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Cognitive Abilities in *Young Lives*: An Overview of Results from Ethiopia, India, Peru and Vietnam

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This paper compiles cognitive test results for children in Ethiopia, Andhra Pradesh (India), Peru and Vietnam from multiple rounds of the Young Lives study. In this international project, the same cognitive tests were administered to children of the same age under standardized conditions, allowing comparisons between countries and between social, ethnic, linguistic and religious groups within countries. Comparisons between countries on non-verbal tests show differences that closely resemble those that have been seen in earlier assessments of scholastic achievement and intelligence. Within each of the four countries there are significant differences between social, ethnic, linguistic and in some cases religious groups that are related to socio-economic conditions. These results have implications for the management of inequalities that have either been present for a long time or that arise in developing countries during the process of modernization.
Key Words: Intelligence; School achievement; Young Lives

Several data sets are available for comparative studies of cognitive abilities in countries. One type of data consists of results from standardized scholastic achievement tests that have been administered to school children in multiple countries. The most useful of these are the PISA (Programme of International

Student Assessment) tests, which are organized by the OECD but include a number of non-OECD countries as well (oecd.org/pisa). This program has assessed mathematics, science and reading skills of 15-year-olds in a 3-year cycle since 2000. Several other international assessment programs have been performed, either with global reach or limited to specific regions such as Africa or Latin America. The results of these have been summarized in Meisenberg & Lynn (2011) and Altinok, Angrist and Patinos (2018).

Nations can also be compared on standardized intelligence tests such as the Wechsler and Raven tests, which have been administered in many countries. For international comparisons, the raw scores from these tests are scaled to a mean of 100 and standard deviation of 15 for Britain. These are designated as British IQs (Lynn & Vanhanen, 2012) or "Greenwich IQs". When country-level averages on these tests are compared with the country scores on scholastic assessment tests such as PISA, correlations are on the order of .90. This shows that these two types of test measure closely related constructs at the country level (Meisenberg & Lynn, 2011).

Tracking these cognitive measures at the country level is considered important because cognitive skills are not only important predictors of individual success in the labor market (Schmidt & Hunter, 2004). They also predict the economic efficiency of countries. No matter whether it is measured with intelligence tests or school achievement tests, country-level cognitive ability predicts the rate of economic growth or at least has done so in the recent past (e.g., Meisenberg, 2014; Weede & Kämpf, 2002).

Many additional correlates of country-level intelligence have been documented in Lynn and Vanhanen (2012) and other sources. In addition to "economic sophistication" (Kodila-Tedika & Asongu, 2016; Lapatinas & Litina, 2018) and general development indicators such as educational degrees, literacy rates, infant mortality and life expectancy (Kirkegaard, 2014), these country-level correlates of cognitive ability include a large variety of more specific outcomes, including positive relationships with institutional quality (Kanyama, 2014), innovation rates (Gelade, 2008) and redistributive policies (Salahodjaev & Kanazawa, 2018), and negative relationships with homicide rate (Burhan et al., 2014), fertility rate (Meisenberg, 2009), the importance of religion in society (Lynn, Harvey & Nyborg, 2009), and a place on the failed states index (Voracek, 2013). Thus cognitive ability is a development indicator that co-varies with other indicators of economic and social development. Correlation does not prove causation, but it is plausible that the cognitive abilities of the population are not only a consequence, but also an important driving force for economic and social developments. It is this hypothesized causal effect of cognitive ability on multiple

outcomes that motivates studies of intelligence in countries. If cognitive ability is indeed causally effective, cognitive abilities measured in children and adolescents today will predict economic and social developments up to four or five decades into the future, when these children will be adults who are shaping the world in which they live.

Measures of the overlapping constructs of cognitive ability, intelligence and school achievement are related to important outcomes at the subnational as well as the national level, which parallel the IQ correlates at the national level. Results from studies at the level of provinces or districts within many countries have been summarized by Lynn, Fuerst and Kirkegaard (2018). In addition to these geographical differences, it is also well established that in many cases different ethnic, racial, religious and social groups living in the same country differ in their average scores on cognitive tests; and as in the case of differences between countries, provinces and smaller geographical units, these cognitive differences between population groups are associated with social and economic differences (e.g., Lynn, 2006).

One reservation about country-level IQ data is that they have been computed from a large number of disparate studies, performed by different investigators using different tests with subjects of different ages at different times, and each with its own selection biases. In most of these studies the samples are not fully representative of the national population. Very few studies have attempted to compile IQ data from multiple countries using the same test administered to samples recruited with the same selection criteria. A notable exception is a study by Flores-Mendoza et al. (2015), which administered Raven's Progressive Matrices to samples in six Latin American countries and Spain.

Importantly, the quality of available cognitive test data tends to be poor in less developed countries. Of the countries included in the present report neither Ethiopia nor India participated in any of the major international assessments of scholastic achievement; and results from IQ tests suffer from poor representativeness of the samples. This is especially serious in countries with incomplete school enrolment, where results from school-based samples routinely overestimate the average cognitive level in the country because children who are not in school are not included. Also, less developed countries may have substantial differences in average cognitive ability between different parts of the country and different social or ethnic groups.

The present paper contributes to filling this gap by summarizing results from the Young Lives project, a longitudinal cohort study about effects of childhood poverty that covers four low-income countries: Ethiopia, India, Peru, and Vietnam. It is co-ordinated by the University of Oxford's Department of International

Development with partners from leading national research institutes, government statistics departments, and Save the Children. Importantly, recruitment of the samples is not school-based, but based on age cohorts. Therefore children not enrolled in school were included. Several cognitive tests were administered in this project. Some of these were identical for all four countries, allowing comparisons between countries in equivalent cohorts of children. Other comparisons are possible between ethnic, social and religious groups within each of the four countries. Results from this project have been published in several dozen academic publications and more than 100 working papers. Some results about cognitive test scores of minority groups in the four countries have been reported by Arouri, Ben-Youssef & Nguyen (2016).

The present paper compiles the major results from the cognitive test administrations with regard to country averages and the averages of subgroups within countries. It has two aims: (1) determining whether the relative levels of cognitive ability that had been reported in Lynn and Vanhanen (2012) for these four countries are reproduced in the Young Lives study; and (2) determining whether there are differences in average cognitive test performance between salient ethnic, religious or social groups within the countries. The prediction is that average cognitive test scores co-vary with the economic development of countries and that within countries, more prosperous and modernized sections of the population achieve higher test scores than more traditional ones and those with lesser socio-economic development.

Methods

The Young Lives data were obtained from the UK Data Service (https://www.ukdataservice.ac.uk/), where the data from this project are publicly archived.

Subjects

The Young Lives data-set contains information on two cohorts of children from four low and middle-income countries: Ethiopia, India, Peru and Vietnam. One cohort was born in 1994/95 while the other was born in 2001/02. It started in 2002, when 2000 younger children aged 6-18 months and 1000 older children aged 7 or 8 years were enrolled in each of the four countries. Differences in average age of the children in different countries did not exceed 2 months (Barnett et al., 2012). Survey data were collected in five waves: 2002, 2006–07, 2009–10, 2013-14, and 2016 (www.younglives.org.uk). Sampling was done at 20 sentinel sites within each country, covering both urban and rural areas, with oversampling of sites covering poor areas. In India, the study area was limited to the state of

Andhra Pradesh. Although the project's objective is to study the implications of childhood poverty, the socio-economic backgrounds of the children enrolled in the study were not atypical. According to the project administrators, "The comparisons of several living standard indicators (e.g., access to public services and caregiver's education) showed that the samples in Young Lives were similar to nationally representative samples in Peru, slightly poorer in Vietnam and slightly better off in Ethiopia and India." (Barnett et al., 2012, p. 703). The current study draws on data from the first three waves when children of the two cohorts were 5-15 years old.

Cognitive tests

Several tests were administered to the children during these three waves of the survey:

1. Raven's Coloured Progressive Matrices (CPM)

This test was used only with the older cohort in 2002, when the children were 8 years old. The test consists of 36 items, each in the form of a figurative matrix in which the child has to fill in a blank (Raven, 2008). Being a non-verbal reasoning test, the CPM was used without country-specific adaptations. Therefore the results can be compared directly between the four countries, as well as between subgroups within countries.

2. Peabody Picture Vocabulary Test (PPVT)

The PPVT is a test of receptive vocabulary that was used in rounds 2 and 3 of Young Lives. The version of the PPVT used in Ethiopia, India and Vietnam was based on the 204-item PPVT-III. The 125-item Spanish version of the PPVT was used in Peru. Children of the older cohort were tested with the PPVT in 2006 at the age of 12 years, and 2009 at the age of 15 years. Children of the younger cohort were tested with the PPVT in 2006 and 2009, at the age of 5 and 8 years respectively. Importantly, adaptations to the test made by the project administrators make it impossible to compare results across countries. According to the technical report of the project (Cueto & León, 2012, p. 6), "…we wanted to use a combination of the plates used in both versions of the PPVT (which consists of four pictures presented on a board for the child to choose the one that corresponds to the word read to him/her) to create local versions of the PPVT." However, the test can be used for comparisons between groups within countries that speak the same language.

3. Mathematics

A mathematics test was used with the older cohort in 2006 and 2009, when the children were 12 and 15 years old. The younger cohort was administered the Cognitive Development Assessment-Quantitative (CDA-Q) Test, a 15-item quantitative (pre-math) test, in 2006 at the age of 5 years, and a 29-item math test in 2009 at the age of 8 years (Cueto & León, 2012, p. 8).

4. Cloze test

This type of test assesses verbal/reading ability by asking the subject to read a sentence or short paragraph that lacks one or a few words, and to fill in the blanks with appropriate words.

The properties of the cognitive tests used in the study and, importantly, the adaptations of these tests made by the researchers, are described in Cueto and Leon (2012). In general, only the CPM and the mathematics/quantitative tests are comparable across countries because the verbal tests were heavily adapted to different languages and countries.

Results

1. Comparisons between countries

The country comparisons depend on the Colored Progressive Matrices (CPM) and mathematics tests, which were essentially the same in all four countries, unlike the extensively adapted verbal tests. The results are summarized in Table 1. Of these, the CPM was used only once, for 8-year-olds in the older cohort in 2002. Row 1 of Table 1 shows the mean scores. In all four countries, the scores are low by Western standards. According to the British 2007 standardization, the average raw score of 16.8 (out of 36) in Ethiopia corresponds to an IQ of 65.5. Even the highest country score, of 23.0 in India, calculates as an IQ of only 81 (Raven, 2008, Table A.1). However, CPM scores of lower-scoring children have risen massively in Britain during the 25 years before the 2007 standardization (Lynn, 2009). When scaled according to 1982 British norms, the CPM IQ in Young Lives is 82 in Ethiopia and 97.5 in India (Raven, Raven & Court, 1998, Table CPM9). Calculated for the year 2002, the average IQ is 68.8 in Ethiopia and 84.3 in India. These are rather close to the estimates of 68.5 for Ethiopia and 82.2 for India in Lynn and Vanhanen (2012).

Table 1 shows that the country ranking on the CPM is India > Peru > Vietnam > Ethiopia. The low score for Vietnam is anomalous because according to Lynn and Vanhanen (2012) the average IQ in Vietnam is estimated as 94, higher than in Peru (84.2), India (82.2), and Ethiopia (68.5). However, in most countries the

CPM test was administered to only part of the total cohort of about 1,000 children: 245 in Ethiopia, 1003 in India, 707 in Peru, and 209 in Vietnam. Therefore it is possible that the tested children are not fully representative of the total sample, especially in Ethiopia and Vietnam.

The only other tests that can be compared meaningfully between the countries are those of quantitative reasoning and mathematics. Unlike the CPM, these tests were constructed ad hoc and have no established norms that could be converted into an IQ score. As shown in row 2 of Table 1, differences between countries were small in pre-schoolers tested with the CDA-Q at the age of 5 years. The largest difference, between Peru and Vietnam, is about 0.64 standard deviations equivalent to 9.6 IQ points. At age 8 and above, however, the country rankings on the mathematics tests correspond very closely to the IQ estimates in Lynn and Vanhanen (2012), with Ethiopia lowest, Vietnam highest, and India and Peru in between. The size of the country differences is now larger. The difference between Ethiopia and Vietnam is 2.1 standard deviations (31.5 IQ points) at age 8, 1.16 (17.4 IQ points) at age 12, and 1.99 (29.9 IQ points) at age 16.

Table 1. *Results for cognitive tests administered to the children of the Young Lives study. CPM, Coloured Progressive Matrices; CDA-Q = Cognitive Development Assessment-Quantitative.*

	Test	Date	Age	Ethiopia	India	Peru	Vietnam	*N*
1	CPM	2002	8	16.79 ± 6.31	23.02 ± 5.33	20.82 ± 8.06	18.72 ± 4.97	209-1003
2	CDA-Q	2006	5	8.24 ± 3.01	9.39 ± 2.60	8.37 ± 2.16	9.79 ± 2.51	1888-1949
3	Math	2009	8	6.59 ± 5.39	12.03 ± 6.42	14.20 ± 5.82	19.40 ± 5.85	1808-1923
4	Math	2006	12	4.90 ± 2.46	5.74 ± 2.26	5.75 ± 1.77	7.44 ± 1.92	676-981
5	Math	2009	15	5.85 ± 4.90	9.47 ± 6.35	13.24 ± 5.63	18.04 ± 7.36	666-950

2. Subgroups within countries

Ethnic and religious subgroups exist in all four Young Lives countries. In the following, we examine differences between those groups that were represented in sufficient numbers to make comparisons meaningful.

2.1. Ethiopia

This is a multi-ethnic country. According to the World Fact Book of the CIA (https://www.cia.gov/library/publications/resources/the-world-factbook/), the largest ethno-linguistic groups are the Oromo (34.4%), Amhara (27%), Somali

(6.2%) and Tigray (6.1%). The largest religious groups are Ethiopian Orthodox (43.5%), Muslim (33.9%), and Protestant (18.5%). Most of the larger groups were represented in the Young Lives sample. The results shown in Table 2 are only for the most numerous ethno-linguistic and religious groups in Young Lives. They are limited to tests of quantitative reasoning and mathematics because the multiple languages spoken by the subjects and difficult-to-compare test adaptations make comparisons on verbal tests problematic.

We see that some differences are statistically significant. Of the three ethno-linguistic groups, the Oromo score lower than the others at age 5, but this reverses at the older ages. Of the religious groups, Orthodox Christians score higher than the other two religions. However, these differences need to be judged by their magnitude rather than their statistical significance. Even the largest group differences in Table 2 are less than one half of a standard deviation, which is small even for sub-national group differences and far smaller than the differences between countries shown in Table 1.

Table 2. *Results on non-verbal tests for the major ethno-linguistic and religious groups in Ethiopia. * p<.05; *** p<.001 in comparison with Oromo and Orthodox, respectively.*

	Age 5 CDA		Age 8 Math		Age 12 Math		Age 15 Math	
	Mean ± SD	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean± SD**	***N***
Amhara	7.99 ± 3.00***	522	7.05 ± 5.50***	508	4.90 ± 2.35	256	6.05 ± 5.07	269
Oromo	8.79 ± 2.72	370	5.54 ± 4.55	362	4.51 ± 2.48	199	5.45 ± 4.78	191
Tigray	7.92 ± 2.98***	406	7.49 ± 5.42***	386	5.59 ± 2.10***	212	6.77 ± 4.95*	211
Orthodox	8.31 ± 2.97	1352	7.01 ± 5.32	1298	5.05 ± 2.34*	686	6.16 ± 5.04	677
Protestant	8.21 ± 3.28	205	6.27 ± 5.62	192	4.45 ± 2.80	101	4.99 ± 4.16*	100
Muslim	7.90 ± 2.89*	294	4.98 ± 5.37***	283	4.56 ± 2.66*	147	5.10 ± 4.58*	146

2.2. India

India has great ethno-linguistic diversity, but caste and religion are as important as ethnic affiliation in social and political life. Castes are primarily social

divisions, although there are small differences in genomic ancestry between them. In Andhra Pradesh, the estimated percentage of "ancestral North Indian" (i.e., West Eurasian) ancestry was estimated as 32% and 34.3% for lower castes, and 43.4% for upper castes (Moorjani et al., 2013).

The Young Lives project was limited to the state of Andhra Pradesh in Central India, and most subjects spoke Telugu, a Dravidian language. However, there were measures of caste and religion on which group comparisons are possible. The Young Lives sample contained sufficient numbers from the categories of scheduled caste (SC), also known as Dalit, Harijan or Untouchables; scheduled tribes (ST), which occupy a similar position to scheduled castes in Hindu society; backward castes (BC); and other castes (OC). Muslims are the only significant religious minority. Tables 3 and 4 show that on most occasions, the "other castes" group scored higher than the other Hindu groups, roughly in parallel to their social status. Some of the differences between the castes are between 0.5 and one standard deviation in size and can be described as moderately large. Hindus scored noticeably higher than Muslims in some test administrations in the older cohort at age 15, although Muslims tended to score higher than Hindus in the younger cohort at age 8. The reasons for these discrepancies are not known.

Table 3. *Differences between castes and religions on non-verbal cognitive tests. SC, scheduled caste; ST, scheduled tribe; BC, backward caste; OC, other caste. $^{*}p<.01$; $^{**}p<.01$; $^{***}p<.001$ in comparison with other caste and Hindu, respectively.*

	Age 5 CDA		Age 8 Math		Age 12 Math		Age 15 Math	
Caste/Rel.	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***
SC	8.87 ± 2.62***	351	11.47 ± 6.34***	343	5.02 ± 2.44***	199	7.14 ± 5.03***	180
ST	9.41 ± 2.62***	244	8.60 ± 5.76***	243	6.57 ± 1.97	97	8.48 ± 5.94***	92
BC	9.26 ± 2.57***	927	12.22 ± 6.22***	916	5.65 ± 2.32***	480	9.63 ± 6.39***	449
OC	10.16 ± 2.49	402	14.18 ± 6.35	398	6.28 ± 1.76	202	11.70 ± 6.72	197
Hindu	9.35 ± 2.60	1765	12.12 ± 6.45	1747	5.75 ± 2.28	904	9.61 ± 6.40	849
Muslim	10.01 ± 2.53**	143	11.14 ± 6.08	138	5.51 ± 2.12	63	7.51 ± 5.39**	59

Table 4. *Differences between castes and religions on verbal tests. For explanations see Table 3.*

	Age 8 PPVT		Age 12 PPVT		Age 15 PPVT		Age 15 Cloze	
Caste/Rel.	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***
SC	57.45 ± 29.29***	342	83.57 ± 24.01***	196	121.57 ± 40.22***	185	9.43 ± 6.23**	175
ST	49.12 ± 23.54***	246	98.97 ± 24.01	98	122.08 ± 38.77***	96	9.61 ± 5.75*	88
BC	57.15 ± 29.28***	915	88.65 ± 24.91***	475	129.19 ± 40.34***	465	10.22 ± 6.31*	436
OC	68.46 ± 35.14	394	96.50 ± 20.17	200	147.21 ± 35.64	196	11.64 ± 6.64	192
Hindu	58.24 ± 30.28	1744	90.00 ± 21.23	61	130.65 ± 40.44	869	10.54 ± 6.34	824
Muslim	62.74 ± 33.20	138	90.16 ± 24.48	897	130.13 ± 38.06	62	6.88 ± 5.57***	56

2.3. Peru

The World Factbook lists Mestizo (60.2%), Amerindian (25.8%), and White (5.9%) as the major ethno-racial groups in Peru. There are two major genetic studies about the genomic ancestry of Peruvians: Sandoval et al. (2013) estimated Peruvian ancestry as 80% Amerindian and only 7.4% European (Sandoval et al., 2013); and Ruiz-Linares et al. (2014) estimated 64% Amerindian and 29% European ancestry. Genomic ancestry and people's own estimates of their ancestry tend to be only moderately related in Latin America. Ruiz-Linares et al. (2014) found that the correlation between people's own estimate of their European and Amerindian ancestry and the estimates from genetic markers is only .48 across several Latin American countries. Therefore distinctions between Native American, Mestizo and White depend on other factors such as place of residence, socio-economic factors, language and visible physical traits, in addition to actual ancestry.

A large majority of subjects in the Young Lives samples are identified as Mestizo, but there are appreciable Native American minorities and some Whites. The Native Americans include two culturally distinct groups. These are the Andean Indians comprised mainly of Quechua and Aymara, and natives of the Amazonian rainforest. Both groups are considered economically disadvantaged relative to the mainly Mestizo mainstream. The results summarized in Tables 5

and 6 are congruent with the economic conditions of the different groups, with the Native American minorities scoring lower than the Mestizo and White groups. The latter two are not much different from each other although the White group scores somewhat lower than the Mestizo in all test administrations. The differences between Andean Indians and Mestizo range between 0.38 (age 16) and 0.61 standard deviations (age 12) on the non-verbal tests. When the Andean Indians are divided into those speaking Spanish as a first language versus those growing up with a native first language, the Spanish speakers score higher at ages of 8 years and above. The differences are large and highly significant ($p<.001$) for the verbal tests at all ages. They are of smaller magnitude for the mathematics tests, where a significance level of $p<.05$ is reached at ages 8 and 15. Thus linguistic background and, by implication, acculturation plays a role in cognitive development even when verbal abilities are not tested explicitly. The small samples of Amazonian Indians score at a level similar to Andean Indians speaking a native language, as is expected based on their relative geographic isolation in the Amazonian rainforest and economic marginalization. A majority in this group spoke Spanish as their first language. The results confirm earlier observations reported by Arteaga and Glewwe (2019).

Table 5. *Results of non-verbal tests with ethnic groups in Peru. QA, Quechua and Aymara; QA_{sp}, QA with Spanish as first language; QA_{ind}, QA with indigenous first language. * $p<.05$; ** $p<.01$; *** $p<.001$.*

	Age 5 CDA		Age 8 Math		Age 12 Math		Age 15 Math	
Ethnicity	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***
Mestizo	8.55 ± 2.07	1518	14.78 ± 5.70	1450	5.98 ± 1.59	531	13.69 ± 5.46	517
White	8.27 ± 2.39	90	13.94 ± 5.83	84	5.52 ± 2.42	27	12.31 ± 5.85	26
QA	7.71 ± 2.26***	286	11.56 ± 5.59***	268	4.90 ± 1.94***	96	11.54 ± 5.92**	94
QA_{sp}	7.72 ± 2.25***	149	13.59 ± 5.20*	136	5.15 ± 2.04**	54	12.75 ± 6.44	51
QA_{ind}	7.69 ± 2.26***	132	9.48 ± 5.15***	128	4.58 ± 1.81***	40	10.05 ± 4.84***	41
Amazon	6.16 ± 2.23***	25	11.88 ± 6.70*	25	3.93 ± 2.40**	15	9.73 ± 6.26*	15

Table 6. *Results of verbal tests with ethnic groups in Peru. For explanations see Table 5.*

	Age 8 PPVT		Age 12 PPVT		Age 15 PPVT		Age 15 Cloze	
Ethnicity	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***
Mestizo	61.25 ± 16.39	1418	74.30 ± 16.61	527	98.59 ± 16.39	506	15.40 ± 5.24	516
White	56.44 ± 18.54*	82	68.00 ± 18.86	26	93.33 ± 21.82	27	14.38 ± 4.95	26
QA	49.23 ± 20.07***	262	66.92 ± 13.78*	97	90.58 ± 17.02***	91	11.50 ± 6.46***	94
QA_{sp}	56.79 ± 19.17*	135	72.70 ± 14.43	54	98.30 ± 16.25	50	14.25 ± 6.00	51
QA_{ind}	41.10 ± 17.87***	124	52.46 ± 8.76***	41	81.49 ± 12.96***	39	8.20 ± 5.47***	41
Amazon	50.80 ± 13.86**	25	55.38 ± 12.62***	16	84.80 ± 18.07*	15	10.00 ± 6.96*	15

2.4. Vietnam

This country has no major religious divisions. According to the World Fact Book, 81.8% of Vietnamese have no religion. This is reflected in the Young Lives samples. In the younger cohort, 1844 out of 1966 are classified as having no religion. There are, however, ethnolinguistic divisions. The Vietnamese-speaking majority, known as the Kinh, comprise 85.7 percent of the total population. Most of the remaining 14.3 percent belong to one or another of 54 officially recognized ethnic minorities. Most of these live in the mountainous northern provinces bordering China, and they have co-ethnics in southern China or trace their recent historical origins to China. The ethnic minorities in the mountainous North and North-West of Vietnam are mainly rural and poor. In the 2006 round of the Vietnam Household Living Standards Survey, 10.3 percent of ethnic Kinh were classified as poor and 3.2 percent as extremely poor. For ethnic minorities these numbers were 52.3 and 29.2 percent, respectively (Dang, 2012). Much of their poverty is attributed to the relative remoteness and inaccessibility of the mountains in which they live (Tran, 2015). In addition, a traditional outlook of these predominantly farming populations is thought to make their integration into the modern Vietnamese economy difficult, and poor education is considered one factor in their backwardness (Baulch et al., 2009).

If education is indeed poor for ethnic minorities in Vietnam, we can predict that this will be reflected in lower scores on cognitive tests. The Young Lives samples contain representatives of most of the major ethnic minorities. To obtain sufficient sample sizes, members of the major northern ethnicities were combined for analysis. These were the H'mong, Nung, Tay, Dao and Giay. Table 7 shows that the ethnic minorities do indeed score lower than the Kinh on the non-verbal tests. The differences are consistent and are substantial in size, ranging from 1.03 to 1.36 standard deviations at different ages. Most minority children in the Young Lives samples grow up with an ethnic first language, but some grow up speaking Vietnamese. As in the case of Peru, those growing up speaking the majority language score higher than those speaking their own ethnic language, even on the non-verbal tests included in Table 7.

Table 7. *Comparisons between Kinh and ethnic minorities in the North of Vietnam. ** p<.01; *** p<.001, compared with Kinh.*

	Age 5 CDA		Age 8 Math		Age 12 Math		Age 15 Math	
Ethnicity	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***	**Mean ± SD**	***N***
Kinh	10.20 ± 2.29	1630	20.25 ± 5.41	1665	7.75 ± 1.51	855	18.87 ± 7.08	836
Minority	7.56 ± 2.28***	224	12.98 ± 5.44***	198	5.38 ± 2.83***	101	11.72 ± 6.76***	90
Vietnamese	8.75 ± 1.87**	24	15.61 ± 4.20	23	8.17 ± 0.75	6	18.00 ± 3.67	5
Other language	7.42 ± 2.28***	200	12.64 ± 5.51***	175	5.20 ± 2.82***	95	11.35 ± 6.73***	85

Discussion

The present inquiry was directed at two questions. The first was whether previously described differences in cognitive ability between countries can be reproduced with a data set that administered the same cognitive tests to children of the same ages in four economically less developed countries. The results, presented in Table 1, show that for the mathematics tests administered at the ages of 8, 12 and 15 years there is a very close equivalence between the Young Lives results and the earlier test results summarized in Lynn and Vanhanen (2012). In both data sets, Ethiopia is lowest, Vietnam highest, and India and Peru are in between. The differences are large. In the Young Lives samples, those between Ethiopia and Vietnam are about 1.75 standard deviations or 26.3 IQ

points (based on standard deviations in the two countries) when the results of the three test administrations are averaged. This is again in full agreement with the earlier results summarized in Lynn and Vanhanen (2012), who reported a difference of 1.7 standard deviations or 25.5 IQ points based on the British standard deviation.

The Colored Progressive Matrices (CPM) administered at age 8 years produced an anomalous result for Vietnam, and the CDA-Q test at age 5 produced only small differences between the four countries. The reasons for this are not known. One possibility is that the typical differences between countries are generally less evident in pre-school children than in older ones. This would mean that most of the cognitive differences between countries develop in school-aged children, in part as a consequence of experiences in the educational system. The merits of this conjecture are difficult to assess at this time because other than Young Lives, there have been no major studies that administered cognitive tests both around the time of school entry and in older school children in multiple countries.

The sub-national results confirm that cognitive test results vary in parallel with the socio-economic development of the tested population. Differences are smallest between the ethnicities and religions of Ethiopia, most likely because this country is uniformly underdeveloped with low standards of living and an educational system that is rather uniform throughout the country although it has penetrated to the more remote regions only recently (for details, see Woldehanna & Araya).

Differences between ethnicities are greater in Peru than in Ethiopia, and greater still in Vietnam. Both countries are economically more developed than Ethiopia, and Vietnam has experienced rather fast economic growth in recent decades. This raises the question of whether major inequalities between different ethnic groups in a country are most likely to emerge with rapid modernization, when different parts of the country, and with them the different local ethnicities, modernize at different rates. The pattern of backward ethnic minorities living in the less accessible parts of modernizing countries is today observed in many countries of the world (Eversole, McNeish & Cimadamore, 2005). The expectation is that economic, educational and cognitive disparities will eventually recede when either economic and educational progress reach even the most remote areas of the country, or the ethnic minorities lose their distinctiveness by being absorbed into the mainstream.

The situation in India is unique because socio-cultural differences are structured based on caste as well as ethnicity. The country does have multiple ethno-linguistic groups. There are cognitive differences between provinces (Lynn

& Yadav, 2015), and therefore between ethnic groups, but these are not evident in the Young Lives study which was limited to the state of Andhra Pradesh.

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