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The Role of Schooling in Skill Development: evidence from Young Lives in Ethiopia, India, Peru and Vietnam

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Abstract

The expansion of schooling in developing countries has improved educational access significantly in recent years, but raises questions about what is learned in school and how this relates to the development of productive skills of value in formal and informal labour markets. Young Lives has collected data since 2002 on two cohorts of children born in 1994/5 and 2000/1 across 80 sites in four developing countries. This paper employs these data to examine the development of general cognitive skills and of basic literacy and numeracy over the child's life course and school career from ages 8 to 15, linking skills development to the advantages afforded by household resources, early nutrition, caregiver literacy, and experience of schooling. It finds that early enrolment in school benefits children in disadvantaged contexts, especially Ethiopia, and that while early advantage at the household is a key determinant of skill acquisition in all four countries, there is evidence that schooling can compensate for this to some extent, especially at the basic education level, so that disparities at age 12 are lower than at younger ages. However, inequalities in skill development appear to strengthen again during the later years of schooling along established lines of household disadvantage, when pressures to drop-out, especially because of rising costs including opportunity costs of labour, begin to rise.

1.0 Introduction

Improvements in access to formal education in many developing countries since the Millennium have meant that youth populations in these countries are more likely to enrol and to stay in school longer than their forbears. Increasing educational access, particularly in times of global economic uncertainty, has nonetheless highlighted issues of educational quality and relevance in the face of intensifying labour-market competition and of an expanding youth population. The development of productive capacities or skills is the key mechanism through which education acquires economic value, both to individuals and society; and the imperative to 'upskill' the labour force finds plentiful expression in current international education and development policy rhetoric, linked especially to globalisation debates.

The development of young people's cognitive and non-cognitive skills occurs through a complex set of mechanisms among which school education is one. School plays a particularly important role in the development of 'basic' cognitive skills in the form of literacy and numeracy, and these skills form a foundation for the development of more complex cognitive skills such as information technology skills and problem-solving abilities. It is by no means the only route by

which children develop such skills, however. Children's work is also key, including in combination with schooling, as illustrated in the Indian case in Box 1.

This paper employs data from Young Lives, an innovative panel study begun in 2002, to explore the relationships between skill development in the basic education age range, access to schooling and patterns of advantage and disadvantage at the child and household level over time. We examine 'skills gaps' across a number of key axes of advantage and disadvantage, both within and between the four study countries, Ethiopia, India (Andhra Pradesh state), Peru and Vietnam; and explore how these develop over the child life-course, drawing attention to potentially policy-relevant implications of our indicative findings. We consider the factors which contribute to early advantage in skill development (at age 8), and potential role of formal schooling in enabling children to overcome early disadvantage both within and between countries later on (at ages 12 and 15). Box 2 provides an illustration of some of the perceived benefits of schooling in terms of skills in the Indian context.

We also present evidence from Young Lives qualitative research in Andhra Pradesh (see Boxes 1-3) to illustrate the perspectives of children and their caregivers on skill development, schooling and work, as well as children's career aspirations, to shed light on the broader socio-economic context in which poverty and inequalities shape school trajectories, learning processes, skill development, and transitions to the labour market.

2.0 Data from 'Young Lives'

Young Lives is an international longitudinal study of child poverty tracing approximately 3,000 children in each study country (fewer in Peru) in two age-cohorts (born in 1994-5 and 2000-01); collecting data every 3 to 4 years at the households of index children based on a sentinel site sampling design. Three rounds of data have been collected to date – in 2002, 2006-7 and 2009. This paper employs data from around 3500 index children across the four countries born in 1994/5 (the 'older cohort'). For this cohort, approximately fifty children aged 8 in 2002 were randomly selected in 20 sites in each country. The data are statistically representative at the site level, while sites were purposively selected to represent diversity within each country on key socio-economic, demographic and geographic dimensions; with a pro-poor focus. In 2009 these children were aged 15 years. They typically started school in or around 2000; and as such are

broadly a millennium cohort of primary school entrants. The three rounds of data available describe the development of these children's skills over the formative years from age 8 to 15 as well as key aspects of their backgrounds and experience, including their schooling.

Measures of cognitive skills recorded in the survey and employed in this paper are based on assessments of literacy (reading and writing), numeracy, and generalised cognitive skill, based on a receptive vocabulary test. Basic literacy tests were conducted with the index children at age 8 and identical tests were used again at 12. These involved asking the respondents to read a simple sentence from a card and to write a simple sentence which was read to them by a trained fieldworker. These very simple indicator tests are widely employed in large scale household surveys (see UIS, 2004), including the DHS (Demographic and Health Surveys) and the LSMS (Living Standards Measurement Study) and provide reliable summary measures in the context of large-scale data collection. Basic numeracy was tested at age 8 by asking children to perform a simple arithmetical calculation. At age 12, a ten item numeracy test was administered and at age 15 a more complex basic mathematics test, consisting of 30 items.

A broader measure of cognitive skill was applied at ages 12 and 15, in the form of the Peabody Picture Vocabulary Test (PPVT), a widely used test of receptive vocabulary that may be considered a proxy-measure for verbal ability/intelligence and/or scholastic aptitude. While the PPVT is vocabulary-based, it is not itself a literacy measure since it does not test the skill to read or write directly. Although higher levels of basic literacy would be expected among those with a wider receptive vocabulary (higher PPVT score), basic literacy tests quickly reach a ceiling once a respondent has mastered the skill in question, while vocabulary continues to expand more measurably. Accordingly, the PPVT is a useful measure of post-basic cognitive development.

The numeracy, mathematics and PPVT test results at ages 12 and 15 were converted to Rasch scores to enable measurement on a uni-dimensional (but country-specific) age-specific interval scale (see Cueto et al, 2009). Because the Rasch scores are age and country-specific, they are not useful for simple descriptive comparisons over time or between countries. For illustrative comparison, we employ the raw score on the numeracy/mathematics tests; but because the PPVT is also a language-specific test, it is not useful to compare results between the study countries. In all countries, children responded to the tests in the language of their choice, usually their mother-tongue.

In each survey round, a range of Likert-scaled attitude items were administered for the purpose of assessing non-cognitive 'skills' including self-esteem. In the analyses in this paper we focus on the measure of 'self-esteem', since the items administered to measure this are the most relevant for the purposes of education-related development and this paper. A specific measure for each country was generated using principal components analysis. Self-esteem is closely linked in a number of studies to longer-term psychosocial outcomes as well as improved health and economic success in the future (Trzesniewski et al, 2003 cited in Dercon & Krishnan, 2009). We do not argue that non-cognitive skills more broadly are measured by these items or the self-esteem measure derived from them; but rather we select the non-cognitive trait or skill which most directly relates to the issues being investigated; namely the development of cognitive skills and the role of schooling therein. The items included in the Young Lives surveys to construct a measure of self-esteem are derived from the Rosenberg Self-Esteem Scale (Rosenberg, 1965) and are adapted to reflect children's lives in contexts of poverty. Items include 'I am proud of my achievements at school' and 'I am ashamed of my clothes'.

3.0 Education and Skills Development

Increased access to education is no guarantee that young people will develop the skills they need for a rapidly changing and increasingly globalised world (Hanushek & Woessmann, 2011; King & Palmer, 2006). Studies in several developing countries have shown that completion of primary education does not ensure even that students will have acquired even basic skills such as numeracy and literacy (Alemu et. al, 2003; Galab et. al, 2005; Heckman & Masterov, 2007; Hill & Chalaus, 2011). Moreover, expansion in school enrolment has placed strain on already limited resources for education in many developing countries, impacting on the quality of education that young people receive (Colclough et al, 2009). Nonetheless, the expectation that schooling should deliver such skills is justified in a voluminous literature which examines the importance of cognitive and non-cognitive capacities, aptitudes and competencies for a wide range of life outcomes, including earnings, productivity, employment and well-being, as well as the more immediate outcomes of school retention, progression and achievement (Blanden et al., 2006; Carneiro et al, 2007; Glewwe, 2002; Heckman et al, 2006; Heckman, 2007).

‘Cognitive skills’ range from basic skills such as literacy and numeracy to much more complex problem solving abilities and capacities (Adams, 2011; Brunello & Schlotter, 2010). Individual cognitive functions and aptitudes may be considered to form part of a broader conception of general cognitive ability/skill, or intelligence. By contrast, ‘non-cognitive skills’ refer to affective or behavioural attributes, capacities or traits of the individual which are not themselves cognitive processes, but which are nonetheless important with regard to some of the same life-outcomes associated with cognitive skills – for example income and employment. Non-cognitive skills include motivation, agency or self-efficacy and self-esteem. These skills may be expected to develop through children’s interactions with their parents, peers and teachers and may be fostered in formal school environments, but also through informal learning processes and other life experiences. They are considered important for the ways in which young people manage opportunities and constraints in their lives and are relevant for school adjustment, academic achievement, school completion, further education and economic outcomes (Borghans, et al., 2008a; Carneiro et al., 2007; Dercon & Krishnan, 2009; Heckman et al., 2006; Heckman & Rubinstein, 2001). Importantly, while not skills in a narrower sense, these traits are found to be associated both with educational access and achievement and with occupational aspirations and outcomes (Adams, 2011; Brunello & Schlotter, 2010).

The processes by which cognitive and non-cognitive skills develop over the life cycle are complex and complementary, beginning early in life and continuing through to adulthood (Helmers & Patnam, 2010). Cognitive skills are considered to be acquired comparatively early in life and possibly to be less malleable than non-cognitive skills; which may demonstrate greater sensitivity to external environments at later stages in the life-course (Borghans et al., 2008a; Carneiro et al, 2003; Heckman, 2007; Helmers & Patnam, 2010). Home and school environments clearly have a significant role to play in facilitating or hampering skill development over time (Bird, 2007; Carneiro et al., 2003; Hanushek & Woessman, 2008; Heckman, 2008; Helmers & Patnam, 2010), while at the same time, non-cognitive and cognitive skills are inter-related domains which shape each other’s development (Borghans et al., 2008a; Helmers & Patnam, 2010). For example self-esteem can improve academic outcomes, which in turn may enhance future self-esteem (Dercon & Krishnan, 2009; Heckman, 2007).

Patterns of transfer of capital and resources from one generation to the next are key drivers of the intergenerational transmission of poverty (Bird, 2007). One important conduit for transmission concerns the impact of socio-economic advantage and disadvantage on skill development and consequently on social mobility. Household characteristics, including both material resources and caregivers' characteristics, have been found to be a primary influence on a young person's skill development (Bird, 2007; Heckman et al., 2006; Helmers & Patnam, 2010). Evidence from Young Lives has shown that measures of material wealth and living standards, such as consumption per capita, are significantly associated with a child's skill acquisition and subjective well-being (Dercon & Krishnan, 2009). Similarly, caregiver characteristics are positively associated with a student's academic performance and outcomes. For example, parental care has been found to impact on children's health which in turn impacts on their cognitive abilities (Helmers & Patnam, 2010). Furthermore, research shows that educated parents are more likely to send their children to school, to report higher aspirations for their children; and to invest more in their children's education (Dercon & Krishnan, 2009).

Beyond the role of household and contextual factors, schooling is often considered key to children's skill development. Young people and their families place considerable emphasis on education as a means of alleviating poverty, improving economic welfare and overcoming disadvantage (Crivello, 2010; King & Palmer, 2006). However, low quality education in many low-income countries may jeopardise some of these potential benefits, especially for the poorest, whose educational access is often the most limited. Low quality education is associated with low levels of cognitive and non-cognitive skills, but not necessarily with low levels of enrolment and progression. Peru and India, for example, have high levels of school enrolment, yet have levels of cognitive achievement which are below the averages of countries with a similar economic status (Cueto et. al, 2005; Galab et. al, 2005; Heckman et al., 2006; Hill & Chalaus, 2011). Relatively low levels of skill acquisition are nonetheless linked with low levels of school attendance and with school dropout, while drop-out may in turn limit skill acquisition potential yet further, later in the life-course (Alemu et. al, 2003).

Although it was previously thought that returns to education were highest for primary levels of education, more recent evidence suggests that this is less often the case, so that economic benefits accrue more rapidly in post-basic educational phases. Disadvantaged groups and

regions are often characterised by low attendance, high dropout and especially by low rates of progression to secondary and tertiary education (Galab et al., 2005; Hill & Chalaus, 2011), so that they typically 'miss-out' on the most economically valuable stages of education. Further, many disadvantaged children who complete primary education do so without mastery of basic literacy and numeracy (Colclough et al., 2009). Poor school quality, low levels of school attendance, weak basic skill acquisition and high levels of school drop-out threaten to entrench the inequalities associated with poverty and disadvantage, while the converse offers a potentially protective or even compensatory mechanism with respect to poverty transmission. In conditions where home socio-economic factors may undermine the development of young people's cognitive and non-cognitive skills, school environments may be more accessible sites for intervention than the family environment (Hanushek & Woessman, 2008). In a study of school to work transitions in Germany, while increased cognitive and non-cognitive skills were found to lower the risk of dropping out of school, the influence of cognitive skills on dropout was found to decrease over time and the influence of non-cognitive skills on dropout to increase over time (Coneus et al, 2009). Interventions to target cognitive skills might therefore be most effective during primary schooling, while interventions to target non-cognitive skills are relevant throughout primary and secondary education (Heckman, 2007).

Further, owing to synergies between cognitive and non-cognitive skill development, interventions which concentrate on enhancing young people's non-cognitive skills may be effective in improving academic outcomes (Brunello & Schlotter, 2010; Heckman et al. 2006; Heckman & Rubinstein 2001, Martins, 2010). One intervention aimed at improving academic achievement by strengthening the non-cognitive skills of young people at risk of poor performance was found to have a positive effect on academic achievement and also improved class retention by approximately ten per cent (see Martins, 2010). These results find some support in a developing world context. Krishnan & Krutikova (2010) investigated the impact of a programme which focused on raising non-cognitive skills of children from slums in Mumbai. The intervention focused on enhancing self-esteem and self-efficacy and had a notable impact on academic outcomes (Krishnan & Krutikova, 2010). Arguably, interventions that raise non-cognitive skills may be at least as effective as more traditional programmes that seek to improve the academic performance of disadvantaged students by offering them extra tuition or revision lessons (Martins, 2010; Tran et. al., 2005). Such interventions can help young people to

overcome learning difficulties, to increase their interest in school and may even reduce the impact of socioeconomic barriers to continued schooling (Adams, 2011).

Skills developed through education may enable young people to enter into the labour market, to enhance their productivity and allow them to adapt to the rapidly changing demands of the economy (King & Palmer, 2006). However in developing countries young people are more likely to leave school with limited skills, while at the same time they may face greater competition in the labour market, a higher risk of unemployment or under-employment and of economic hardship (Adams, 2007; Brewer, 2004). The situation is particularly challenging in Ethiopia, which has one of the largest youth populations in Sub-Saharan Africa (Guarcello et al, 2006; ILO, 2011). In addition to relatively low demand and higher levels of labour market competition, difficulties in the school to work transition are also attributable to a skills mismatch, especially where labour markets are increasingly rewarding high-skilled workers, but where few school-leavers have been able to acquire such skills (Heckman, 2008; Ryan, 2000). Such skills mismatches waste resources and represent a significant cost to society (Quintini, 2011). Unemployment not only has economic costs but is damaging to the wellbeing of individuals, including because it impacts their social standing and self-esteem and leads to the deterioration of skills and motivation (Ryan, 2000).

Box 1: Skill development and work: Evidence from India (Andhra Pradesh)

Qualitative work by Young Lives in Andhra Pradesh suggests that alongside learning and skill development in school, children and their caregivers emphasise the importance of learning the skills required for household chores and manual, especially agricultural, work. In common with certain skills gained through formal learning, these skills are considered important to enable children to fulfil their social roles, both as children and for the transition into adulthood. The learning of work-related skills is a gendered process and girls are expected to learn how to do household chores in preparation for marriage,

> "by the time we go to our husband's house, we must have learnt all these things... if we don't know these works... they might say "what work do you know? What work have your parents taught you?"....so we have to learn now" (female interviewee, aged 17)

Barriers to progression in formal education beyond the tenth grade alongside limited opportunities for vocational training mean that children need to keep their options open by learning skills needed for traditional livelihoods based in agriculture or trades such as tailoring or masonry from their parents and elders,

> "if I fail in my pre-college, that is in 11th class, then I will not sit idle at home, I will go to do the work and earn" (male interviewee, aged 16)

Children explain that manual work is dependable, while there is no guarantee of gaining access to other forms of employment:

> "As it is, one is not sure of getting an employment after completion of education. We are not sure of getting a job. So we cannot depend on one source for employment alone. We have to take up studies and work simultaneously during holidays. If we do these two things at a time maybe we will be able to do some work to survive even in case we don't get a job. We can do one of these jobs and earn a living. We can also have some confidence in us that we can take up one of these jobs and survive. If we depend totally on education alone, we will not be able to do any work in case we don't get a job. " (male interviewee, age unknown)

This view is consonant with socio-cultural norms which expect children to contribute to the household livelihood and with a notion that it is not possible for adults to learn agricultural or vocational skills after 18-20 years old,

> "If we learn when we grow up we cannot do [the work]" (male, aged 14)

Learning through work is an important way in which children acquire skills which may be essential for the future, given that they may not be able to access schooling of a level or quality sufficient for developing the skills necessary to participate in an increasingly globalised and technologized labour market (Coneus et al., 2009; Martinez-Fernandez & Powell, 2005). At the same time, infrequent school attendance linked to the exigencies of work and poverty or to perceptions that children should 'not rely upon education alone for survival' reinforce low levels of skill acquisition and related cognitive development. The effect may be, somewhat paradoxically, to increase the likelihood that children will drop-out of school and fail to access the levels of education or to develop the skills required to access the more lucrative forms of employment.

4.0 Evidence from 'Young Lives'

School Enrolment is high in all countries at age 12, but much lower in Ethiopia at age 8 due to late enrolment.

Official school entry ages vary between countries in the Young Lives study, being highest in Ethiopia at age 7. However, a high proportion of children in Ethiopia enrol in school somewhat later than the official age, so that many are out of school at age 8. Table 1 shows enrolment levels by age across the four countries. The pattern, except in Ethiopia, is of very high enrolment in school at age 8, falling slightly by age 12 due to drop-out, most noticeably in India. Enrolment then falls in all countries between age 12 and 15, with the lowest levels of enrolment being found at this age in the countries with the highest initial enrolment levels – Peru and Vietnam. In terms of the mean number of years of schooling received, figures are lowest at both 12 and 15 in Ethiopia and highest in Peru. Disparities between countries are wider at age 12 than at 15, owing largely to the later start of children in Ethiopia. These figures include attendance at pre-school.

Table 1: School Enrolment by Country and Age

		Ethiopia		**India**		**Peru**		**Vietnam**		**Total**	
		N	**% of total**	**N**	**% of total**	**N**	**% of total**	**N**	**% of total**	**N**	**% of total**
Age 8	Enrolled	639	65.5	954	97.3	699	99.0	970	98.5	3262	89.4
Age 12	Enrolled	913	93.5	862	88.0	678	96.0	943	95.7	3396	93.1
	Years of Schooling (mean)	3.62	-	6.51	-	7.40	-	5.60	-	5.66	-
Age 15	Enrolled	854	87.5	741	75.6	616	87.2	727	73.8	2938	80.6
	Years of Schooling (mean)	6.45	-	8.77	-	9.94	-	8.34	-	8.25	-

Source: Young Lives data

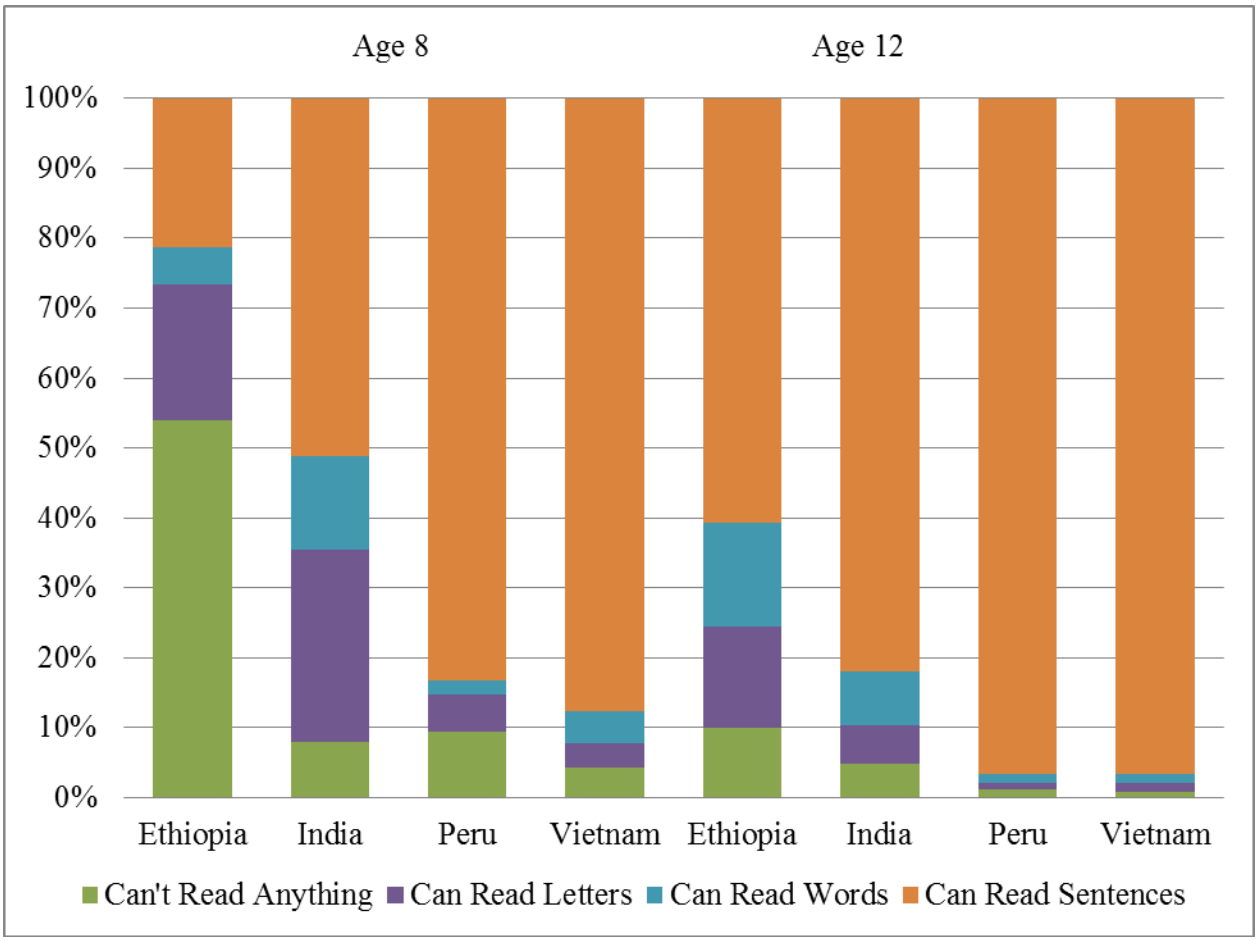
A majority of children in Vietnam, Peru and India had gained simple basic skills in literacy and numeracy by age 8; and in Ethiopia by age 12.

Table A1 in the Appendix reports cognitive skill levels from the various assessment instruments by age and gender for the four countries. At age 8, around half of boys and two-fifths of girls in Ethiopia could perform a simple calculation, with the difference between the sexes being

statistically significant. In the other countries, more than three quarters could do so, with the difference between boys and girls being significant only in India. Around a quarter of children at that age could read words or sentences in Ethiopia, rising to more than three fifths in India, more than four fifths in Peru and to almost all children in Vietnam. The difference between the sexes on reading is significant again only in India. Figures are higher for writing, but show a similar pattern, once again with the difference between the sexes being significant only in India. By age 12, around three fifths of children had acquired these literacy skills in Ethiopia, somewhat more in India and the vast majority in Peru and Vietnam. There is no significant difference by sex on literacy skills in any country by this age. The results for general cognitive skill (using PPVT) show a significant difference by sex in India only. It is not possible to compare these data descriptively across countries.

Figure 1 compares reading skills at age 8 and 12 and Figure 2 compares writing skills. Figure 1 shows similar patterns of reading skills in Vietnam and Peru at age 8, with a large majority of children being able to read sentences by that age. By contrast, in Ethiopia, a majority of children could not read at all. Four years later, the pattern across countries shows a narrowing of the reading skills gaps, with a majority of children being able to read sentences in all countries. Progress is most marked in Ethiopia, where skills were initially least developed. Notably, reading skills at age 12 in India show a similar pattern to those in Vietnam at age 8, while in Ethiopia skill levels at age 12 remain lower than those four years earlier in Vietnam or Peru.

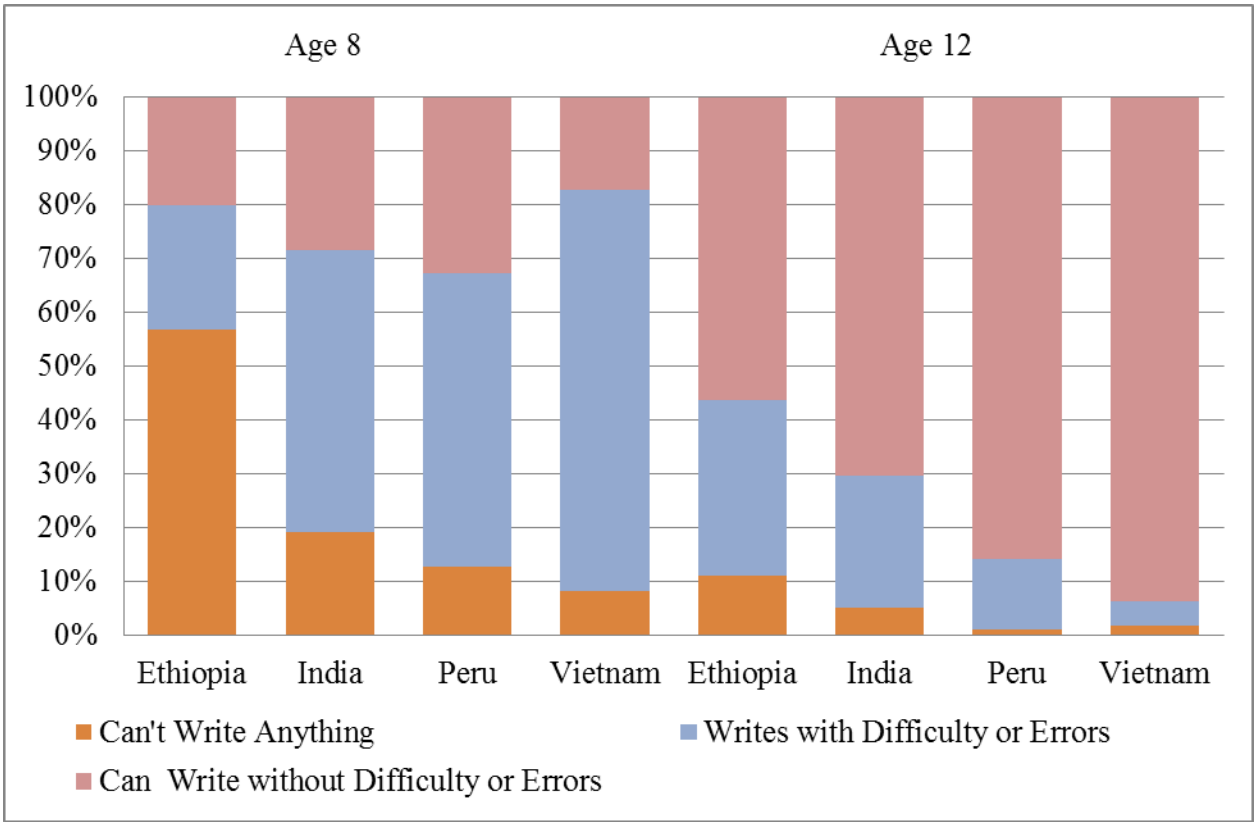
Figure 1: Reading Skills at Age 8



Source: Young Lives data

With regard to writing skills at age 8, a majority of children in Vietnam, India and Peru could write a sentence but with some difficulty or error, while between a fifth and a third could do so without difficulty. In Ethiopia, more than half could not write anything. Four years later, the vast majority of children in Vietnam and Peru could write without difficulty or errors and more than half could do so in Ethiopia and India. However, around a third in India and two fifths of children in Ethiopia remained either unable to write or were able to write only with difficulty or errors.

Figure 2: Writing Skills at Age 8



Source: Young Lives data

Numeracy skill development varies widely between and within countries, with skills gaps widening over time especially between the more advantaged areas of Vietnam and elsewhere.

Cognitive skill levels vary widely both between countries and within countries. We illustrate this in Figure 3 below using numeracy scores which constitute the most comparable outcomes over time and within countries. Each bar represents a site-level mean score on the three tests at ages 8, 12 and 15 – the first has a binary response, the second a maximum score of 10 and the third a maximum of 30. At age 8, more than half of children in most sites in India, Peru and Vietnam can perform a simple calculation, although there is notable variation between sites. In Ethiopia, variation between sites is especially wide however, with more than three quarters of children having gained this skill in some sites and less than a quarter in others. Four years later, the gap between Ethiopia and the other countries with respect to very basic numeracy skill mastery has narrowed somewhat, in common with the pattern for literacy skills discussed above, while the performance of children in Vietnam is beginning to exceed that in the other countries. At this

age there is no significant difference in numeracy scores at the individual level by sex in any country. Intra-country variation remains notable, typically with more advantaged sites (e.g. urban coastal areas in Vietnam compared to rural mountainous sites) achieving considerably higher mean scores. A further three years later, differences in mastery of numeracy and basic mathematical skills are observed to be stark. While intra-country variation remains important and appears to have increased, the differences between countries stand out. Mean scores in the lowest performing sites in Vietnam are typically higher than all sites in Ethiopia and India. While at age 8 and 12, the numeracy skills of children in India were not markedly different from those in Peru, by age 15 children's mathematics skills in India are typically much lower and are closer to those of children in Ethiopia. This perhaps suggests that while learning quality is comparable in the early years, Peruvian children benefit somewhat more from their learning experience in the latter years of basic numeracy learning. At age 15, there is a significant difference in maths results by sex in all countries except Peru, in favour of boys in Ethiopia and India and of girls in Vietnam. Table 2 shows the summary statistics for the three numeracy tests and illustrates a shifting pattern of average numeracy skills over time. More complex literacy skills are mastered much more often by children in Peru and Vietnam, with differences between these countries and Ethiopia and India widening considerably between ages 8 and 15.

Table 2: Summary of numeracy skill outcomes in Young Lives data

	Age 8 *Ability to perform a simple calculation*		**Age 12** *Numeracy test score (maximum 10)*		**Age 15** *Numeracy test score (maximum 20)*	
	%	**N**	**Mean score**	**N**	**Mean score**	**N**
Ethiopia	43	729	4.90	928	4.19	973
India	90	937	5.75	953	5.50	927
Peru	74	517	5.75	676	11.42	671
Vietnam	86	759	7.43	967	14.10	972

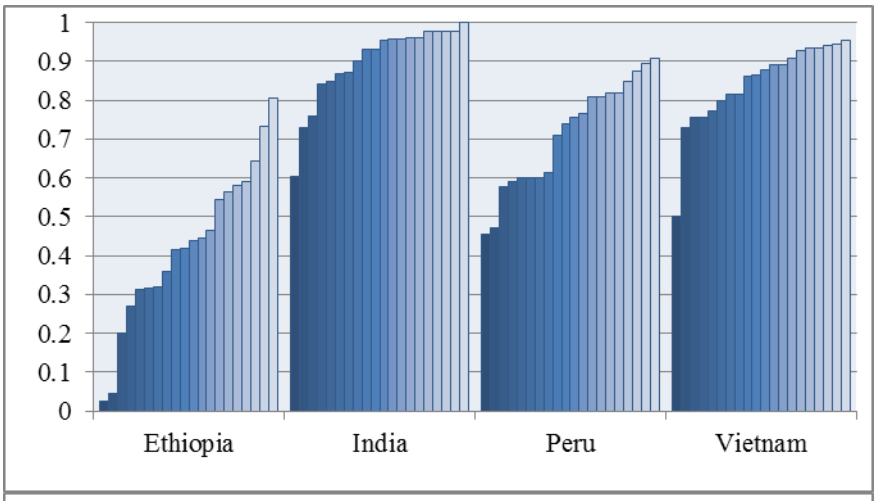
Source: Young Lives data

Figure 4 explores site-level relationships further by plotting mean values for numeracy skills at age 15 against mean values for educational access (years of schooling) alongside a fitted line (including a quadratic term) for the association. Points on the chart therefore depict mean years of schooling and mean numeracy scores for all sites for each country. A positive relationship is observed in all countries, being apparently strongest in Ethiopia and much weaker in India, Vietnam and Peru. In these latter three countries, there is relatively little variation between sites

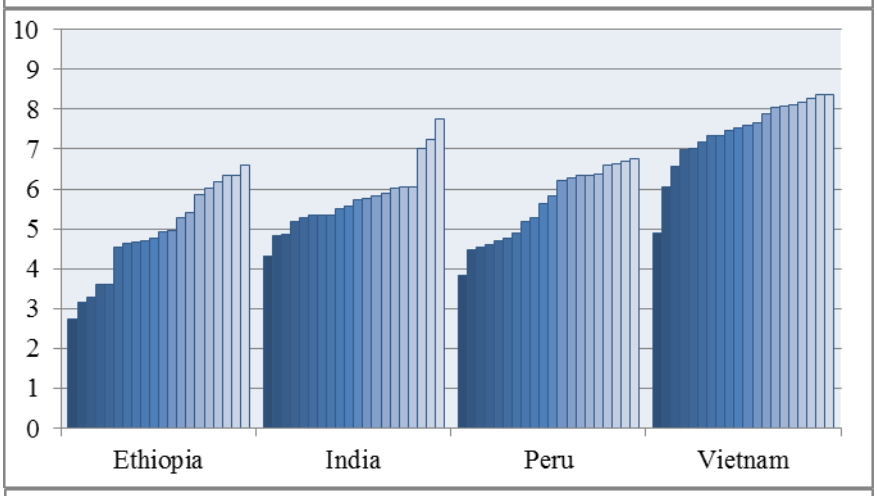
on years of schooling, suggesting relatively homogenous educational access, but while in India there are only moderate differences on maths results at site level, there are larger differences in Vietnam; apparently indicating a greater importance of other explanatory variables at the site level, perhaps including school quality. In Ethiopia, variation between sites on educational access is widest, likely linked to the more recent expansion of basic education provision in that country. While site-level scores on the maths test are low in Ethiopia, for sites with a mean of four or more years of schooling, maths scores were comparable to sites in India, the majority of which had a mean of 6 or more years of schooling.

Figure 3: Children's numeracy skills over time: variation between sites

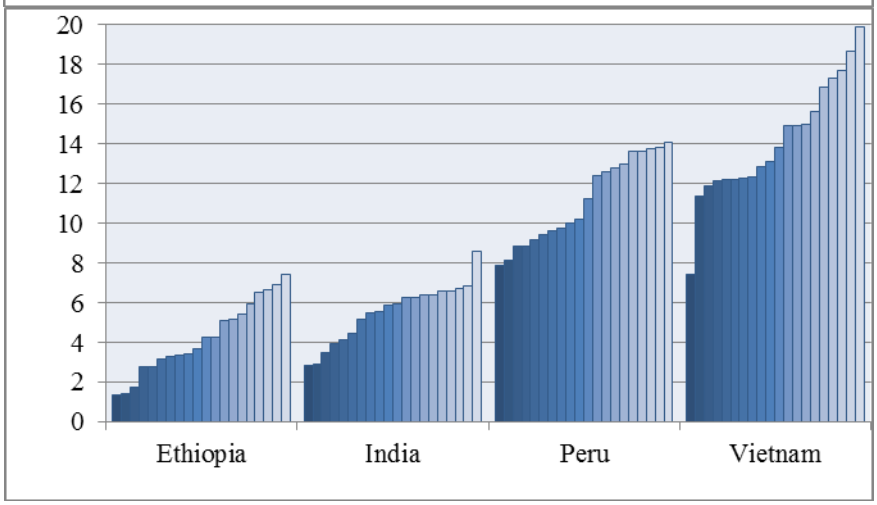
Age 7-8



Age 11-12

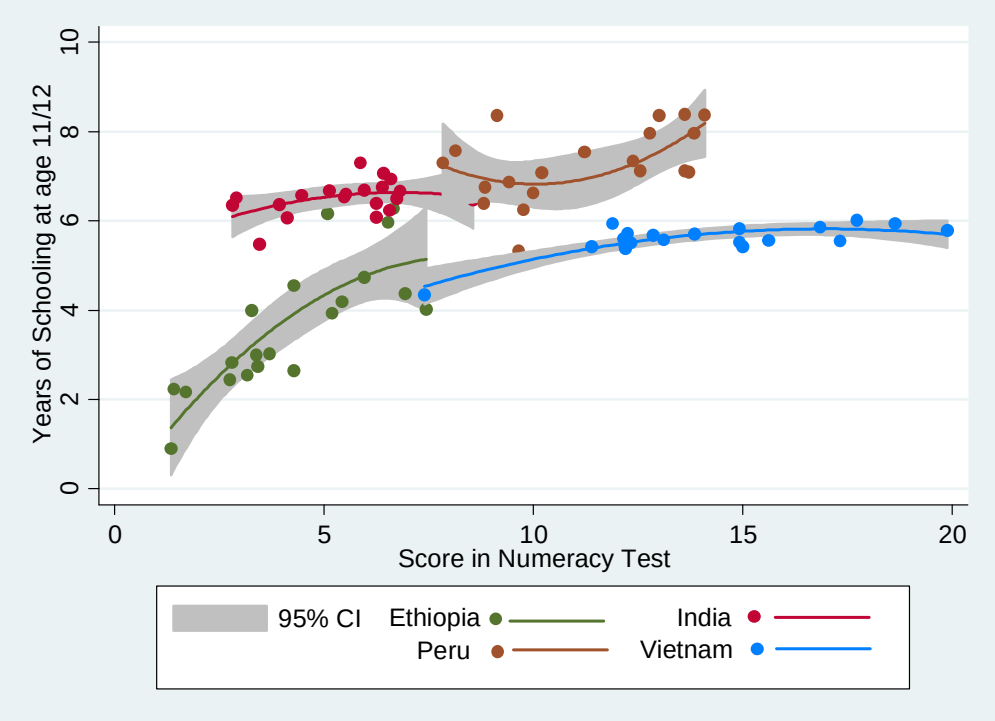


Age 14-15



Source: Young lives Data

Figure 4: Site-Level Relationships between Schooling and Numeracy (at age15) by Country

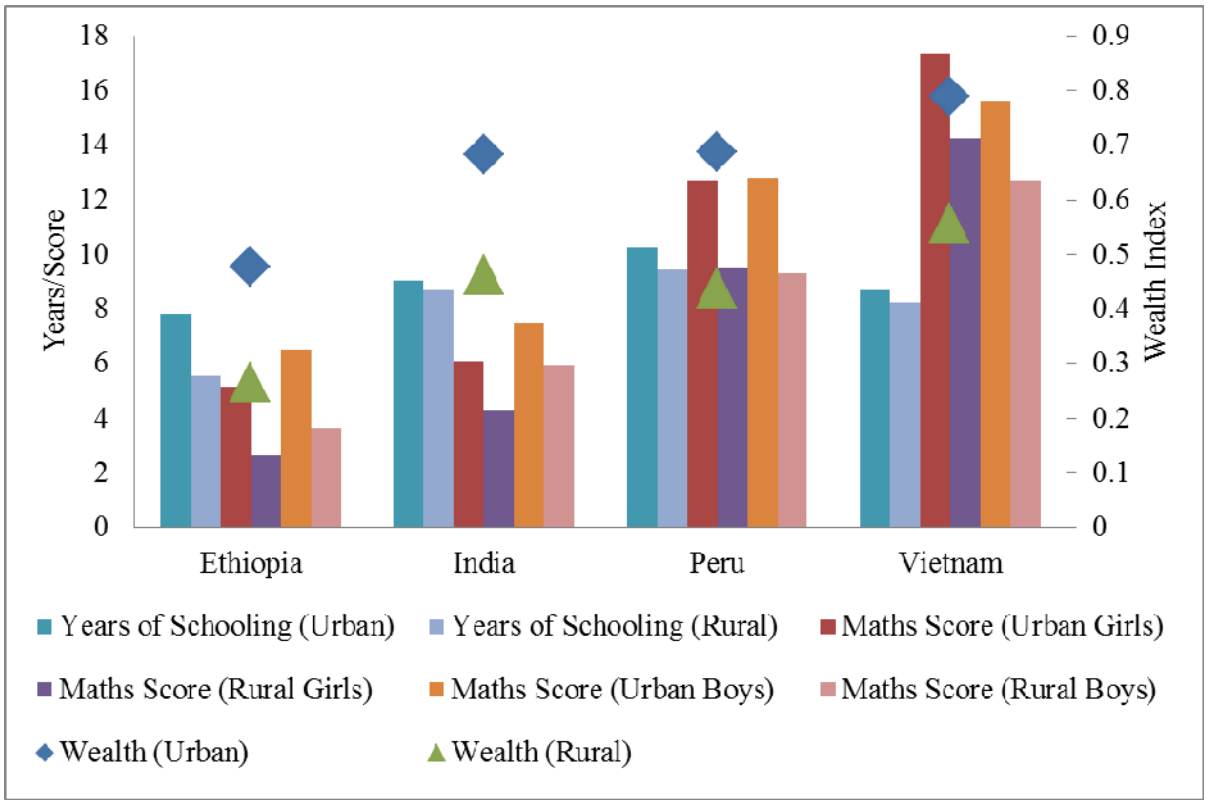


Source: Young Lives Data

We examined how cognitive skills (maths scores at age 15 for girls and boys separately), household wealth and access to schooling vary between urban and rural areas and between countries. The results are illustrated in Figure 5. Large differences in wealth are observed in all countries between urban and rural households. On educational access, however, the difference is only marked in Ethiopia. Differences in cognitive skills are marked in all countries for both sexes, being largest in Ethiopia, with skills gaps by gender between urban and rural being similar for all countries. While schooling is clearly an important driver of cognitive skill development, differences in years of schooling are small compared to differences in skills and in advantage due to wealth, and urban or rural location. Table 3 shows the mean scores on the numeracy test at age 15 for the advantaged urban highest wealth quintile and the disadvantaged rural lowest wealth quintile groups, reporting the score for either girls or boys, whichever is higher for the first category and lower for the second. Typically, mathematics scores on this test are two to three times higher for the most advantaged, as compared to the least advantaged groups, suggesting a powerful influence of

contextual factors such as urban location and of levels of wealth, which are likely to be linked to other background factors and also to the quality of schooling received.

Figure 5: Wealth, Schooling and Cognitive Skills at age 15



Source: Young Lives Data

Table 3: Mathematics Test Scores at age 15 for the Most and Least Advantaged Groups

	Ethiopia	India	Peru	Vietnam
Highest wealth quintile urban	7.4 (boys)	8.8 (boys)	13.7 (girls)	18.1 (girls)
Lowest wealth quintile rural	2.1 (girls)	3.5 (girls)	7.0 (boys)	9.4 (boys)

Source: Young Lives Data

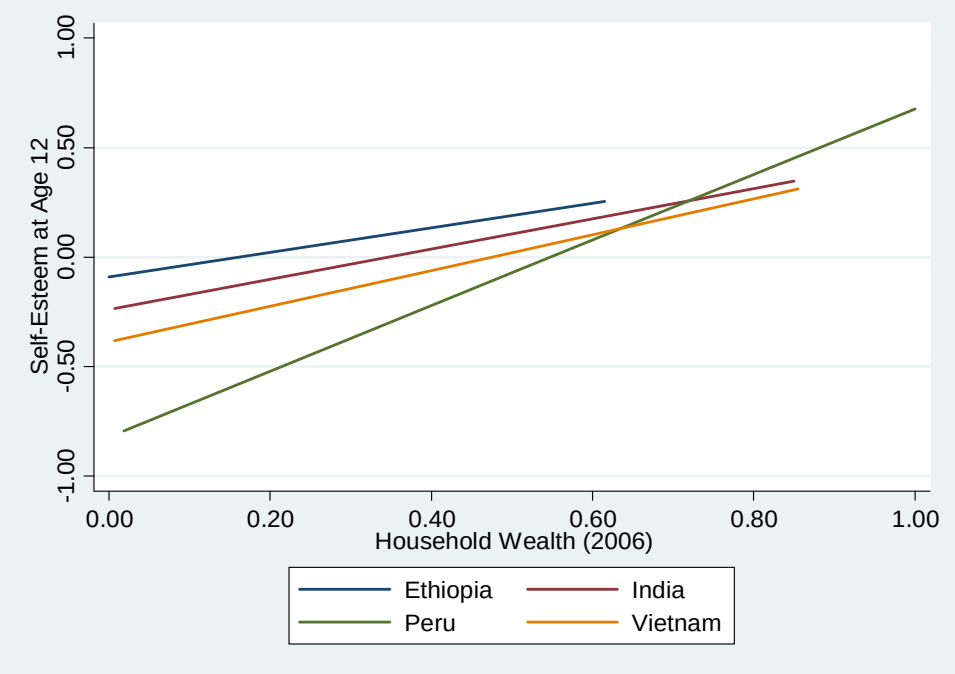
While the direction of relationships is difficult to determine, non-cognitive skill (self-esteem) is positively related to cognitive skill, wealth and schooling in all countries

Although we do not expect non-cognitive skills or attributes to develop in the same way as cognitive skills, it is informative to examine the associations between self-esteem and

cognitive skill (using maths test results to allow illustrative comparison between countries) and the associations between household-level advantage and self-esteem. Measures of non-cognitive skills, including self-esteem, are found in the literature to be linked with success educationally and in the labour market, but are of course themselves associated with advantage in complex ways while also being relatively malleable, so that causal relationships may be difficult to unpack.

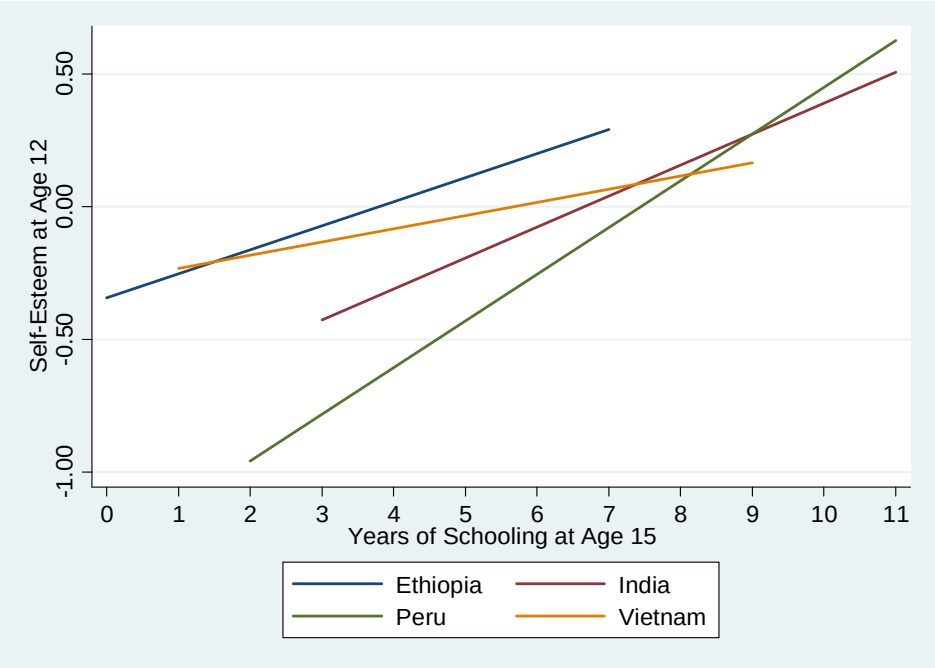
Figure 6 shows the linear fitted relationship between household wealth and self-esteem among 12 year old children. A broadly similar pattern is observed in all four countries, so that children in wealthier households are found on average to have higher levels of self-esteem. Figure 7 shows the relationship between the same measure of self-esteem and the number of years of schooling children had received three years later. Again, in all four countries a positive relationship is found - children with higher levels of self-esteem went on to receive more schooling. Figure 8 presents the relationship between children's self-esteem at age 12 and their cognitive skills (scores in mathematics) when tested three years later. A comparable pattern to that for wealth and schooling is found, with those children with higher self-esteem at age 12 scoring higher on average in mathematics at age 15 in all countries.

Figure 6: Self-Esteem and Household Wealth in 2006 (at age 12)



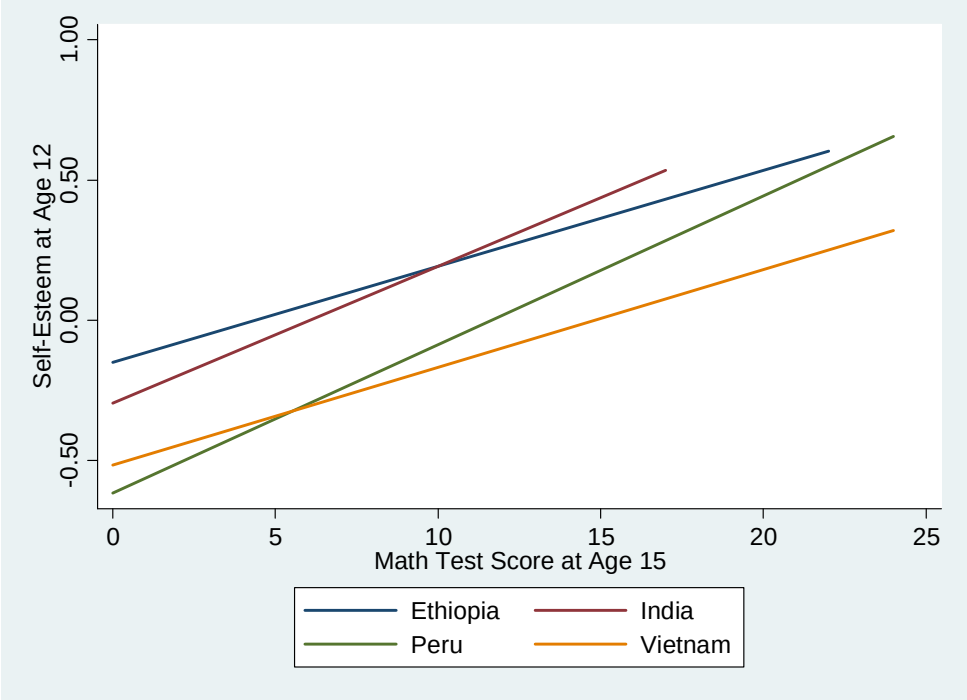
Source: Young Lives Data

Figure 7: Self-Esteem at Age 12 and Years of Schooling at age 15



Source: Young Lives Data

Figure 8: Self-Esteem at age 12 and Mathematics Test Scores at age 15



Source: Young Lives Data

Career aspirations at age 15 are high across all four study countries, varying according to reading ability at age 8 urban and rural locations, and by gender.

At the age of 15, children were asked about the occupation to which the aspired, specifically they job they would like to have by the age of 20. Responses were categorised into those jobs which would usually require higher education, those which require some level of formal education, and those which would not require formal education at all. Tables 4-6 report children's responses. Aspirations in Ethiopia, particularly in rural areas, are higher overall than in any other of the study countries, with an overwhelming majority of children aspiring to careers which require higher education. In India, Peru and Vietnam, proportionately more children in urban areas aspire to careers requiring higher education than in rural areas. In Ethiopia, aspirations are similarly high among both boys and girls. While they are also high in the other study countries, the patterns are more nuanced. For example, in India, 24.6% of girls aspired to careers which require no formal education, compared to 18.6% of boys, a pattern which is reversed in Peru and Vietnam. Interestingly, in Vietnam, 78.6% of girls aspired to careers which require higher education, somewhat more than the 63.18% of boys who did so. We examined children's aspirations in relation to their ability to read (words or sentences) at age 8. While aspirations are, as before, consistently high in Ethiopia, interesting differences emerge in the other study countries. In India, 75.3% of children who could read at age 8 aspired to a career requiring higher education, compared to 52.6% of those who could not read at that age, 35.1% of whom aspired to a career which required no education at all. In Vietnam, the differences were even larger, with 75.0% of children who could read at age 8 aspiring to a career requiring higher education, and 61.2% of children who could not read aspiring to a career which required no formal education.

Table 4: Career aspirations among children who could read words or sentences at age 8, and those who could not

	Ethiopia		**India**		**Peru**		**Vietnam**	
	Could read	Could not read	Could read	Could not read	Could read	Could not read	Could read	Could not read
Career requiring higher education	83.61 (199)	85.51 (584)	75.31 (424)	52.60 (162)	63.79 (310)	55.95 (47)	75.00 (603)	28.36 (19)
Career requiring school education	5.88 (14)	5.27 (36)	10.12 (57)	12.34 (38)	15.84 (77)	15.48 (13)	6.09 (49)	10.45 (7)
Career not requiring formal education	10.50 (25)	9.22 (63)	14.56 (82)	35.06 (108)	20.37 (99)	28.57 (24)	18.91 (152)	61.19 (41)

Source: Young Lives data

Table 5: Career aspirations among children in rural and urban locations

	Ethiopia		India		Peru		Vietnam	
	urban	rural	urban	rural	urban	rural	urban	rural
Career requiring higher education	81.62 (302)	86.99 (86.99)	79.33 (165)	63.49 (426)	63.14 (221)	61.00 (147)	81.61 (142)	68.62 (481)
Career requiring school education	6.22 (23)	4.99 (28)	11.54 (24)	10.88 (73)	16.00 (56)	16.18 (39)	2.30 (4)	7.42 (52)
Career not requiring formal education	12.16 (45)	8.02 (45)	9.13 (19)	25.63 (172)	20.86 (73)	22.82 (55)	16.09 (28)	23.97 (168)

Source: Young Lives data

Table 6: Career aspirations among children by gender

	Ethiopia		India		Peru		Vietnam	
	male	female	Male	Female	Male	Female	Male	female
Career requiring higher education	83.51 (400)	86.28 (390)	67.45 (286)	67.03 (305)	64.92 (211)	59.02 (157)	63.18 (266)	78.63 (357)
Career requiring school education	3.76 (18)	7.30 (33)	13.92 (59)	8.35 (38)	11.69 (38)	21.43 (57)	9.50 (40)	3.52 (16)
Career not requiring formal education	12.73 (61)	6.42 (29)	18.63 (79)	24.62 (112)	23.38 (76)	19.55 (52)	27.32 (115)	17.84 (81)

Source: Young Lives data

Box 2: Skill development and schooling: evidence from India (Andhra Pradesh)

The importance of education for learning skills and 'gaining knowledge,' as well as equipping young people with skills to improve future employment opportunities, is highlighted by both children and caregivers in Andhra Pradesh. Formal schooling is seen as important for employment opportunities:

'If we get educated we will get a job. If we don't study and roam around we will not gain anything' (male, 16 years old)

Moreover, caregivers see formal education as playing a central role in children's future success:

'Can we imagine a life for children without schooling? It is most important for them to be educated. Only when they go to school they will come to know about everything and gain worldly wisdom apart from studies' (urban caregiver, 2011).

This notion of 'worldly wisdom' is linked to the development of non-cognitive capacities, which children identify as important not just for future job prospects, but also for learning to become independent and responsible members of society:

> 'If we go to school we can gain intellect and learn many things and imbibe certain traits like honesty, scruples and so on, apart from the routine education. In this way our knowledge might improve especially general knowledge, which will be very helpful to us in our future life especially in case if we are holding some position.' (female, 17 years old)

Learning to be proficient in both English and computing skills at school or through extra classes are deemed to be important:

'Now if we have to go anywhere, or want to travel we need to read the boards, or if we want to go to Kuwait or to speak in English, education is important' (male, 15 years old).

This in part reflects the changing nature of the Indian economy with demands for more highly-skilled labour, as well as increasing migration into globalised labour markets such as those in the Middle East.

Perceptions about the importance of these skills, may also be linked to parental beliefs about the merits and demerits of the growing array of education providers in India and to the increasing numbers of children moving into the low-fee private education sector, which may be more responsive to these shifts in perception and demand.

Accordingly, it is not just *formal schooling* that is seen as important for skill development by caregivers in Andhra Pradesh, but above all *private schooling*. Compared to the government-provided equivalent, many caregivers believe that private schools may offer a higher quality of English teaching and a higher ratio of computers to students, among other benefits. This is illustrated by a mother who explained why she and her husband were prepared to make large sacrifices for the sake of sending their daughter to private school:

> 'Nowadays most of the jobs are computer based jobs. And for working with computers one needs good education. […] If we educate our children in good school they will get good jobs and this means getting a fat salary and leading a nice life. Moreover, they will not regret and blame us. We are struggling hard to meet both ends as we did not get good education and we don't want our children to suffer like us.' (caregiver, urban area)

Regression modelling results demonstrate the importance of background factors at a young age and of school experience plus earlier skill development for older children.

To further explore patterns of skill development, we employ regression modelling to identify the predictors of cognitive skill levels. We focus on the importance of prior cognitive and also non-cognitive skills and on how skill development may relate to schooling. We also explore the relationships between skills and a range of other predictors available in the surveys which might be expected to be associated with skill development. The approach is analogous to an 'education production function' in that the outcomes used are cognitive tests scores and that these are modelled as a function of a child's background and educational experience, although we are not able to include school inputs beyond years of schooling attended (and school type in India). We focus on basic child and household characteristics which expected to influence learning achievement according to the wider literature (see Glewwe and Kremer 2006 for a review). These include sex, height-for-age (as an indicator of nutritional status), household wealth, caregiver literacy (associated with educational preferences) and country-specific factors including caste, language and ethnicity. Controlling for relationships with other explanatory variables, we expect that cognitive scores will be positively associated with various forms of advantage which may be linked to cognitive development more directly (as in the case of nutrition and exposure to education) or less directly, through parental expectations, social constructions of gender roles and so on. Table A2 (in the Appendix) presents the descriptive statistics for all variables used in the models. The results of regression modelling are shown in Tables A3-A17 in the Appendix.

The sentinel site sample design of the Young Lives surveys means that data are strongly clustered. Within sites, which are typically groups of contiguous villages, we may expect considerable homogeneity with respect to economic and educational characteristics owing to a common environment, but between them considerable heterogeneity is observed, especially because site selection is purposive (shown in Figure 3 in relation to numeracy). In order to better estimate the strength of relationships between individual and household characteristics which are not due to site-level clustering, we employ a 'site fixed effects' approach. While we do not claim to estimate the size of causal relationships, this strategy may be expected to reduce bias due to endogeneity at site level. The partial correlations estimated are thus average *within site* relationships between skill outcomes and key predictors, net of the association with the controls included in the model. Probit models with dummy variables for

sites are used where the outcome is binary.

For India, versions of the models are run both including and excluding a variable for attendance at private school. In all cases, the inclusion of the private school variable makes a small difference to the coefficients for wealth but does not alter the significance level or the interpretation of the analysis. In discussing the findings across countries, reference will therefore be made to those India models which include variables for private school attendance.

At age 8, basic skill development is associated with advantage at the household level including wealth and caregiver literacy as well as with schooling in Ethiopia, where significant numbers of children are not enrolled at this age.

We model the predictors of numeracy and literacy at age 8, when no prior cognitive or non-cognitive scores are available. A variable for ever-attendance at school is available but can only be included in the model for Ethiopia, since in the other countries a large majority of children had already attended by this age. Household-level advantage is found to be the key predictor of both numeracy and literacy skills at age 8, except in Ethiopia, where there is a strong relationship between early school enrolment and both numeracy and literacy. Caregiver literacy (measured by ability to read) is also associated with basic reading skills in all countries and with numeracy skills in India and Vietnam. The advantage for boys in Ethiopia and India found in the descriptive statistics (Table A1) persists when controlling for other factors, suggesting a gender effect on both numeracy and early literacy skills in these countries (writing skills only in Ethiopia). An advantage in numeracy is found for children with a greater height-for-age at age 8, except in India; and also for basic reading, except in Peru. These findings paint a general picture of the role of early advantage in numeracy and literacy skill development, in terms of early nutrition, household resources and literate environments, broadly consistent with the literature (Helmers and Patnam, 2010; Dercon and Krishnan, 2009). The effects of these forms of advantage are in part transformed into higher skill levels, which we use as predictors of cognitive skills four years later at age 12.

At age 12, the importance of early mastery of basic skills and of access to schooling for the development of cognitive skills is clear.

At age 12 we model the predictors of numeracy, literacy and general cognition, focusing on prior skill levels and on schooling. We include a continuous measure of the number of years

a child has attended school to capture the potential benefits of education on skill acquisition. We find that prior skills and experience of schooling (except in Peru) become the key factors associated with literacy outcomes by age 12. Specifically, numeracy and literacy at age 8 are found to be significant predictors of the development of those skills in Ethiopia and India four years later and literacy (especially reading) at age 8 is found to be associated with general cognitive skills at age 12 in all countries. Accordingly, children who had acquired basic numeracy and literacy skills early-on are found to have maintained an advantage compared to their peers; which is further strengthened for those who had received most schooling. The number of years a child had attended school by age 12 is found to be a strong predictor of numeracy and of general cognitive skills in all countries except Peru in the presence of controls for key background factors and prior skills, suggesting an important role for school learning in terms of skill development.

While we are not able to make inferences about school quality directly, this finding is encouraging at least to the extent that it is suggestive of positive educational benefits in these countries, in spite of concerns about school quality in these contexts. An additional year at school is broadly comparable in its association with numeracy at age 12 to the association with a correct (as opposed to incorrect) answer in the prior numeracy test, or to a child's caregiver being literate (as opposed to illiterate) in Ethiopia, India and Vietnam. In terms of general cognitive skills, an additional year of schooling is associated with a rise in skill levels equivalent to around half of that associated with a correct score on the prior binary reading measure in Ethiopia, India and Vietnam. These results draw attention to the potential benefits of schooling on the development of cognitive skills, but also to the importance of early mastery of basic skills for later development. Interestingly, in this model for children aged 12, household wealth is not found to be a significant predictor of numeracy or literacy in Ethiopia, India or Vietnam; while it remains a strong predictor in Peru, alongside only Spanish as a first language (an important indicator of advantage in Peru). Caregiver literacy is a significant predictor of literacy skills only in India and height-for-age is no longer a significant predictor of literacy skills in any country at age 12. However, for general cognitive skill – a more finely graded measure with greater variation (and which is based on vocabulary, which may have particular implications for the importance of social advantage) – household wealth is a significant predictor at age 12 in all countries, alongside caregiver literacy in India and in Vietnam. In India, a male gender effect is also found at this age in relation to general cognitive skills.

While early development of skills is associated with household resources, nutrition and literate environments and therefore early skills measures reflect the effects of these factors, what is notable is that the evidence for further consolidation of these forms of advantage in terms of progress in skills development is not particularly strong, especially concerning literacy and numeracy. As considered above, however, the measure of general cognitive skills (the PPVT) is based on a vocabulary test, and while vocabulary is no doubt also learned at school, the home environment and especially the vocabulary of parents would be expected to exert a strong influence here; perhaps stronger in particular than on numeracy or mathematics skills which may be more dependent on schooling.

In India, it was possible to examine the relationship between attending a private school and skills development, net of the influence of the number of years of schooling a child had received, since this variable was included separately. At age 12, private school attendance is found to predict an increase in numeracy skills broadly equivalent to somewhat less than a year of general schooling or to success in the early numeracy test, suggesting a discernible difference between numeracy skills between pupils attending private school or otherwise, while controlling for prior scores and key background characteristics. In terms of general cognitive skills, enrolment in a private school is found to be associated with an increase in scores equivalent to approximately one year of general schooling. Such results must, however, be treated with caution since we are not able to control for all of the factors associated with selection into private schooling, including for example child and parental aspirations, as discussed in Box 3. Consequently, we do not suggest a private school effect *per se*.

At age 15, the importance of prior skill development and access to schooling remain central to cognitive skill development but household background factors are also key at a point when basic education is nearing completion for many children and both costs of schooling and pressures to work may rise.

We model the predictors of mathematical skill and of general cognition at age 15, focusing on the associations with prior skill levels in numeracy and literacy (from 3 years earlier) and on the child's access to schooling. The pattern of relationships found is similar to that found at age 12 in that prior numeracy skills are a strong predictor of mathematics scores in the same three countries as at age 12, and that prior literacy scores are a key predictor of general

cognitive skills in all countries except Peru. Schooling continues to be an important predictor of mathematics skills and becomes a significant predictor in Peru by this age. It remains a significant predictor of general cognition in all four countries. In India, however, only private schooling is significantly associated with higher maths scores at age 15 and enrolment in private schooling is associated with an increase in cognitive skill-for-age equivalent to that for almost two years of general schooling. Again, however, since the measure employed is based on vocabulary, unobserved social background factors associated with private school choice may be driving some of this apparent effect. Higher levels of self-esteem at age 12 were also found to be associated with a higher maths skill levels in India, Peru and Vietnam, and with gains in cognitive skill-for-age in Peru, consistent in general terms with the literature (Heckman, 2007; Dercon and Krishnan, 2009).

Descriptive findings showed that age 12 is the point at which most children were likely to be in school in all of the countries. By age 15, when fewer children are in school, it is notable that male sex returns to being a significant predictor of maths skills in Ethiopia and India and of general cognition in all countries except Vietnam; while being female becomes associated with higher skill levels in Vietnam. Household wealth re-emerges as important at this age, and is found to be a significant predictor of maths skills in all countries except Ethiopia, and of general cognition except in India where caregiver literacy is a significant predictor. The apparent renewed influence of household-level advantage at this age outside Ethiopia, where, due to a later start, most children are still in early basic education, is unsurprising perhaps, given that by this age the opportunity costs of schooling are rising owing to the children's potential productivity in work and that typically, schooling costs are also rising as children progress to post-basic education levels.

Box 3: Children's aspirations and private schooling in India (Andhra Pradesh)

Figure 9 shows the careers to which children in the Young Lives sites in Andhra Pradesh aspired in 2009, according to the type of school they attend. Levels of aspiration are separated into those aiming at occupations which require higher (university) education, those that require school-level education, and those for which formal education is unlikely to be a prerequisite. Clear differences emerge between children in attending private school and otherwise. These cannot be attributed to the schools themselves however, as selection into private schools will no doubt be linked to both parents and children's own aspirations. Around 90% of children studying in private schools in 2009 aspired to careers which would require a university-level education, compared to slightly less than 60% of those not studying in a private school. Interestingly, while only 2% of children studying in a private school in 2009 envisaged themselves pursuing a career which required no formal education at age 20, just under 30% of children not in private schools envisaged themselves in these careers at that age.

Figure 9: Children's career aspirations by school type

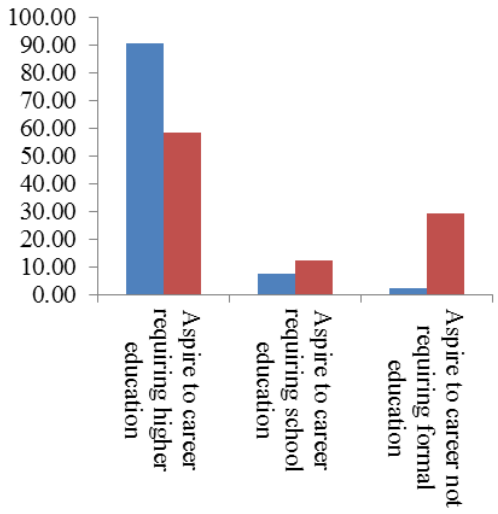
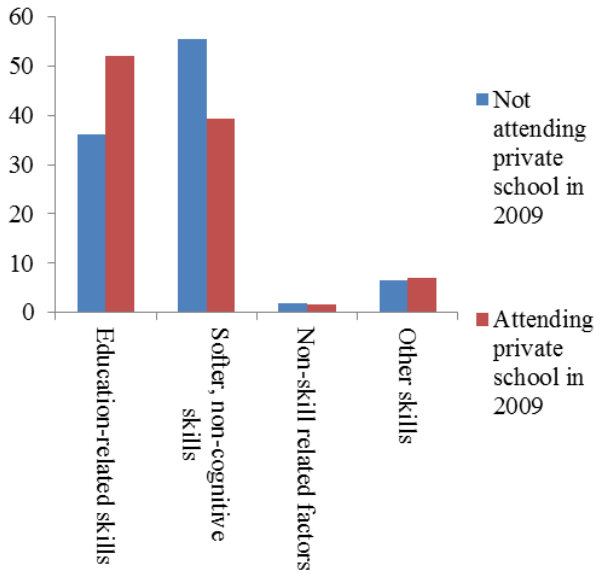


Figure 10: Skills required to get the job to which children aspire by school type



When asked what skills would be important in order for them to get the job identified in the question concerning career aspirations, children listed a variety of education-related (cognitive) skills, alongside a number of 'soft' or 'non-cognitive' skills, together with other types of skills and non-skill factors. Results are shown in Figure 10. Both children who studied in a private school and those who did not, attached value to both education-related and softer non-cognitive skills as important in enabling them to pursue the career to which they aspired. A slightly larger proportion of those children studying in private school valued education-related skills more than 'soft skills', while the reverse was true for children who did not study in a private school in 2009.

5.0 Conclusion

The Young Lives study provides a unique opportunity to explore the development of cognitive skills longitudinally across four countries, using data collected at three key points in children's lives and schooling trajectories. Analysis of this data shows that many children in Ethiopia are disadvantaged by a relatively late start in basic education, when compared to India, Peru and Vietnam; and that lower levels of schooling in Ethiopia at least in part explain relatively low levels of skill acquisition for many children in that country. In relation to cognitive skills that could be compared more generally, we find that the gap between countries on basic skills of literacy and numeracy narrows by age 12 when compared to age 8, with a majority of pupils achieving a basic minimum skill level across all countries. But where the measure of skills extends beyond a basic minimum, and especially after age 12, the gap between Vietnam and the other three countries widens considerably, while that between India and Ethiopia narrows, although pupils attending private schools in India achieve slightly higher skills outcomes. These differences suggest possible differences in schooling quality at the different ages, which may be explored using future Young Lives data.

Variation within countries is also important however, and differences in skills between the most and least advantaged socio-economic groups and also between more and less advantaged sites are large in all countries. At the household level, wealth and caregiver literacy are important predictors of skill-levels, especially when significant numbers of children have yet to enrol or when significant numbers are beginning to leave school, as is the case around age 15. Notwithstanding possible differences in school quality and experience, the household economy of course remains important where initial enrolment and subsequent progression decisions are concerned, most of all in the poorest contexts. Conversely, however, where access to school is almost universal, we find that schooling may serve to mitigate and even to counterbalance the effects of differences in household level advantage on skill development, suggesting an important policy principle of equalising access, especially across the dimensions of urban and rural and across the spectrum of household wealth and advantage. Expansion of schooling provision in recent years has clearly advanced this principle considerably, but the potential protective and compensatory benefits of schooling for the most vulnerable will depend increasingly upon access to quality education; especially in view of accelerating competition in the market for skills.

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Table A1: Cognitive Skills by Country, Age and Gender

Variable	Observations		Mean		S.D.		Observations		Mean		S.D.	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
	India						Vietnam					
Child reads words or sentences (2002)	497	472	0.612	0.680	0.488	0.467	488	492	0.932	0.911	0.251	0.286
Child reads sentences (2006)	485	467	0.808	0.831	0.394	0.375	488	481	0.965	0.967	0.184	0.180
Child writes (2002)	484	464	0.779	0.838	0.415	0.369	488	491	0.922	0.910	0.268	0.286
Child writes easily (2006)	479	463	0.706	0.702	0.456	0.458	488	480	0.949	0.925	0.221	0.264
Basic Numeracy (2002)	477	460	0.881	0.922	0.325	0.269	373	386	0.869	0.850	0.338	0.358
Numeracy Score (2006)	471	449	298.261	302.212	50.078	49.098	458	449	302.210	297.830	50.798	49.304
Numeracy Score (2006) (raw)	486	467	5.638	5.861	2.255	2.223	489	478	7.493	7.370	1.945	1.900
Numeracy Score (2009)	463	454	297.172	303.097	13.901	15.441	469	454	302.103	297.757	14.492	15.262
Numeracy Score (2009) (raw)	484	466	4.713	6.358	3.638	4.230	485	473	14.868	13.281	6.029	6.324
Cognitive Score (2006)	467	435	297.122	303.305	50.083	49.125	467	457	299.929	299.786	51.065	49.514
Cognitive Score (2009)	446	424	296.736	303.508	14.461	14.765	478	468	300.159	299.509	14.859	15.198
	Peru						Ethiopia					
Child reads words or sentences (2002)	311	365	0.842	0.860	0.365	0.347	473	492	0.285	0.246	0.452	0.431
Child reads sentences (2006)	315	368	0.968	0.965	0.176	0.185	462	484	0.636	0.579	0.482	0.494
Child writes (2002)	316	373	0.889	0.858	0.314	0.350	470	493	0.417	0.444	0.494	0.497
Child writes easily (2006)	315	367	0.879	0.837	0.326	0.370	455	477	0.545	0.581	0.499	0.494
Basic Numeracy (2002)	226	291	0.730	0.756	0.445	0.430	347	382	0.395	0.471	0.490	0.500
Numeracy Score (2006)	316	367	281.770	280.547	85.636	89.222	382	390	298.100	302.538	47.924	51.594
Numeracy Score (2006) (raw)	312	364	5.753	5.755	1.757	1.790	458	470	4.779	5.026	2.458	2.449
Numeracy Score (2009)	306	346	300.108	299.805	13.756	16.066	403	410	297.394	302.599	14.409	15.079
Numeracy Score (2009) (raw)	311	353	11.408	11.391	4.586	5.087	463	487	3.667	4.745	3.803	4.544
Cognitive Score (2006)	295	346	300.618	299.474	45.955	53.268	452	479	75.480	76.299	26.107	26.447
Cognitive Score (2009)	302	348	298.658	301.142	14.167	15.452	458	482	122.413	126.110	28.231	28.388

Source: Young Lives data

Table A2: Variable definitions and descriptive statistics

Variable	Definition	Ethiopia		India		Peru		Vietnam	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Child Characteristics									
Sex (male)	Child is male	0.512	0.016	0.489	0.016	0.541	0.019	0.499	0.016
Age in months	Child's age in months	94.528	0.112	95.744	0.122	95.143	0.150	95.678	0.104
Child is Kinh	Child is Kinh							0.872	0.011
Child is 'Other Caste'	Child is Other Caste			0.205	0.013				
Child's first language is Spanish	Child's first language is Spanish					0.882	0.012		
Height for age (2002)	Child's height for age in 2002	-1.478	0.042	-1.576	0.034	-1.411	0.038	-1.466	0.031
Height for age (2006)	Child's height for age in 2006	-1.395	0.041	-1.646	0.540	-1.528	0.044	-1.468	0.035
Attended school (2002)	Child attended school in 2002	0.668	0.015	0.997	0.002	0.994	0.003	0.988	0.003
Years of schooling (2006)	Child's years of schooling in 2006	3.615	0.0672	6.511	0.031	7.407	0.055	5.590	0.025
Years of schooling (2009)	Child's years of schooling in 2009	6.447	0.075	8.769	0.056	9.939	0.058	8.343	0.037
Attended private school (2006)	Child attended private school in 2006			0.237	0.014				
Attended private school (2009)	Child attended private school in 2009			0.270	0.014				
Self-esteem (2006)	Child's score on self-esteem scale in 2006	0.000	0.030	0.000	0.026	0.000	0.033	0.000	0.029
Self-esteem (2009)	Child's score on self-esteem scale in 2009	0.000	0.029	0.000	0.028	0.000	0.032	0.000	0.029
Household characteristics									
Wealth index (2002)	Index of household wealth in 2002	0.176	0.005	0.345	0.007	0.512	0.008	0.444	0.007
Wealth index (2006)	Index of household wealth in 2006	0.157	0.004	0.333	0.006	0.540	0.008	0.461	0.005
Caregiver can read	Ability of caregiver to read a newspaper in the local language	0.299	0.015	0.313	0.015	0.858	0.013	0.887	0.010
Child Outcomes									
Child reads words or sentences (2002)	Child can read words or sentences (2002)	0.265	0.014	0.645	0.015	0.852	0.014	0.921	0.009
Child reads sentences (2006)	Child can read sentences (2006)	0.607	0.016	0.819	0.012	0.966	0.007	0.966	0.006
Child writes (2002)	Child can write, even with difficulty (2002)	0.431	0.016	0.808	0.013	0.872	0.013	0.916	0.009
Child writes easily (2006)	Child can write easily (2006)	0.563	0.016	0.704	0.015	0.856	0.013	0.937	0.008
Basic Numeracy (2002)	Child can answer a basic calculation (2002)	0.435	0.018	0.901	0.010	0.745	0.019	0.859	0.013
Numeracy Score (2006)	Child's score on a 10-question math test (2006)	300.342	1.793	300.189	1.636	281.113	3.349	300.042	1.663
Numeracy Score (2009)	Child's score on a 30-question math test (2009)	300.019	0.525	300.106	0.494	299.947	0.588	299.966	0.495
Cognitive Score (2006)	Child's rasch score on the PPVT (2006)*	75.901	0.861	300.104	1.655	300.000	1.975	299.858	1.654
Cognitive Score (2009)	Child's rasch score on the PPVT (2009)*	124.309	0.925	300.036	0.508	299.989	0.585	299.937	0.488

*For Ethiopia, the raw score is reported

Table A3 Numeracy: Ethiopia

VARIABLES	(1) age 7-8 (2002) Basic Calculation	(2) age 11-12 (2006) Numeracy	(3) age 14-15 (2009) Maths
Sex (male)	0.125	8.015	5.624
	(2.98)***	(1.68)	(5.65)***
Age in months (2002)	0.014	0.372	0.123
	(2.24)**	(0.79)	(0.88)
Height for Age (2002)	0.062	-1.021	
	(3.37)***	(-0.57)	
Height for Age (2006)			0.234
			(0.50)
Attended School (2002)	0.320		
	(5.26)***		
Years of Schooling (2006)		11.051	
		(7.64)***	
Years of Schooling (2009)			1.009
			(2.37)**
Basic Numeracy (2002)		10.181	
		(3.05)***	
Numeracy score (2006)			0.121
			(10.94)***
Self esteem (2006)			0.653
			(1.14)
Wealth index (2002)	0.370	12.047	
	(1.81)*	(0.87)	
Wealth index (2006)			9.874
			(1.73)
Caregiver can read	0.073	13.593	-0.085
	(1.46)	(2.89)***	(-0.08)
Observations	695	556	679
R-squared/pseudo R-squared	0.225	0.183	0.291

t/z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A4 Numeracy: India (excluding attendance at private school)

VARIABLES	(1) age 7-8 (2002) Basic Calculation	(2) age 11-12 (2006) Numeracy	(3) age 14-15 (2009) Maths
Sex (male)	0.043	3.972	5.987
	(2.48)**	(1.07)	(4.95)***
Age in months (2002)	0.005	-1.719	-0.013
	(2.06)**	(-4.31)***	(-0.10)
Child is 'Other Caste'	0.001	9.200	1.388
	(0.05)	(2.20)**	(1.02)
Height for Age (2002)	0.012	2.017	
	(1.61)	(1.14)	
Height for Age (2006)			0.215
			(0.80)
Years of Schooling (2006)		18.029	
		(7.03)***	
Years of Schooling (2009)			0.893
			(1.96)*
Basic Numeracy (2002)		18.094	
		(3.41)***	
Numeracy score (2006)			0.140
			(8.19)***
Self esteem (2006)			2.072
			(3.16)***
Wealth index (2002)	0.110	12.769	
	(1.69)*	(0.98)	
Wealth index (2006)			10.105
			(4.06)***
Caregiver can read	0.061	5.096	3.828
	(2.77)***	(1.44)	(4.05)***
Observations	874	869	756
R-squared/pseudo R-squared	0.177	0.184	0.315

t/z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A5 Numeracy: India (including attendance at private school)

VARIABLES	(1) age 7-8 (2002) Basic Calculation	(2) age 11-12 (2006) Numeracy	(3) age 14-15 (2009) Maths
Sex (male)	0.043	3.193	5.563
	(2.48)**	(0.85)	(4.55)***
Age in months (2002)	0.005	-1.728	-0.006
	(2.06)**	(-4.39)***	(-0.05)
Child is 'Other Caste'	0.001	7.713	0.975
	(0.05)	(1.92)*	(0.72)
Height for Age (2002)	0.012	1.759	
	(1.61)	(0.96)	
Height for Age (2006)			0.214
			(0.76)
Years of Schooling (2006)		18.021	
		(7.03)***	
Years of Schooling (2009)			0.751
			(1.63)
Attended private school (2006)		10.986	
		(2.51)**	
Attended private school (2009)			3.787
			(3.03)***
Basic Numeracy (2002)		17.626	
		(3.25)***	
Numeracy score (2006)			0.136
			(7.76)***
Self esteem (2006)			1.667
			(2.47)**
Wealth index (2002)	0.110	6.514	
	(1.69)*	(0.48)	
Wealth index (2006)			7.474
			(2.82)**
Caregiver can read	0.061	3.263	3.243
	(2.77)***	(0.88)	(3.64)***
Observations	874	869	756
R-squared/pseudo R-squared	0.177	0.191	0.324

t/z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6 Numeracy: Peru

VARIABLES	(1) age 7-8 (2002) Basic Calculation	(2) age 11-12 (2006) Numeracy	(3) age 14-15 (2009) Maths
Sex (male)	0.046	-5.602	-0.717
	(1.13)	(-0.84)	(-0.67)
Age in months (2002)	0.020	-0.411	0.005
	(3.77)***	(-0.76)	(0.03)
Child's first language is Spanish	0.092	103.643	4.200
	(0.64)	(14.50)***	(1.41)
Height for Age (2002)	0.085	-0.997	
	(3.90)***	(-0.30)	
Height for Age (2006)			1.057
			(2.13)**
Years of Schooling (2006)		0.068	
		(0.02)	
Years of Schooling (2009)			1.818
			(3.59)***
Basic Numeracy (2002)		6.052	
		(1.03)	
Numeracy score (2006)			0.003
			(0.21)
Self esteem (2006)			2.064
			(2.08)*
Wealth index (2002)	0.524	27.376	
	(3.92)***	(2.61)**	
Wealth index (2006)			11.482
			(2.89)***
Caregiver can read	-0.037	13.964	0.961
	(-0.55)	(1.64)	(0.62)
Observations	492	491	630
R-squared/ pseudo R-squared	0.161	0.089	0.114

t/z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A7 Numeracy: Vietnam

VARIABLES	(1) age 7-8 (2002) Basic Calculation	(2) age 11-12 (2006) Numeracy	(3) age 14-15 (2009) Maths
Sex (male)	-0.013	-2.881	-2.551
	(-0.57)	(-0.93)	(-3.09)***
Age in months (2002)	0.019	0.029	-0.298
	(4.94)***	(0.04)	(-1.68)
Height for Age (2002)	0.038	6.127	
	(2.68)***	(3.03)***	
Height for Age (2006)			1.004
			(2.19)**
Years of Schooling (2006)		13.333	
		(2.27)**	
Years of Schooling (2009)			2.136
			(3.55)***
Basic Numeracy (2002)		12.305	
		(1.57)	
Numeracy score (2006)			0.112
			(7.80)***
Self esteem (2006)			1.732
			(4.17)***
Wealth index (2002)	0.253	24.682	
	(2.83)***	(1.59)	
Wealth index (2006)			9.744
			(3.41)***
Caregiver can read	0.111	20.446	-0.074
	(1.96)*	(2.34)**	(-0.05)
Child is Kinh	0.062	16.138	2.470
	(0.91)	(1.04)	(1.28)
Observations	624	612	775
R-squared/ pseudo R-squared	0.173	0.095	0.284

t/z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A8 Reading and Writing: Ethiopia

VARIABLES	(1) age 7-8 (2002) Basic Reading	(2) age 7-8 (2002) Basic Writing	(3) age 11-12 (2006) Basic Reading	(4) age 11-12 (2006) Basic Writing
Sex (male)	-0.011	0.096	-0.035	0.081
	(-0.43)	(2.45)**	(-0.97)	(2.08)**
Age in months (2002)	0.004	0.004	-0.000	-0.002
	(1.05)	(0.65)	(-0.06)	(-0.34)
Height for Age (2002)	0.036	0.075	0.009	0.010
	(2.97)***	(4.20)***	(0.57)	(0.61)
Attended School (2002)	0.283	0.459		
	(6.20)***	(9.33)***		
Years of Schooling (2006)			0.111	0.114
			(7.63)***	(7.56)***
Child reads words or sentences (2002)			0.074	
			(1.21)	
Child writes (2002)				0.088
				(1.78)*
Wealth index (2002)	0.182	0.457	0.199	0.020
	(1.45)	(2.12)**	(0.96)	(0.09)
Caregiver can read	0.071	0.068	-0.014	0.006
	(2.23)**	(1.39)	(-0.29)	(0.11)
Observations	815	910	892	876
Pseudo R-squared	0.450	0.390	0.235	0.273

z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A9 Reading and Writing: India (excluding attendance at private school)

VARIABLES	(1) age 7-8 (2002) Basic Reading	(2) age 7-8 (2002) Basic Writing	(3) age 11-12 (2006) Basic Reading	(4) age 11-12 (2006) Basic Writing
Sex (male)	0.080	0.070	0.010	0.017
	(2.46)**	(2.76)***	(0.45)	(0.53)
Age in months (2002)	0.016	0.007	-0.011	-0.014
	(3.57)***	(2.14)**	(-3.32)***	(-2.91)***
Child is 'Other Caste'	0.143	0.067	-0.045	-0.054
	(3.25)***	(1.93)*	(-1.30)	(-1.17)
Height for Age (2002)	0.027	0.015	0.006	0.008
	(1.74)*	(1.22)	(0.59)	(0.55)
Attended School (2002)	0.278	0.196		
	(0.89)	(0.75)		
Years of Schooling (2006)			0.085	0.100
			(5.89)***	(4.50)***
Child reads words or sentences (2002)			0.112	
			(4.12)***	
Child writes (2002)				0.158
				(3.48)***
Wealth index (2002)	0.437	0.347	0.075	0.313
	(3.72)***	(3.72)***	(0.87)	(2.69)***
Caregiver can read	0.072	0.060	0.082	0.098
	(1.73)*	(1.82)*	(2.82)***	(2.41)**
Observations	953	888	925	895
Pseudo R-squared	0.118	0.141	0.156	0.184

t/z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A10 Reading and Writing: India (including attendance at private school)

VARIABLES	(1) age 7-8 (2002) Basic Reading	(2) age 7-8 (2002) Basic Writing	(3) age 11-12 (2006) Basic Reading	(4) age 11-12 (2006) Basic Writing
Sex (male)	0.080	0.070	0.005	0.011
	(2.46)**	(2.76)***	(0.22)	(0.35)
Age in months (2002)	0.016	0.007	-0.011	-0.013
	(3.57)***	(2.14)**	(-3.29)***	(-2.89)***
Child is 'Other Caste'	0.143	0.067	-0.051	-0.064
	(3.25)***	(1.93)*	(-1.48)	(-1.37)
Height for Age (2002)	0.027	0.015	0.006	0.008
	(1.74)*	(1.22)	(0.56)	(0.51)
Years of Schooling (2006)			0.084	0.100
			(5.89)***	(4.48)***
Attended private school (2006)			0.062	0.075
			(1.82)*	(1.53)
Child reads words or sentences (2002)			0.106	
			(3.95)***	
Child writes (2002)				0.153
				(3.38)***
Wealth index (2002)	0.437	0.347	0.046	0.280
	(3.72)***	(3.72)***	(0.53)	(2.37)**
Caregiver can read	0.072	0.060	0.072	0.086
	(1.73)*	(1.82)*	(2.43)**	(2.09)**
Observations	953	888	925	895
Pseudo R-squared	0.118	0.141	0.160	0.186

z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A11 Reading and Writing: Peru

VARIABLES	(1) age 7-8 (2002) Basic Reading	(2) age 7-8 (2002) Basic Writing	(3) age 11-12 (2006) Basic Reading	(4) age 11-12 (2006) Basic Writing
Sex (male)	0.005	-0.034	-0.004	-0.044
	(0.16)	(-1.31)	(-0.93)	(-1.58)
Age in months (2002)	0.004	0.009	-0.000	-0.000
	(1.16)	(2.63)***	(-0.08)	(-0.02)
Child's first language is Spanish	0.097	0.136	0.024	0.143
	(1.33)	(1.93)*	(1.53)	(1.81)*
Height for Age (2002)	0.014	0.023	0.001	0.022
	(0.90)	(1.65)*	(0.53)	(1.40)
Attended School (2002)		0.052		
		(0.27)		
Years of Schooling (2006)			0.001	0.019
			(0.86)	(1.59)
Child reads words or sentences (2002)			0.048	
			(3.11)***	
Child writes (2002)				0.163
				(3.59)***
Wealth index (2002)	0.332	0.126	0.006	0.082
	(3.40)***	(1.53)	(0.51)	(0.90)
Caregiver can read	0.111	0.077	0.003	0.047
	(2.13)**	(1.76)*	(0.44)	(1.04)
Observations	567	606	333	610
Pseudo R-squared	0.177	0.149	0.292	0.153

z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A12 Reading and Writing: Vietnam

VARIABLES	(1) age 7-8 (2002) Basic Reading	(2) age 7-8 (2002) Basic Writing	(3) age 11-12 (2006) Basic Reading	(4) age 11-12 (2006) Basic Writing
Sex (male)	-0.001	0.009	-0.000	-0.010
	(-0.13)	(1.06)	(-0.25)	(-3.13)***
Age in months (2002)	-0.000	0.000	-0.000	-0.001
	(-0.24)	(0.31)	(-1.66)*	(-1.11)
Child is Kinh	0.016	0.009	0.893	0.987
	(0.75)	(0.52)	(1.37)	(1.89)*
Height for Age (2002)	0.013	0.020	0.000	-0.000
	(3.01)***	(4.28)***	(1.19)	(-0.06)
Years of Schooling (2006)			0.000	0.008
			(2.73)***	(4.23)***
Child reads words or sentences (2002)			0.050	
			(4.07)***	
Child writes (2002)				0.110
				(4.07)***
Wealth index (2002)	0.105	0.068	-0.002	0.007
	(3.15)***	(2.18)**	(-1.80)*	(0.58)
Caregiver can read	0.088	0.112	0.001	0.008
	(3.52)***	(4.17)***	(0.98)	(0.92)
Observations	648	647	523	707
Pseudo R-squared	0.414	0.466	0.498	0.378

z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A13 Cognitive Skill: Ethiopia

VARIABLES	(1) age 11-12 (2006)	(2) age 14-15 (2009)
Sex (male)	2.423	6.111
	(0.99)	(3.41)***
Age in months (2002)	0.414	-0.282
	(2.34)**	(-1.33)
Height for Age (2002)	0.787	
	(1.25)	
Height for Age (2006)		-0.522
		(-0.68)
Years of Schooling (2006)	2.644	
	(3.90)***	
Years of Schooling (2009)		4.540
		(9.53)***
Child reads words or sentences (2002)	5.586	
	(2.15)**	
Cognitive Score (2006)		0.173
		(4.80)***
Self esteem (2006)		-0.137
		(-0.13)
Wealth index (2002)	14.130	
	(2.14)**	
Wealth index (2006)		12.914
		(1.91)*
Caregiver can read	2.756	2.341
	(1.69)	(1.40)
Observations	876	793
R-squared	0.092	0.173

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A14 Cognitive Skill: India (excluding attendance at private school)

VARIABLES	(1) age 11-12 (2006)	(2) age 14-15 (2009)
Sex (male)	7.336	5.018
	(3.06)***	(4.10)***
Age in months (2002)	-0.326	-0.113
	(-0.71)	(-0.86)
Child is 'Other Caste'	0.594	2.261
	(0.14)	(1.38)
Height for Age (2002)	2.779	
	(2.49)**	
Height for Age (2006)		0.320
		(1.62)
Years of Schooling (2006)	9.224	
	(5.35)***	
Years of Schooling (2009)		1.232
		(2.71)**
Child reads words or sentences (2002)	16.424	
	(6.27)***	
Cognitive Score (2006)		0.147
		(13.66)***
Self esteem (2006)		0.597
		(0.85)
Wealth index (2002)	28.165	
	(2.93)***	
Wealth index (2006)		0.949
		(0.30)
Caregiver can read	8.202	4.334
	(2.58)**	(3.37)***
Observations	870	709
R-squared	0.146	0.336

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A15 Cognitive Skill: India (including attendance at private school)

VARIABLES	(1) age 11-12 (2006)	(2) age 14-15 (2009)
Sex (male)	6.561	4.787
	(2.81)**	(4.05)***
Age in months (2002)	-0.320	-0.107
	(-0.72)	(-0.81)
Child is 'Other Caste'	-0.735	2.059
	(-0.17)	(1.25)
Height for Age (2002)	2.560	
	(2.30)**	
Height for Age (2006)		0.325
		(1.57)
Years of Schooling (2006)	9.245	
	(5.35)***	
Years of Schooling (2009)		1.145
		(2.49)**
Attended private school (2006)	10.603	
	(2.15)**	
Attended private school (2009)		2.295
		(2.29)**
Child reads words or sentences (2002)	15.841	
	(5.85)***	
Cognitive Score (2006)		0.145
		(13.32)***
Self esteem (2006)		0.362
		(0.50)
Wealth index (2002)	22.394	
	(2.27)**	
Wealth index (2006)		-0.602
		(-0.20)
Caregiver can read	6.485	4.013
	(2.00)*	(3.20)***
Observations	870	709
R-squared	0.153	0.340

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A16 Cognitive Skill: Peru

VARIABLES	(1) age 11-12 (2006)	(2) age 14-15 (2009)
Sex (male)	-3.402	2.178
	(-0.97)	(2.36)**
Age in months (2002)	0.225	0.014
	(0.49)	(0.11)
Child's first language is Spanish	14.490	2.815
	(1.46)	(1.10)
Height for Age (2002)	2.407	
	(1.36)	
Height for Age (2006)		1.150
		(2.53)**
Years of Schooling (2006)	0.234	
	(0.14)	
Years of Schooling (2009)		1.239
		(3.79)***
Child reads words or sentences (2002)	18.910	
	(2.20)**	
Cognitive Score (2006)		0.021
		(1.04)
Self esteem (2006)		2.374
		(3.39)***
Wealth index (2002)	22.013	
	(2.48)**	
Wealth index (2006)		15.384
		(4.38)***
Caregiver can read	6.111	-0.396
	(0.79)	(-0.17)
Observations	603	589
R-squared	0.057	0.156

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A17 Cognitive Skill: Vietnam

VARIABLES	(1) age 11-12 (2006)	(2) age 14-15 (2009)
Sex (male)	2.991	0.411
	(1.25)	(0.61)
Age in months (2002)	0.437	-0.283
	(0.83)	(-1.47)
Height for Age (2002)	5.983	
	(3.41)***	
Height for Age (2006)		1.124
		(3.29)***
Years of Schooling (2006)	12.532	
	(3.95)***	
Years of Schooling (2009)		2.374
		(3.38)***
Child reads words or sentences (2002)	31.660	
	(3.40)***	
Cognitive Score (2006)		0.089
		(6.59)***
Self esteem (2006)		0.026
		(0.07)
Wealth index (2002)	38.119	
	(4.52)***	
Wealth index (2006)		6.997
		(1.79)*
Caregiver can read	22.654	3.401
	(3.76)***	(1.42)
Child is Kinh	17.504	4.877
	(2.52)**	(2.74)**
Observations	781	786
R-squared	0.263	0.240

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1