfried (2010) examined the impact of days a student was present in school on learning outcomes in the US. The author finds positive and statistically significant relationships between student attendance and academic achievement for both elementary and middle school students. Pritchett and Beatty (2012) highlight the negative dynamics of overambitious curriculum using data from South Asia and Africa.

the next level.[8] Second, low achievement despite high level of school participation could be the outcome of yet another policy choice. In many developing countries including Bangladesh, the conditional cash transfer programs and other poverty-targeted interventions have attracted more children to schools, particularly from poor families. Inclusion of these children from disadvantaged backgrounds may create a downward pressure on average learning outcomes. Indeed, the Bono de Desarrollo Humano of Ecuador has been found to impact enrolment positively. Yet, in their evaluation of the cash transfer program, Bedi and Ponce (2009) find that there is no impact of the program on test scores. Similarly, Filmer and Schady (2009) evaluate a scholarship program in Cambodia. They find that the program had a large effect on school enrollment and attendance. However, there was no evidence that, 18 months after the scholarships were awarded, recipient children did any better on mathematics and vocabulary tests than they would have in the absence of the program.[9] Third, low achievement could reflect poor school quality. With the influx of new students, classrooms may become too crowded thereby negatively influencing learning outcomes (as suggested by Filmer and Schady, 2009, albeit without any strong causal impact on lowering learning outcomes).

In this paper, we revisit the debate on school attendance and student learning by exploiting a unique dataset from Bangladesh. Our study adds to the growing international evidence highlighting importance of the level and distribution of cognitive skills for economic development rather than absolute measures of schooling attainment. We test whether completion of primary schooling is sufficient to achieve basic competence in mathematics in rural Bangladesh, controlling for a number of factors that are usually omitted in educational production function analysis using developing country data, namely, innate ability of the child and household income. Moreover, we avoid sample selection bias by administering the test to school dropouts as well. Lastly, we field both verbal and written tests to assess basic competency. This is because at least 50% of our sample comprise of girls for whom response categories labelled numerically but not verbally could be less attractive.[10] These features of our study help capture causal effect of schooling on basic competence. The next section elaborates on the data and the survey design.

[8] However, King, Orazem and Paterno (2008) in their study of a sample of schools from the Northwest Frontier Province (NWFP) of Pakistan find that students are promoted primarily on the basis of merit – this study is more of an exception.

[9] Anyway, cash transfer programs are not designed improve learning outcomes, they are designed to improve quality of schooling, and there is no evidence to date that these programs have actually lead to lowering average learning outcomes.

[10] This gender-biased labelling hypothesis is consistent with the gender differences commonly found in results of cognitive tests focusing on quantitative and verbal skills, with test scores skewed toward the former for men and the latter for women (Halpern, 2000).

Data

A specifically designed large education institution and household based sample survey, "Quality of Secondary School Madrassah Education in Bangladesh" (QSSMEB) was initiated by the World Bank in 2008 to primarily address the quality of education in public-aided secondary (non-religious) schools and madrassahs (Islamic schools). The survey was designed by the authors. We randomly selected 12 districts from 6 divisions (highest administrative unit in Bangladesh). The probability proportional to size (PPS) method of random sampling was used, based on division/district level secondary school going age population data from the 2001 national population census. Two Upazilas (sub-districts) were randomly selected using PPS from each of the selected 12 districts. Then 2 unions were randomly selected with PPS from each of the selected 24 Upazilas. Again, the population weight was union level population data from the 2001 national population census.

In each union, a census of all pre-primary, primary, and secondary education institutions was carried out.[11] In addition, the survey had a detailed companion household component. For each of the 48 sample Unions, we randomly selected 2 villages using PPS based on village-level population data from the 2001 national census. A complete census of all households was carried out in each sample village. From the census, 25 households that have at least one school-aged child (aged 6–18 years) regardless of current enrolment status, was randomly selected from each village. In each sample household, 2 randomly selected secondary school aged children were given a battery of cognitive tests. This led to a sample of 3,236 children belonging to 2,400 households.[12]

Since one of our objectives was to ascertain the level of basic learning in rural communities, we fielded a unique test at the household level. Instead of using an arbitrary definition of minimal achievement, our test instrument comprised of 8 questions that were specifically designed to assess basic competence in Bangladesh and originally developed by Greaney et al. (1998).[13] The first set of four questions was used to test oral competency in mathematics while the second set of 4 questions assessed written competency in mathematics. Because these questions are based on primary school curriculum, they only assess basic competency in rudimentary mathematics (see Appendix Table 1 for details). Therefore, the mathematics test instrument is fully comparable to previous studies on school quality conducted in Bangladesh. To be precise, the same instrument was used previously to assess basic

[11] The school survey component of the QSSMEB project is not used directly in this paper; it is the basis of a companion paper on secondary school quality in rural Bangladesh.

[12] This excludes 108 eligible children who were either absent from the household during the field test or declined to take part in the test. After ignoring cases with missing data on background characteristics, final analytical sample has 3219 children.

[13] Greaney et al. developed a basic test of learning skills in reading, writing, written mathematics and oral mathematics and administered it to a sample of 5235 individuals, aged 11 years or older, in 1992 in 29 (rural) thanas. The four questions included in our test were full adaption of 4 written maths (level 3) questions used in Greaney et al. (1998). In addition to these four questions answered by all students, we also tested a sub-sample of students on an additional set of four questions, once again previously used in Greaney et al. (1998).

competency amongst the adult population in Bangladesh by Greaney et al. in 1992. However, we depart from Greaney et al. by additionally giving sample children the Raven's colored progressive matrix test, a proxy for innate ability or cognitive capacity of the child.[14]

In our dataset, 63% of children aged between 10 and 18 years have completed at least primary schooling.[15] For testing purpose, we focused on children aged 10-18 years old irrespective of their schooling status. Overall, 75% of the children tested where in school at the time of the survey. In general, girls are more likely to be currently enrolled in school (75%) than boys (71%). More girls (67%) in our sample are reported to have completed primary schooling than boys (58%).[16] Our main findings are discussed in the next section.

Results

Schooling-learning profile by gender

Appendix Table 1 reports detailed item wise breakdown of scores in oral and written tests. The rudimentary nature of the test is evident if we look at some of the individual test questions. For instance, the first question of the oral section is: "Suppose you went to the market taking two Tk. 100 note and ten Tk. 5 note. So what is the total amount of money that you took with you to the market?" Only 68% of the sample children could correctly answer this question. Similarly, the 3rd question asks: "You went to the market to buy a hen taking Tk. 250. The price of each chicken is 60 takas. How many chickens can you buy and what amount will remain with you after the purchase?" Only 46% students could correctly answer this question.

There are 3 main patterns that stand out from our descriptive analysis of the raw data. First, the overall level of basic competence is very low: on average, only 43% (52%) of the children attained basic competence in oral (written) mathematics. The proportion failing the written competency test is 52% amongst children completing only primary school compared to 68% amongst those who had less than primary education. Given that these tests are designed to assess rudimentary mathematics skill (taught at the primary level), they highlight very low level of achievement in rural Bangladesh.

Second, grade (or year of schooling completed) wise analysis of pass rate also shows clear learning gains for an additional year of schooling at every level of education up to grade 10.

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[14] Sample children also took a short test in Islam studies and general knowledge. This was in keeping with the general focus of the survey on Islamic faith schools.

[15] Because we focus on rural areas and a younger cohort, our figure is slightly lower than the national average for individuals aged 15 years or above -- estimate obtained from nationally representative household survey data suggests that 70% of children have completed at least primary school (see Riboud, Yevgeniya and Hong, 2007).

[16] This is consistent with extant studies on gender gap in school completion and enrolment in Bangladesh that use several rounds of nationally representative household survey data (e.g. see Asadullah and Chaudhury, 2009).

Those with "no schooling' achieves 22.9 percent correct on the written test while those with "primary schooling completed" get 54.5 percent right (see **Table 1**). This implies that five years of primary education only raises the percent correct by 31.6 percentage points or 6.3 when averaged over the five years (the figure is even lower, 3.6 percent, in case of oral maths). This is because, a large number of children with significant schooling experience fail the cognitive test. The average child who failed the test had spent 4.3 years in school. At the same time, there is an absence of a sizable jump in the schooling-learning relationship at five years of primary schooling. Amongst children who have completed primary schooling, 62% (52%) fail in oral (written) test.[17] Completion of secondary schooling however leads to nearly doubling of the pass rate. This implies that whilst positive, the relationship between gains in test scores and years of schooling is less than ideal.

Table 1: Mean score in oral and written maths test by years of schooling and gender

		Male		Female		Total	
	Level of schooling	% of total answers being correct	At least 3 answers being correct	% of total answers being correct	At least 3 answers being correct	% of total answers being correct	At least 3 answers being correct
Oral maths	No schooling	41.31	0.21	14.29	0.04	32.81	0.16
	Some primary schooling	49.66	0.35	38.52	0.22	44.46	0.29
	Primary schooling completed	58.62	0.46	43.04	0.29	50.95	0.38
	Some secondary schooling	73.93	0.68	60.87	0.49	66.35	0.57
	Secondary schooling completed	81.60	0.82	80.36	0.76	80.95	0.79
	Total	60.83	0.50	50.71	0.37	55.61	0.43
Written maths	No schooling	26.23	0.13	13.39	0.04	22.19	0.10
	Some primary schooling	47.35	0.37	38.96	0.31	43.44	0.34
	Primary schooling completed	62.05	0.56	46.88	0.40	54.58	0.48
	Some secondary schooling	78.11	0.79	65.84	0.61	70.99	0.69
	Secondary schooling completed	84.00	0.86	81.36	0.89	82.62	0.88
	Total	61.63	0.56	53.86	0.48	57.62	0.52
	Observations	1557		1662		3219	

[17] These figures are consistent with the competency level amongst grade 5 and 6 completers reported by Greaney et al. (1998) which according to the authors was 40% and 50% respectively.

Third, if school completion leads to skill formation, this combined with reverse gender disparity in enrolment and completion data would suggest a gender gap in cognitive skill. On average, girls have 0.6 years of extra schooling compared to an average boy in our sample and 10 percentage points more probability of completing primary education. Irrespective of the test type and individual test question used, however, girls systematically score below boys. Girls have 13 (8) percentage points less probability of passing the oral (written) test than boys.[18] Boys have higher scores than girls at every level of education. To be precise, gender gap in mathematics competence exists at the beginning of primary education cycle and prevails throughout. This is despite the fact that girls on average have completed more years of schooling and have a higher current enrolment rate than boys in rural areas.[19] However, there is convergence over the schooling cycle between boys and girls, conditional upon secondary school completion.

In sum, the above discussion highlights two puzzles in our data. First, our raw data suggests a clear positive correlation between years spent in school and levels of maths scores. Yet, despite advantage over boys in terms of years spent in school, girls in our sample have lower maths scores. Second, despite primary school completion, for a significant fraction of our sample children, it requires extra years of education beyond primary schooling to attain basic competency in maths. Instead of being a step-function, the relationship between pass rate and years spent in school is characterized by a continuous, positively sloped function. There are significant jumps in the pass rate for an extra grade completed even beyond grade 5 (i.e. primary schooling).

In section 3, we discussed a number of possible explanations for why some children take extra years of education beyond primary schooling to attain basic competencies. First, recent educational expansion in Bangladesh may have paved the way for school participation of children from poor families and it is children from poor families in higher grades who may be disproportionately failing in the test. The educational expansion may also have attracted first generation learners where the child's parents are illiterate. Second, these marginal children may have lower cognitive capacity to begin with. Third, a significant fraction of these children may constitute school drop-outs who were not enrolled in school at the time of field. Similarly, the explanation for the puzzle of lower cognitive skill of girls despite having more education than boys may lie in (a) household poverty, (b) greater representation of girls from poor families in our sample, (c) gender difference in ability. Therefore, in the next section, we assess whether (i) the gender penalty in learning, and (ii) the correlation between pass probability and schooling beyond primary education, remains even after

[18] The dismal state of learning reported here is consistent with previous institution based assessment exercise of students enrolled in secondary schools (e.g. 2008 Education Watch of CAMPE).

[19] Gender gap in maths is not common to Bangladeshi primary schools. Dickerson et al. (2013) document significant differences in maths test scores in favour of boys in 19 African countries. Two datasets are used: the PASEC dataset includes children in Grade 2 and Grade 5 whilst SACMEQ includes children in grade 6. Since grade-specific samples are used, the study does not examine the schooling-learning profile by gender.

controlling for household expenditure, parental education, cognitive capacity, age and current enrolment status of the child.

What can explain the puzzle of low achievement and twin gender gaps?

Notwithstanding the policy implication of our finding, we revisit the negative association between gender and basic cognitive achievement despite gender advantage in school completion in a regression framework. We report Probit regression estimates of determinants of basic competence in maths skill where control variables include the child's age, gender, current enrolment status and individual dummies for the highest grade completed. To net out the influence of community specific factors (including average quality of schools in a village), we control for village dummies.

Results are reported in **Table 2** using oral and written mathematics pass rate as the dependent variable. Apart from estimates for the full sample, the Tables also report estimates for gender-specific sub-samples. **Appendix Tables 2** reports results from a slightly different specification where we replace the grade-specific schooling dummies by a set of dummies corresponding to different levels of schooling. A number of findings follow from Table 2. First, it requires completion of middle-school (i.e. grade 8 equivalent) to close gaps in primary-standard mathematics skills across children. Second, even after controlling for the child's age, years of schooling, current enrolment status and family background, girls have a significant lower probability of acquiring basic competence. Third, some of the children requiring additional years of schooling could be those drawn from the bottom of the ability distribution. However, our results are robust to controlling for cognitive ability (as captured by Raven's scores). In other words, additional control for innate cognitive capacity does not explain away the influence of schooling (beyond primary education) on the probability of correctly answering the test question.[20]

In order to work out gains in learning per year of schooling, we repeated regression model on written test score using a continuous dependent variable on the pooled sample using the full specification (results not reported). The estimated coefficient on no schooling dummy was -40.07 (over base category of 9 years of schooling or above). This implies that children on average increase their written maths scores (i.e. percent correct) by 4 percentage points each year. Without controlling for child attributes, parental characteristics and Raven's scores, the figure increases to 6.4 percentage points per year (see Table 1).

[20] Falch and Massih (2011) note that **schooling increases intelligence quotient. For US data, their ordinary least squares estimates indicate that 1 year of schooling increases IQ by 2.9–3.5 points (about 0.2** *standard* **deviations)**. Therefore, if our ability measure (i.e. Raven's score) is entirely determined by years of schooling, then this should not have any independent impact on test outcome.

Table 2: Determinants of basic competence in mathematics, Probit regression

	Oral maths						Written maths					
	Pooled		Male		Female		Pooled		Male		Female	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Female++	-0.19	-0.162					-0.162	-0.132				
	(9.87)**	(8.21)**					(8.08)**	(6.42)**				
Age (in years)	-0.014	-0.013	-0.016	-0.03	-0.025	-0.016	-0.071	-0.074	0.074	0.079	-0.195	-0.21
	(0.22)	(0.20)	(0.16)	(0.30)	(0.27)	(0.17)	(1.06)	(1.07)	(0.76)	(0.80)	(1.97)*	(2.08)*
Age, squared	0.05	0.053	0.024	0.075	0.126	0.096	0.184	0.189	-0.336	-0.36	0.619	0.671
	(0.22)	(0.23)	(0.07)	(0.22)	(0.39)	(0.30)	(0.78)	(0.79)	(1.01)	(1.05)	(1.80)+	(1.91)+
Father's schooling (years completed)	0.002	0.002	0.004	0.004	0.001	0.002	0	0.001	0	0	0	0.001
	(0.48)	(0.50)	(0.59)	(0.55)	(0.11)	(0.36)	(0.11)	(0.14)	(0.06)	(0.06)	(0.07)	(0.24)
Mother's schooling (years completed)	-0.001	-0.002	0	-0.002	-0.001	-0.003	-0.004	-0.005	-0.006	-0.008	0	-0.002
	(0.17)	(0.52)	(0.06)	(0.33)	(0.17)	(0.52)	(0.89)	(1.27)	(1.00)	(1.24)	(0.02)	(0.37)
Monthly per capita household expenditure	0.081	0.051	0.057	0.016	0.094	0.074	0.149	0.125	0.164	0.135	0.128	0.111
	(3.26)**	(2.04)*	(1.52)	(0.42)	(2.81)**	(2.16)*	(5.82)**	(4.81)**	(4.20)**	(3.42)**	(3.57)**	(3.04)**
No schooling++	-0.371	-0.335	-0.455	-0.416	-0.336	-0.324	-0.513	-0.497	-0.555	-0.532	-0.477	-0.471
	(6.47)**	(5.32)**	(5.55)**	(4.63)**	(3.40)**	(3.03)**	(8.48)**	(7.51)**	(6.23)**	(5.55)**	(4.52)**	(4.09)**
Schooling: Grade 1 completed++	-0.392	-0.349	-0.483	-0.443	-0.313	-0.27	-0.506	-0.475	-0.556	-0.521	-0.462	-0.441
	(8.01)**	(6.34)**	(6.71)**	(5.45)**	(4.26)**	(3.26)**	(10.04)**	(8.39)**	(7.20)**	(6.11)**	(6.36)**	(5.34)**
Schooling: Grade 2 completed++	-0.378	-0.334	-0.469	-0.414	-0.301	-0.275	-0.508	-0.479	-0.592	-0.565	-0.448	-0.425
	(8.92)**	(7.13)**	(7.17)**	(5.64)**	(5.02)**	(4.24)**	(11.65)**	(10.00)**	(8.92)**	(7.76)**	(7.41)**	(6.45)**
Schooling: Grade 3 completed++	-0.347	-0.287	-0.441	-0.385	-0.285	-0.227	-0.511	-0.466	-0.548	-0.504	-0.49	-0.451
	(8.51)**	(6.43)**	(6.76)**	(5.44)**	(5.23)**	(3.77)**	(12.22)**	(10.24)**	(7.94)**	(6.86)**	(9.17)**	(7.59)**
Schooling: Grade 4 completed++	-0.314	-0.262	-0.418	-0.358	-0.239	-0.199	-0.386	-0.332	-0.44	-0.381	-0.371	-0.326
	(8.00)**	(6.26)**	(6.51)**	(5.16)**	(4.57)**	(3.63)**	(8.84)**	(7.17)**	(6.09)**	(4.98)**	(6.47)**	(5.36)**
Schooling: Grade 5 completed++	-0.278	-0.22	-0.366	-0.309	-0.214	-0.159	-0.352	-0.292	-0.365	-0.308	-0.36	-0.298
	(7.41)**	(5.54)**	(5.82)**	(4.65)**	(4.38)**	(3.07)**	(8.49)**	(6.69)**	(5.24)**	(4.25)**	(6.70)**	(5.21)**
Schooling: Grade 6 completed++	-0.215	-0.171	-0.299	-0.25	-0.151	-0.115	-0.285	-0.241	-0.307	-0.26	-0.279	-0.238
	(5.44)**	(4.14)**	(4.41)**	(3.52)**	(2.97)**	(2.18)*	(6.53)**	(5.30)**	(4.05)**	(3.33)**	(4.97)**	(4.04)**

Schooling: Grade 7 completed++	-0.143	-0.117	-0.2	-0.189	-0.095	-0.06	-0.177	-0.147	-0.139	-0.132	-0.22	-0.174
	(3.58)**	(2.84)**	(2.96)**	(2.73)**	(1.86)+	(1.14)	(3.96)**	(3.20)**	(1.82)+	(1.72)+	(3.89)**	(2.96)**
Schooling: Grade 8 completed++	-0.098	-0.067	-0.145	-0.115	-0.058	-0.03	-0.13	-0.096	-0.103	-0.068	-0.153	-0.115
	(2.39)*	(1.59)	(2.08)*	(1.59)	(1.12)	(0.57)	(2.86)**	(2.05)*	(1.34)	(0.87)	(2.64)**	(1.92)+
Currently enrolled in school++	0.062	0.037	0.057	0.038	0.072	0.042	0.111	0.084	0.096	0.077	0.128	0.094
	(2.25)*	(1.32)	(1.37)	(0.88)	(1.88)+	(1.07)	(3.88)**	(2.90)**	(2.26)*	(1.79)+	(3.11)**	(2.20)*
Raven's score		0.047		0.051		0.043		0.049		0.044		0.054
		(11.49)**		(8.26)**		(7.64)**		(11.67)**		(7.09)**		(8.88)**
Observations	3219	3219	1557	1557	1662	1662	3219	3219	1557	1557	1662	1662
Pseudo R^2	0.15	0.19	0.18	0.22	0.16	0.19	0.2	0.23	0.25	0.28	0.19	0.23
Village dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (a) ++ indicates dummy variables; (b) base category for schooling dummies is grade 9 or above; (c) coefficients reported as marginal effects. (d) + significant at 10%; * significant at 5%; ** significant at 1%.

Additional robustness tests

Our finding that girls perform less satisfactorily than boys in mathematics is consistent with the international literature which report girls to be weaker in mathematics but outperform boys in language skills. Nonetheless, given the rudimentary nature of our tests, persistence of the gender gap even after holding a wide range of controls remains a puzzle. In this connection, there may be important non-schooling explanations for why girls underperform in our study.

First, the advantage of boys over girls in mathematics skill may be partly explained by gender differences in socialization in rural areas. Due to restriction on mobility of females, boys may be more exposed to market activities than girls (in the context of rural Bangladesh, boys are more likely to be sent to local markets compared to girls). In other words, there may exist a gender gap in market transaction experience – such experience can potentially improve basic numeracy skills. This gender difference in non-schooling activities may then lead to gender difference in basic mathematics skill. If true, however, this should be more influential on explaining gender gap in oral maths (instead of written) scores. Nonetheless, we further tested this proposition by including a variable – household's distance to the nearest market – in the regression model. If the above hypothesis is correct, proximity to market will be significant for boys but not for girls and that too for oral test only. However, our finding on the correlation between schooling attained and test outcome remains unchanged even after control for market access (results available upon request).

Second, another non-schooling explanation for the gender difference may lie in the environment in which the test was conducted. Children from large households may have faced additional difficulties when taking the test and girls may have suffered disproportionately than boys. To this end, we experimented by including household size in the regression model. Once again, our results remained robust to inclusion of household size as an additional control variable (results not reported but available from the authors upon request).

Third, a majority of our enumerators were males which may adversely affect performance of females. Girls may under-perform because they are less comfortable with participation in cognitive tests in presence of enumerators of opposite gender. If true, this should affect performance in the oral test more than the written test. Once again, we test this for this possibility by including a gender dummy for the enumerator in our regression model. However, coefficient on the enumerator gender dummy turns out to be insignificant (results not reported but available from the authors upon request).

Low achievement and school quality: How much can be explained?

Since low achievement cannot be explained in terms of household and child characteristics, it can be attributed to low quality of schools in rural areas. Existing reviews of the developing country literature attribute poor quality to a variety of factors such as untrained teachers, larger class size, the lack of teacher accountability and so on (e.g. see Glewwe, 2002; Glewee and Kremer, 2005). Indeed, children in our sample attend a variety of primary schools which differ considerably in terms of management type, faith orientation, ownership status and conventional correlates of education quality.

Because of concerns over selection effects, we have not explicitly taken into account the influence of school type in explaining gaps in cognitive skills across children in our sample. Broadly speaking, children can attend a madrassah (with or without public support/recognition), an NGO-run non-formal school, a formal recognized government or public-aided non-government school. A unique feature of QSSEMB is its focus on Islamic faith schools. A significant proportion of test participants in our study are educated in madrassas (at the secondary school level in particular). Of all these school types, the common perception is that education quality is poorest in madrassah. These religious schools are staffed by untrained teachers and emphasise rote learning. However, quality of public and public-aided schools is also questionable (e.g., teacher absenteeism is a serious problem Chaudhury et al, 2006). Classrooms in these schools are also overcrowded. **Appendix Table 3** reports competence in oral and written mathematics by school type for the full sample as well as the sample of children who have at least completed primary schooling. Among children who have completed some secondary education, the largest fraction of competent children is found to attend government schools followed by non-government schools. Children who are educated in madrassahs perform worse. Even within the madrassah sample, there is considerable heterogeneity. Students of unrecognized unregistered madrassahs perform significantly worse than those educated in government recognized and supported (Aliyah) madrassahs.

The poor state of learning in traditional madrassahs is also evident if we focus on children who are currently enrolled in primary school or have only completed primary grades. In oral (written) test for instance, only 18% (24%) children of Quomi madrassahs (which do not receive government support/recognition) passed in comparison to 30% (31%) children educated in non-formal NGO (i.e. BRAC) schools. However, learning deficit of traditional primary madrassah students is relatively small if compared to students of government primary schools. Only 28% (33%) of children attending government primary schools passed the oral (written) math test.

If data presented in **Appendix Table 3** suggest causal relationship, it implies that the institutional dimension of basic skill formation in rural Bangladesh needs to be better understood. At the primary level, government (publicly financed and delivered) schools are a majority. Yet they do not provide children with a significant learning advantage over state-recognized madrassahs. On the other hand, public school attendance during primary schooling is associated with a learning advantage at the secondary level over recognized as well as unrecognized madrassahs. However, this gap is not large. Besides, public schools constitute a very small share of total secondary educational institutions in the country. The major provider at the secondary is recognized non-governmental schools where 58% (69%) children passed the oral (written) test. This is suggestive of 7 (8) percentage points advantage over recognized madrassahs. However, given the rudimentary nature of the test, these gaps are not large. We formally tested significance of the learning disadvantage associated with different school types by repeating the regression analysis where controls for primary school type attended is included. The coefficients on madrassah dummies are never significant which is unsurprising given the low level of learning across school types (results not reported but available from the authors upon request).

The QSSMEB study included a short census of primary schools in the survey cluster (i.e. union). Therefore, it was possible to examine the quality of schools attended by our sample children in terms of conventional indicators such as student-teacher ratio, teacher training. **Appendix Table 4** uses census data to describe profile of an average primary school in the study area. 15% of the schools are of religious type (i.e. being some type of madrassah). Therefore, we also provide a breakdown of quality indicators by non-religious and religious type. Compared to differences in learning outcomes reported in Appendix Table 3, there are large gaps in educational inputs across schools and madrassahs. Average student-teacher ratio is much bigger in non-religious school sample. Schools on the other hand have more trained teachers and female teachers – only 5% madrasa teachers have formal training compared to over 50% school teachers. In terms of two other indicators, "time spent in disciplining students" and "fraction of teachers absent", there is no difference.

Table 3: Determinants of basic competence in mathematics with control for school quality, Probit regressions

	Oral maths		Written maths	
	(1)	(2)	(1)	(2)
Female++	-0.154	-0.156	-0.131	-0.131
	(8.14)**	(7.42)**	(6.63)**	(7.13)**
Age	-0.043	-0.033	-0.082	-0.077
	(0.68)	(0.50)	(1.23)	(1.10)
Age, squared	0.145	0.115	0.222	0.202
	(0.66)	(0.52)	(0.96)	(0.84)
Father's schooling (years completed)	0.005	0.004	0.003	0.003
	(1.22)	(0.90)	(0.68)	(0.58)
Mother's schooling (years completed)	-0.005	-0.004	-0.007	-0.006
	(1.32)	(0.90)	(1.89)+	(1.48)
Monthly per capita household expenditure	0.042	0.052	0.115	0.12
	(1.85)+	(2.06)*	(4.74)**	(5.09)**
No schooling++	-0.354	-0.339	-0.493	-0.494
	(6.22)**	(5.51)**	(8.22)**	(6.38)**
Schooling: Grade 1 completed++	-0.347	-0.338	-0.468	-0.468
	(6.24)**	(6.83)**	(8.26)**	(7.63)**
Schooling: Grade 2 completed++	-0.346	-0.336	-0.47	-0.471
	(8.04)**	(7.81)**	(10.33)**	(8.48)**
Schooling: Grade 3 completed++	-0.31	-0.299	-0.466	-0.465
	(7.40)**	(6.97)**	(10.68)**	(8.46)**
Schooling: Grade 4 completed++	-0.272	-0.266	-0.329	-0.329
	(6.82)**	(6.98)**	(7.41)**	(6.19)**

Schooling: Grade 5 completed++	-0.242	-0.234	-0.29	-0.292
	(6.42)**	(6.24)**	(6.94)**	(6.15)**
Schooling: Grade 6 completed++	-0.179	-0.179	-0.234	-0.239
	(4.52)**	(5.04)**	(5.34)**	(4.80)**
Schooling: Grade 7 completed++	-0.129	-0.125	-0.146	-0.148
	(3.28)**	(3.21)**	(3.28)**	(3.22)**
Schooling: Grade 8 completed++	-0.091	-0.09	-0.102	-0.107
	(2.30)*	(2.06)*	(2.29)*	(2.66)**
Currently enrolled in school++	0.051	0.049	0.096	0.089
	(1.94)+	(1.80)+	(3.46)**	(2.34)*
Raven's score	0.048	0.047	0.051	0.051
	(12.41)**	(8.49)**	(12.73)**	(10.46)**
Student-teacher ratio (STR) in madrassah		0.0002		0.001
		(0.03)		(0.60)
Student-teacher ratio (STR) in school		-0.003		-0.002
		(2.82)**		(1.70)+
Fraction of trained teachers in madrassah		0.186		0.056
		(3.44)**		(0.92)
Fraction of trained teachers in school		0.001		-0.113
		(0.02)		(1.29)
Time spent by teacher to discipline students in madrassah		0.001		-0.001
		(1.74)+		(1.96)*
Time spent by teacher to discipline students in school		-0.005		-0.001
		(1.95)+		(0.51)
Pseudo R^2	0.14	0.15	0.19	0.20
Observations	3219	3219	3219	3219

Note: (a) ++ indicates dummy variables; (b) base category for schooling dummies is grade 9 or above; (c) standard errors corrected for clustering at union level; (d) coefficients reported as marginal effects; (e) + significant at 10%; * significant at 5%; ** significant at 1%.

Identifying the causal effect of school resources on learning outcomes is outside the scope of this paper. However, we use information presented in **Appendix Table 4** to test the extent to which conventional proxies of school quality help explain the schooling-learning profile in our data. Since children also attend schools outside their village of residence, we aggregate data on school quality at the union level and merge this with household survey data. Regression results are reported in Table 4. Controlling for class size (proxied by student-teacher ratio), trained teachers and time spent by teachers to discipline students did not wash out the effect of gender and years of schooling. Of the three indicators of quality, only average STR in schools in the sample unions was found to have a negatively signed and statistically significant coefficient[21][22]. The fact that institutional indicators of quality in Table 4 do not explain the coefficient on years of schooling does not imply that schools are

[21] We also experimented with a number of other indicators of quality (e.g. fraction of female teachers and fraction of absent teachers). However, this did not change our conclusion.

[22] The lack of systematic effect of inputs in our regression model is consistent with the existing evidence in the literature. A recent review suggests that the estimated impacts on learning of most school characteristics are statistically insignificant (Glewwe, Hanushek, Humpage and Ravina, 2011).

efficient. As pointed out earlier, we only have crude data on physical inputs; apart from time spent to discipline students, we do not have detailed information on school inspection, teacher efforts in the classroom and measures of accountability. In addition, the effect of extra years of schooling required could be driven by poor control for household-specific correlates. Whilst we are limited by the nature of available data on school quality, we are able to directly test the second possibility. This approach also helps better understand the puzzle of female disadvantage in learning. Results are reported in Table 4.

Table 4: Determinants of basic competence in mathematics with control for household fixed-effects

	Oral maths		Written maths	
	(1)	(2)	(1)	(2)
Female++	-0.121	-0.104	-0.057	-0.044
	(4.79)**	(4.14)**	(2.57)*	(1.98)*
Age (in years)	0.043	0.014	0.079	0.055
	(0.51)	(0.17)	(1.06)	(0.75)
Age, squared	-0.12	-0.033	-0.254	-0.184
	(0.42)	(0.12)	(1.00)	(0.73)
No schooling++	-0.476	-0.465	-0.374	-0.364
	(3.96)**	(3.91)**	(3.51)**	(3.45)**
Schooling: Grade 1 completed++	-0.358	-0.342	-0.278	-0.264
	(3.07)**	(2.96)**	(2.68)**	(2.58)*
Schooling: Grade 2 completed++	-0.297	-0.284	-0.263	-0.252
	(3.18)**	(3.07)**	(3.17)**	(3.07)**
Schooling: Grade 3 completed++	-0.209	-0.201	-0.195	-0.189
	(2.60)**	(2.53)*	(2.74)**	(2.68)**
Schooling: Grade 4 completed++	-0.224	-0.211	-0.134	-0.124
	(3.15)**	(3.00)**	(2.13)*	(1.99)*
Schooling: Grade 5 completed++	-0.189	-0.181	-0.106	-0.1
	(3.01)**	(2.91)**	(1.91)+	(1.81)+
Schooling: Grade 6 completed++	-0.152	-0.138	-0.115	-0.104
	(2.33)*	(2.13)*	(1.98)*	(1.80)+
Schooling: Grade 7 completed++	-0.109	-0.11	-0.048	-0.048
	(1.82)+	(1.85)+	(0.89)	(0.91)
Schooling: Grade 8 completed++	-0.018	-0.02	-0.056	-0.057
	(0.30)	(0.33)	(1.05)	(1.09)
Currently enrolled in school++	0.084	0.064	0.099	0.083
	(1.99)*	(1.53)	(2.64)**	(2.22)*
Raven's score		0.031		0.025
		(4.24)**		(3.84)**
Constant	0.231	0.241	-0.002	0.006
	(0.37)	(0.39)	(0.00)	(0.01)
R-squared	0.08	0.10	0.06	0.08
Observations	3219	3219	3219	3219

Note: (a) ++ indicates dummy variables; (b) base category for schooling dummies is grade 9 or above; (c) coefficients reported as marginal effects; (d) + significant at 10%; * significant at 5%; ** significant at 1%.

Even after controlling for household fixed-effects and child ability, it takes extra years of schooling (beyond primary grades) to attain basic competence. This is true for oral maths though control for common unobserved household specific significantly reduces the influence of extra years of schooling in case of written maths. Equally, the girl-specific learning disadvantage still remains. The coefficient on female dummy is reduced from -0.15 to -0.12 in case of oral test but the fall is larger in case of written test (-0.13 to -0.06). This implies that unobserved household-specific factors (e.g. taste for discrimination) do not fully explain the observed gender gap in learning. Instead, unobserved quality of schools enrolled can provide an important explanation for the observed result. Equally, girls could be sent to poor quality (e.g. over-crowded) schools which in turn may explain the observed gender gap in learning.

To better understand the implication of our findings for the observed gender gap, we created the learning-schooling profile using mean predicted competency from the gender-wise regressions (not reported). It plots years of schooling completed on the x-axis against predicted competency attainment rate of students on the y-axis. The slope of the schooling-learning relationship is much steeper for boys as for girls in the first five years of schooling. In other words, boys enjoy learning premiums over girls in all grades of primary school. Moreover, when assessed in terms of written maths competence test, the schooling-learning profile is concave for boys while it is convex for girls. We, however, do not conduct any further tests on the statistical properties of this distribution – hence, only included for illustrative purposes. It is, however, suggestive of one potential important explanation for the puzzle highlighted earlier, namely, girls have lower test score despite completing more years of schooling.

Conclusion

Parents and policymakers in developing countries assume a positive relationship between school completion and academic success. And yet, among the vast body of empirical research examining how educational inputs relate to cognitive outcomes, few investigations have focused on the precision of the relationship between years spent in school and student learning. Our study attempted to fill this gap by evaluating the hypothesis that years spent in school positively affect learning outcomes. We used recently collected data from a nationally drawn sample of rural schools and households to investigate the causes of low level of student learning taking into account a variety of educational inputs.

Our analysis documents low level of learning even amongst children who have successfully completed five years of primary schooling. About half of the children failed to pass the competence test and amongst children who failed, at least 50% were graduates of primary school. Even after holding constant a wide range of factors such as household and parental characteristics, there remains a statistically significant correlation between years of schooling and primary mathematics competence above and beyond primary school education. This pattern is more pronounced for girls who have a lower pass rate compared to boys despite enjoying higher primary school completion rate. These results are not driven by the presence of children who belong to the lower end of the cognitive ability distribution i.e. our findings remain robust to additional control for "cognitive capacity" of the child. Our results are also robust to control for household-specific unobserved correlates of learning.

Our findings add to the growing international evidence highlighting importance of the level and distribution of cognitive skills for economic development than absolute measures of schooling attainment. Without investing in quality, education policies that are focused on expanding access to schooling without concurrent focus on learning outcomes, is likely to engender future policies to reduce poverty by further weakening the positive link between years of schooling and cognitive skill attainment.[23] The finding of imperfect correlation between years of schooling and level of cognitive skill is corroborated by the growing international evidence that schools in developing countries churn out graduates without ensuring minimal learning achievement. At the same time, the proportion of adult population with primary and secondary schooling still remains very low in South Asia when compared to other regions such as East Asia. Addressing the issue of access therefore is a legitimate one. However, without ensuring a functional primary education system, mere increase in stock of primary school graduates is unlikely to add to the nation's skill base. Attempts at building human capital, as measured by cognitive achievement, require additional and alternative interventions beyond policies that ensure greater school participation. At the same time, investment in quality can feed into efforts to improve school completion. Instead of a trade-off between quality and access to schools, there may be important complementarities between the two objectives. There is emerging evidence for developing countries that school quality and grade completion by students are directly linked (Hanushek, Lavy and Hitomi, 2008).[24] Future research should re-examine the added benefit of investment in quality on school participation in South Asia.

[23] One case in point is the new education policy under which the government of Bangladesh is planning to expand primary education from grade 5 to 8. According to our analysis, for the majority of the graduates of rural primary schools, it requires additional years of schooling beyond primary education to pass basic competence test in mathematics. On the basis of the evidence presented in this paper, there is therefore a weak basis for expansive education policy.

[24] Hanushek, Lavy and Hitomi (2008) use unique panel data on primary school age children in Egypt and find that even after holding constant the student's own ability and achievement, a student is much less likely to remain in school if attending a low quality school rather than a high quality school.

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Appendix Table 1: Mean score in basic competence test

Oral mathematics questions	Male	Female	Total
Suppose you went to the market with two Tk. 100 notes and ten Tk. 5 notes. So how much money did you take in total to the market?	0.74	0.62	0.68
Suppose you save Tk. 20 each month. How much will you have saved after six months?	0.76	0.69	0.72
Suppose you have Tk 250 in total and a chicken costs Tk 60. How many chickens can you buy? How much money will be left after the purchase?	0.53	0.40	0.46
Suppose you take a loan of Tk 100 with a monthly interest rate of Tk 5. How much money in total will you have to return after one year (with interest and principal amount combined)?	0.35	0.26	0.30
% of total answers being correct	60.76	50.66	55.55
At least 3 answers being correct (out of 4)	0.50	0.37	0.43
Written mathematics questions	Male	Female	Total
We know that 365 days equal one year. Suppose it rained for 123 days last year. If so, how many days it did not rain last year?	0.65	0.59	0.62
Shafiq has 6 cows. Rafiq has twice as many as Shafiq does. How many cows do they have altogether?	0.61	0.52	0.56
Rahima has 32 mangoes. She divided them equally amongst her 4 children. How many did each child receive?	0.75	0.66	0.71
Suppose Bangladesh has 18 districts and each district has 7 thanas. How many thanas are there in total in the 18 districts?	0.45	0.38	0.41
% of total answers being correct	61.54	53.82	57.56
At least 3 answers being correct (out of 4)	0.56	0.48	0.52
Observations	1557	1662	3219

Note: Oral questions correspond to level 2 oral maths questions in Greaney et al (1998) while written questions correspond to level 3 written maths questions in Greaney et al.

Appendix Table 2: Determinants of basic competence by gender: alternative specification

Oral test			
	Pooled	Male	Female
No schooling	-0.346	-0.385	-0.34
	(4.64)	(3.32)	(3.29)
	**	**	**
Some primary schooling	-0.337	-0.376	-0.316
	(5.16)	(3.62)	(3.78)
	**	**	**
Primary schooling completed	-0.247	-0.276	-0.232
	(3.84)	(2.67)	(2.87)
	**	**	**
Some secondary schooling	-0.156	-0.151	-0.168
	(2.44)	(1.50)	(2.01)
	*		*
Pseudo R2	0.18	0.21	0.19
Observations	3219	1557	1662
Written test			
No schooling	-0.484	-0.443	-0.481
	(5.90)	(3.47)	(4.11)
	**	**	**
Some primary schooling	-0.409	-0.358	-0.485
	(5.63)	(3.44)	(4.70)
	**	**	**
Primary schooling completed	-0.261	-0.16	-0.362
	(3.54)	(1.50)	(3.51)
	**		**
Some secondary schooling	-0.137	-0.011	-0.264
	(1.92)	(0.11)	(2.47)
	+		*
Pseudo R^2	0.22	0.26	0.21
Observations	3219	1557	1662

Note: Base category for schooling dummies is secondary school (i.e. grade 10) completion or above. All regressions control for child and household characteristics and village dummies.

Appendix Table 3: Learning outcome (i.e. pass rate in competence test) by primary school type

	Full sample			Attended only primary school			Attended secondary school		
	Written test	Oral test	N	Written test	Oral test	N	Written test	Oral test	N
Recognized madrassah	0.54	0.43	155	0.40	0.32	87	0.73	0.57	70
Unrecognized madrassah	0.42	0.39	140	0.36	0.34	101	0.59	0.54	39
Government school	0.55	0.44	1935	0.41	0.33	1021	0.70	0.57	923
Non-government school	0.54	0.45	671	0.37	0.29	356	0.73	0.64	318
NGO school	0.48	0.46	186	0.39	0.34	109	0.62	0.62	77
Overall	0.53	0.44	3087	0.39	0.32	1674	0.70	0.59	1427

Appendix Table 4: Average profile of a primary school in the study area

	Full sample		Madrassah		School	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Student-teacher ratio	40.76	24.15	34.66	24.95	41.83	23.87
Fraction of teachers trained	0.45	0.44	0.04	0.14	0.55	0.43
Fraction of teachers female	0.48	0.36	0.10	0.19	0.58	0.33
Time spent in disciplining students	12.23	13.74	13.79	20.21	11.76	11.06
Fraction of teachers absent	0.13	0.30	0.13	0.30	0.12	0.30
Observations	1140		170		970	