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Age-Specific Effects of an Early Grade Literacy Intervention in Asia and Africa

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Abstract

Education has been widely recognized in the economic literature as a fundamental element in the economic development of nations and individuals. In this study, I focus on literacy acquisition for young children in poor communities in South Asia and Sub- saharan Africa. Literature on cognitive skill formation, neurobiology and psychology have found converging evidence that returns to investments in education differ by age. This is explained by the fact that neural circuits are more receptive to environmental influences at sensitive periods of brain development. Using data from a RCT experiment conducted between 2012-2016 in Bangladesh, Burundi, Ethiopia, Eswatini, Ghana, India, Malawi, Nepal and Rwanda, I seek to answer the question: did the treatment effects of World Vision's Unlock Literacy program vary according to the age that a child began receiving the intervention? I find evidence of differential effects for both letter recognition and reader tier achievement (measuring different levels of literacy skills), with larger treatment effects for younger children and smaller treatment effects for older children: the treatment effect for children age 7 and younger is 0.436 standard deviations (σ) higher than the treatment effect for children ages 8 to 10 for reader tier achievement and 0.132σ for letter recognition, while children ages 11 and older have treatment effects that are 0.119σ lower in letter recognition. Disaggregating by country the coefficients were statistically significant only for some of them, typically the countries where the intervention was more effective (India, Nepal, Malawi). Potential implications of the results from this study include promoting initiatives that could prevent and address root causes of delayed enrollment. Further studies would benefit from measuring how much of the variation in age is due to relative age effects and delayed enrollment, as well as how this plays a role in the existence of differential effects per country.

JEL Classification: I21, I25, I26, J13

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Dedication

This thesis is dedicated to the One who has given me life. Thank You, my dear Heavenly Father, for always doing above and beyond all I could have ever asked or imagined when I entrusted myself and the course of my life to You. Thank You, Lord Jesus, for redeeming me and loving me. Thank You, Spirit of Truth, for guiding, comforting, and correcting me.

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1 Introduction

Economic research in human capital formation has firmly established the role of cognitive skills in explaining socioeconomic outcomes (Heckman et al., 2006; Cameron and Cameron, 2006). Cognitive skills are powerfully related to individual earnings, to the distribution of income, and to economic growth (Murnane et al., 1995). Literacy, in specific, is essential to absorb printed information, follow written instructions, or communicate well in writing, and thus a predictor of future earnings, as well as health and well-being (Cameron and Cameron, 2006). On an aggregate level, reading and learning achievement are central to economic productivity and growth. Hanushek and Woessmann (2012) find that a 10 percent increase in a country's proportion of students reaching basic literacy is associated with 0.3 percentage points of higher annual growth rate. Coulombe and Tremblay (2006) find evidence that increasing the average literacy skills of a population has a positive and significant effect on the transitory growth path and on the long-run levels of GDP per capita and labor productivity. Literacy enables communication, which is reflected in trade, population's health indicators, acquisition of new technologies, political awareness, research and development, and many other areas.

During the 1990s, many low and middle-income countries committed themselves to provide universal access to primary education and students' completion of all primary grades, one of the United Nations Education for All Goals. However, empirical evidence has shown that the mere expansion of school attainment has not guaranteed improved economic conditions (Hanushek and Woessmann, 2008). Data from the UNESCO Institute for Statistics (UIS) reveals that globally, there are 387 million children of primary school age that are in school but are unable to read proficiently by school exposure. Of those, 262 million (68%, approximately two-thirds) are predicted to reach the last grade of primary but not achieve minimum proficiency levels in reading. Another 78 million (20%) are in school but are not expected to complete the last grade of primary. Therefore, six out of ten children and adolescents are not achieving minimum proficiency levels in reading and mathematics (UNESCO, 2017). These facts elucidate the importance of distinguishing between mere school attainment and the development of cognitive skills.

Figure 1 shows the number of children and adolescents who do not achieve minimum proficiency levels in reading per region. Central and Southern Asia and Sub-saharan Africa are the regions with the highest number of children that do not meet that indicator. The countries analyzed in this experiment were from South Asia (Bangladesh, India, Nepal), East Africa (Burundi, Ethiopia, Malawi) West Africa (Ghana), and Southern Africa (Eswatini).

World Vision International is present in these regions with initiatives to promote child well-being and economic development for impoverished communities. Recognizing that much effort in building school capacity and ensuring favorable conditions for children to attend school (such as access to clean water, which prevents absenteeism due to illness and also reduces the number of hours of needed chore load) has not been enough to improve reading outcomes for early learners, the organization developed a holistic program targeting the development of literacy skills for children in Grades 1-3. This program was developed based on Literacy Booster, which is an initiative by another non-profit organization called Save the Children. Unlock Literacy was piloted in 2012, in twelve countries. RCTs were performed at the launch of the program (2012-2016), in partnership with Save the Children and InformEd. Ryall et al. (2020) evaluated the program in a Meta-Analysis conducted in ten countries: Bangladesh, Burundi, Eswatini, Ethiopia, Ghana, India, Nepal, Malawi, Rwanda, and Senegal.[1] The authors focused their analysis on the effect sizes based on Cohen's d effect, which is a common metric used in educational interventions (Lipsey et al., 2012). Cohen's d effect sizes are calculated by the difference in means of treatment and control, divided by the pooled standard errors. They found that the average effect sizes of the program ranged from 0.07 to 0.99 standard deviations (σ) in literacy scores. Ghana[2], Bangladesh, Ethiopia (schools in pilot phase), and India had large effects ranging from 0.48 σ in India to 0.99 σ in Ghana (for the Twi language). Senegal, Nepal, Ethiopia (schools on scale phase), and Malawi had medium effects that ranged from 0.30 to 0.37 σ. Burundi, Rwanda, and Eswatini (former Swaziland) had small effects (0.07 to 0.10 σ).[3]

Although the program already had a target age group (children from 6 to 9), the exact age - and thus potentially the brain development stage - that children began benefiting from the program had a much wider variation, ranging from 5 to 15 years of age.[4] These age differences may be explained by the country's curriculum, age of entry regulations, and the grades Unlock Literacy program targeted in that particular country.[5] The within country and within school differences could be explained by variation in parents' perception of returns to investment, which might have led to later or earlier enrolment (Boneva and Rauh, 2016; Moyi, 2010). Family economic and literacy situation, as well as individual's health and other circumstantial issues could also be an explanation.

[1]Tanzania, Democratic Republic of Congo, and Kenya were included in the beginning, but could not be analyzed due to inconsistencies in data collection

[2]for the Twi language test

[3]A study from Evans and Yuan (2020) compared results from 156 randomized controlled trials and 143 quasi-experimental analyzes conducted in low- and middle-income countries, finding that the medium effect size of education studies is 0.10 σ for the standardized coefficients.

[4]There were other 15 observations outside this range, which were considered potential data entry errors or outliers.

[5]Most countries evaluated students at Grade 2, but Bangladesh and Rwanda had students at Grade 1, Ghana and Ethiopia at grade 3.

While there is a substantial body of literature that provides evidence for age-specific effects in education (Cunha and Heckman, 2007; Boneva and Rauh, 2016; Knudsen et al., 2006), the heterogeneous effects of Unlock Literacy interventions per age had not been previously analyzed. Therefore, this paper sought to answer the question: did the treatment effects of the Unlock Literacy program vary across different children's age depending on when the child began receiving benefits from the intervention? To analyze this, I created a combined dataset integrating literacy assessment surveys conducted in 9 countries where World Vision International piloted the implementation of the Unlock Literacy program: Bangladesh, Burundi, Ethiopia, Eswatini, Ghana, India, Nepal, Malawi, and Rwanda.

Overall, I find evidence of age-specific treatment effects. For the whole sample, the results show that children ages 7 and younger have higher gains from the program both in the letter recognition subtest and in reader tier acquisition, while children ages 11 and older have lower gains from the program in letter recognition. For individual countries, the coefficients are not always statistically significant, but I can statistically identify the same pattern of positive effect for ages 7 and under in India (letter subtest), Ethiopia (reader tier), Ghana (reader tier), Malawi (both) and the pattern for lower effects for ages 11 and older in Burundi and Rwanda (letter subtest) and Ghana (reader tier). Rwanda and Ghana however also have a negative coefficient for ages 7 and younger, indicating that their 8-10 age group benefited more than either younger or older children.

To lay out the foundation for this analysis, I review the literature on economics, psychology, education, and neurobiology in the next session. I also present the Unlock Literacy program components and explain how they relate to the literature on early literacy interventions. In Section 3, I present the data, beginning with a description of how the RCT data collection was done, and then detailing how that data was used for this analysis. In Section 4, I present the empirical strategy used to answer the research question. In Section 5, the results are presented and discussed. Finally, Section 5 concludes.

2 Literature Review and Program Background

Education impacts labor-market and behavioral outcomes in later stages of life, so it has often been modeled by economists as a process of human capital accumulation (Heckman et al., 2006). Various studies in the economics of education sought to understand what are the mechanisms that contribute to the formation of cognitive and non-cognitive skills.

Todd and Wolpin (2003) survey an extensive multi-disciplinary literature that studies the determinants of cognitive skills in children in the branches of Education Production Function (EPF) and Early Childhood Development (ECD). The authors point out the importance of modeling child development as a cumulative process dependent on three main factors: family history, school inputs, and inherited endowments.

Unlock Literacy sought to address these components by implementing activities in (i) teacher training; (ii) community action and (iii) teaching and learning materials. All Grade 1-3 literacy teachers in target schools were trained in a one-year-long, nine-module curriculum that focused on the implementation of five core reading skills (letter knowledge, phonemic awareness, vocabulary, reading fluency, and comprehension), formative assessment, creation of rich print environments and dealing with language issues in a multi-linguistic environment where the language of instruction is often not the language spoken at the child's home. The community interventions included parental support, community libraries, and extracurricular activities for children. Parental interventions were focused on helping parents to read with their children, including teaching them how to make reading materials. Unlock Literacy promoted a 7-session reading awareness workshop for parents, which typically occurred once a month and thus spanned over a seven-month period. Community libraries were managed by a volunteer and children were encouraged to borrow books on a weekly basis. Reading camps and reading buddies typically operated on a weekly basis by volunteers, although there was some variation in the dosage and implementation. For example, in India, volunteers were paid, and the program was conducted 4 times a week. World Vision gives support through training, materials, and monitoring.

The initiative to develop teaching and learning materials (TLMs) was meant to address the common lack of locally-made and contextually relevant materials. Materials were created by teachers, reading camp facilitators, parents and children when they could not be printed or purchased locally or commercially. All locations implemented the core components of the program. However, there was large heterogeneity in the dosage and quality of how countries and schools within those countries implemented the components of Unlock Literacy. That can explain the large differences found by Ryall et al. (2020) in the treatment effects.

Looking through the framework of the technology skill formation, we see that Unlock Literacy's holistic approach has fostered social interactions that are essential to both cognitive and non-cognitive skill development. The development of cognitive skills begins before a child enters school, fostered through home environment stimulation (Levitt and Eagleson, 2018). Students' achievement is strongly correlated with their parents' expectations, education levels, income, the number of books owned, and many parental behaviors, such as being warm and affectionate, responding positively, and giving praise (Davis-Kean, 2005). Parental involvement is a significant input in student achievement, but its effect occurs mostly indirectly, through an impact on behavioral outcomes, and not directly on student test scores. Interventions that tried to promote changes in the home environment in which children are raised have shown very small success at increasing student achievement (Avvisati et al., 2014).

A growing literature on the effectiveness of early childhood interventions shows that programs such as Head Start (HSIS – compensatory preschool program in the US) might have limited short-term impacts on cognitive development but large long-term impacts on behavioral problems. Carneiro and Ginja (2014) also points out the long-term impacts on lowering serious health problems, such as obesity and depression for preadolescents in the United States, as well as reducing engagement in criminal activities for young adults. Heckman et al. (2006) shows that preschool interventions typically affect children by developing non-cognitive skills. So measuring the short-run impact on cognitive skills does not give the complete picture.

Another type of intervention that is specifically focused on improving literacy for early grade students is the Reading Recovery (RR) program. It consists of intensive, short-term tutoring provided to low-performing students who are lagging behind their peers. May and Philip (2018) investigated the causal impact of being assigned to RR program, finding that RR participation increased student achievement by 0.60 σ on the reading words subtest of the Iowa Test of Basic Skills and 0.61 σ on the reading comprehension subtest.

A very helpful study to understand which types of interventions have systematically shown efficacy is a compilation from Fryer Jr (2017). The paper reviewed 196 randomized control trials designed to increase human capital production, gathered from about 50 decades of experiments. These studies included various levels of interventions (such as student, school, and family randomization). From those, the author saw converging evidence on the efficacy of: (i) early childhood investments (pre-primary school); (ii) professional development for teachers[6]; and (iii) high-dosage tutoring (one-on-one tutoring or tutoring in very small groups at least three times a week). These factors systematically increased students' achievement, demonstrating the importance of timing (age), quality of instruction, and dosage (frequency and personalized attention).

[6] Hill (2007) explains that professional development for teachers is viewed as a vital tool to increase their human capital and improve school effectiveness.

Early childhood development interventions are seen as less risky investments. Cunha and Heckman (2007) say that "high early investments have a multiplier effect in making later investments more productive. If investment inputs are not perfect substitutes but are instead complements, (...) investment in the early years for disadvantaged children promotes investment in the later years." While this suggests that the researcher should not consider inputs across different years of a child's life as perfect substitutes, the evidence on high-dosage tutoring suggests that neither should we consider inputs at different frequencies throughout a year/week as perfect substitutes. High-dosage tutoring is characterized by a higher intensity per week (less time spanned between each activity), and a more personalized, tailored instruction. Evidence shows that high dosage tutoring of adolescents seems to be as effective - or even more effective - than early childhood investments (Fryer Jr, 2017). The conclusion is that there is robust evidence in the literature suggesting the importance to take into consideration not only the quality of intervention, but also the timing across a child's life and week.

In the modeling of skill formation, there is growing evidence for varying effects according to age. Cunha and Heckman (2007) estimated a theoretical framework to identify the technology of cognitive and non-cognitive skill formation, on which different inputs have different effects at different periods. Non-cognitive skills foster the acquisition of cognitive skills, and vice-versa. This process is called dynamic complementarity (Heckman and Kautz, 2013). The authors found that cognitive skills are affected more at early ages and non-cognitive skills, at later ages. Family inputs affect both non-cognitive and cognitive skills, but have heterogeneous effects in shaping them according to the different stages of the life cycle of the child.

Ages at which inputs have higher marginal productivity, holding all inputs constant, are called "sensitive" periods. Neuroscientific and psychological research have elucidated the importance of considering the stages of brain formation to design and implement effective educational policy. Hopkins and Bracht (1975) find evidence that IQ scores become stable around age 10, which suggests that its sensitive period of formation is below age 10. Levitt and Eagleson (2018) explain that the brain's gray matter begins to be reduced in size in late childhood, pruning connections that are not stabilized by experience. "Late childhood" is the period before the onset of puberty, which may range from 7 to 11 years old, depending on the child. Therefore, although there is a wide variation in the onset of pruning across the population, the bottom line is that the earlier a child activates and utilizes synaptic neuron connections, the most likely it is established before those synapses are eliminated by pruning.

Knudsen et al. (2006) consolidate decades of mutually independent research in economics (human capital formation and child development), neurobiology, and developmental psychology (behavioral research), finding a striking convergence on a set of core principles. These principles can be summarized by the following statements: (i) early experiences of the developing child have a uniquely powerful role in the formation of the brain's architecture and neural circuits, shaping cognitive, linguistic, social, and emotional competencies. (ii) Human abilities are formed in a predictable cumulative sequence, where higher skills depend on lower skills. There are sensitive periods in which the development of specific neural circuits is more plastic and thus, optimally receptive to environmental influences. "The capacity for change in the foundations of human skill development and neural circuitry is highest earlier in life and decreases over time." Their cross-disciplinary examination leads to the conclusion that "to invest greater human and financial resources in the social and cognitive environments of children who are disadvantaged, beginning as early as possible" is the most cost-effective strategy for strengthening the future workforce.

Cunha and Heckman (2007) affirm that "on average, the later remediation is given to a disadvantaged child, the less effective it is." However, Boneva and Rauh (2016) have documented that "parents perceive late investments as more productive than early investments, and that they perceive investments in different time periods as substitutes," though these beliefs differ significantly across socioeconomic groups.

There is a branch of research that examines the effect of age on school entry. Cascio and Schanzenbach (2016) distinguish between 3 different age effects in relation to school entry: (i) school entry age; (ii) relative age (age in relation to peers); (iii) age at testing (answering the survey). The authors find that being relatively young improves test scores.

Table 2 shows that there is a wide discrepancy between the expected age entry and the median age in the countries that participated in the pilot Unlock Literacy interventions, which is a reflection of grade repetition and delayed school entry, widespread problems in developing countries (Moyi, 2010). Therefore, it is very pertinent to investigate how students' ages are affecting their academic achievement, as well as their capacity to benefit from Unlock Literacy. If being relatively older has efficiency losses, uncovering these patterns has important implications for programming, as it can promote preventive measures to increase literacy acquisition in the communities. Imai and Ratkovic (2013) affirms that "effect heterogeneity plays an essential role in evaluating the efficacy of social programs".[7] Therefore, this study seeks to investigate the heterogeneous effects of Unlock Literacy interventions through the lens of brain development literature. I seek to identify the existence of sensitive age periods where literacy interventions are potentially most cost-effective.

[7] Treatment effect heterogeneity is defined as "the degree to which different treatments have differential causal effects on each unit."(Imai and Ratkovic, 2013)

3 Data

To conduct this analysis, I used the Randomized Control Trial carried out by World Vision and Save the Children at the Unlock Literacy pilot project. Therefore, I begin this section by describing the data collected.[8] Later, I focus on describing the dataset utilized to answer the research question of this paper.

3.1 RCT Data Collection

World Vision partnered with Save the Children to pilot the Unlock Literacy program between 2012 and 2016.[9] A pretreatment assessment was conducted at the onset of the program to gather background information and literacy outcomes of children and schools. Furthermore, a post-treatment assessment was carried on one to two years later.[10] I will refer to the pretreatment assessment as baseline and to the post-treatment assessment as endline. Ten countries were included in the complete final evaluation: Bangladesh, Burundi, Eswatini, Ethiopia, Ghana, India, Malawi, Nepal, Rwanda, and Senegal.[11]

A Randomized Control Trial (RCT) was implemented to estimate the causal effect of the program on literacy outcomes. An RCT is designed to overcome issues of self-selection, exogeneity and ommitted variable bias. This is done by implementing an exogenous variation in the treatment: taking two comparable groups and assigning treatment to one while leaving the other group as a comparison. Since the intervention was done on the school community level, half of the schools in each country were randomly assigned to treatment and the other half to the control group. The total number of schools varied across countries: 40 schools in Bangladesh, 28 in Burundi, 36 in Eswatini, 36 in Ethiopia in its pilot phase and 63 in its scale-up phase, 43 in Ghana, 80 in India, 30 in Malawi, 62 in Nepal, 28 in Rwanda, 42 in Senegal. The grades also varied per country: most of the baseline assessment was done with students in Grade 2, with the exception of students in Bangladesh and Rwanda, who were in Grade 1, as well as Ghana and students at some of the schools in India, who were at Grade 3.[12] From each school, 20-26 children were sampled to participate in the literacy assessment. Children were evaluated on literacy competencies using an assessment tool adapted from the internationally recognized reading assessment EGRA (Early Grade Reading Assessment) (Gove and Wetterberg, 2011). The survey is orally administered by an independent enumerator with the use of an electronic device (a tablet). The assessment was conducted in each country's language of instruction. In Eswatini,

[8] This information is gathered from the final report conducted by Ryall et al. (2020)

[9] The intervention did not begin simultaneously in all the countries. See table 7 for dates of evaluation assessments in each country.

[10] Burundi also carried out a midline evaluation. DRC did not carry out an endline assessment and thus was excluded from the final evaluation.

[11] Kenya, DRC, and Tanzania were also meant to be a part of the program but ended up not being analyzed due to data quality issues.

[12] See table 2

Ghana, and India, students were assessed in two different languages: English and then a local language, which was Swati for Eswatini, Twi for Ghana, and Hindi for India.

The assessment contains five subtests so children could be evaluated on the following 5 core reading skills: (i) letter recognition, (ii) most used word recognition,[13] (iii) phonemic awareness,[14] (iv) ability to read a Grade 3 level passage, and then answer (v) comprehension questions about the passage. From the reading passage subtest, children were classified into three categories: non-reader, beginning reader, and reader with comprehension. If the child could not read more than 5 words in 30 seconds, the enumerator stopped the assessment and classified the child as a non-reader. If the child could read the text but could not answer more than 80% of the comprehension questions correctly, she was classified as a beginning reader. If the child could read the text and answer more than 80% of the comprehension questions correctly, she was classified as a reader with comprehension. This outcome variable was called "Reader Tier", assuming values 0, 1, and 2.

Letter recognition originally had a dummy variable for each letter of that language's alphabet, in upper and lower case. A total count of correct letters was created by counting the number of letters correctly identified. Then, to enable comparison across different alphabets, the letters score was transformed into a percentage score. The percentage score is defined by the total number of letters that the child answered correctly divided by the total number of letters in the subtest done for that particular language.

Additionally, children were assessed on their background characteristics: demographic (gender, age), academic (grade repetition in Grade 1 and, for some countries, in Grade 2 as well), home literacy, and family possessions. Detailed information about children's home literacy environment was collected to assess how household members engaged in reading activities,[15] and what were the printing materials available to the child at home. Detailed information was also collected about the family possessions, such as housing quality of roof and walls, possession of radio, electricity, tv, bike, moto. These questions were used to create indexes of Home Literacy Environment (HLE) and Socioeconomic Status (SES). Children were then categorized into HLE and SES quantiles within each country.

The last component of the assessment was a school survey, which identified the infrastructure of the school, such as latrines for girls. Ryall et al. (2020) did not find a strong correlation between school-level variables and the children's literacy achievements.

[13] Identified by the Ministry of Education of each country.

[14] Children had to read an "invented" word. These words were created by changing one letter or sound of a common word in that language so they became a meaningless words. They were referred to as "decodable words".

[15] For example, if household members read with the child, whether they helped with homework, asked questions about what the child read, or if the child saw anyone in the house reading.

3.2 Dataset for this analysis

The dataset used in this analysis was created by first selecting variables of interest to the research question and then, integrating the literacy assessment surveys conducted in nine of the countries where World Vision International piloted the implementation of the Unlock Literacy program.[16] In Senegal, over half of the children did not know their age. Although Ryall et al. (2020) addressed this limitation by imputing the value from the average age of the rest of the children, this approach would create a significant bias in my estimate of age-specific effects. The number of children from each country and the composition of the final dataset per country is presented in table 1. Ghana had the largest number of children (775) and thus represented 16.62% of the total sample. It was followed by Nepal (14.76%), Bangladesh (14.71%), Eswatini (12.51%) and Ethiopia (11.80%).[17] Then, Malawi (9.05%), Rwanda (8.94%), India (6.63%), and Burundi (only 4.98%, with 232 children). Of those, 51.2% belonged to intervention schools (2384 children) and 48.8% (2278 children) to the control schools, as seen in tables 4 and 6.

The final choice of variables was constrained by the ones that were consistently present in all datasets. Therefore, school-level variables, for example, were not included in this integrated sample, since it was not collected for Bangladesh.

In this paper, I chose to use scores of letters percentage and reader tier achievement as measures of literacy score outcomes, since they capture the basic and the advanced level literacy skills and were more easily mapped across all the datasets.[18]

For the choice of covariates, I selected the following: Grade 1 repetition, preschool (ECD) attendance, Socioeconomic Quantile, Home Literacy Environment Quantile. These covariates are designed to capture the student's academic, demographic, economic, and household characteristics, which are consistently shown in the literature as predictors of literacy achievement (Davis-Kean, 2005; Fryer et al., 2017).

The children included in the analysis were the ones to whom all variables were observed. Therefore, a total of 4662 children from 354 schools were included in my sample. The summary statistics for these variables will be discussed in the following paragraphs. In table 4, I present the summary statistics for the main dataset that contains all countries, reporting the minimum and maximum values, the median and average/mean values, and the standard deviation. The summary statistics disaggregated by treatment group

[16]For mapping, selecting, and renaming variables across the hundreds of columns, as well as concatenating the datasets, I used Python. For data transformation, exploration, plotting, and summary statistics, I used R. For the regressions and tabulating frequencies, I used STATA.

[17]I also only the pilot phase data from Ethiopia, and not the scale-up, as I chose to select only one dataset from each country.

[18]Decodable words, for example, was only included in the assessment when some of the countries had already conducted the baseline evaluation. Therefore, it was not present in all the countries.

are presented in table 5. For the summary statistics by country, see table 6.

For the outcome variables, we see that Letter Score ranged from 0 to 100%. The Average score for Baseline was 57.63% and for Endline it increased to 81.15% across the whole sample. The standard deviation decreased from 36.41 at Baseline to 26.27 at Endline. When those variables were standardized to mean 0 and standard deviation of 1, they ranged from -2.050 to 0.904. Reader tier achievement assumed values 0 for Non-Readers (those who could not read more than 5 words of the reading passage in the first 30 seconds of that subtest), 1 for Beginners (those who could read more than 5 words in the first 30 seconds but could not answer at least 80% of comprehension questions) and 2 for Readers with Minimum Proficiency (could read and answer more than 80% of comprehension questions). Its mean increased from 0.237 at Baseline to 0.867 at Endline, which is expected. This reflects that in the aggregate, children were progressing in their ability to read between the two assessments. The standard deviation increases, which means that the reader tier is more spread out at Endline than at Baseline.

When looking at the main explanatory variable of interest, we see that age ranged from 5 to 15. Figure 2 is the histogram with the distribution of age for the nine countries aggregated. Table 4 shows that the median age across all countries was 8 and the average was 8.54. The standard deviation was 1.79 years. When analyzed for each country separately, we see on the histograms for each country (Figure 3) that Bangladesh, Eswatini, and Rwanda had a concentration of children at younger ages. In Bangladesh, there were no children ages 11 and older. These differences are explained by the different age entry rules in each country, the differences in grades assessed by the survey, as well as cultural, economical, and social elements that may have caused delayed enrollment and grade repetition.

On the aggregate, 34.2% of the children were younger or equal to 7 years old, a majority (52.6%) were between 8 and 10, and 13.2% were older or equal to 11 years old. About 58.2% had attended preschool, and 27.6% had repeated grade 1. 48.8% were boys, and 51.2% were girls. Figures 3 are nine age histograms representing the age distribution by country.

On table 5, the summary statistics are presented by treatment group. We see that the average age for the treatment was slightly lower (8.532 compared to 8.551 in the control group), but this difference was not statistically different, as verified by a statistical test of the difference of means. The composition of age group categories was also similar between the control and treatment groups. Therefore, the variables of interest in both the treatment and control groups were comparable.

School entry age varies by country, ranging from age 5 in Nepal to age 7 in Ethiopia, Burundi, and Rwanda. Since the children assessed in each country were not from the same grade, this meant that the expected age at baseline evaluation was 6 in Bangladesh and Nepal, but 8 in Ghana, Burundi, Ethiopia, and some of the schools in India. There was a notable difference between expected and average ages for each country. The median age was on time for Rwanda and Eswatini, but one or two years later for the other countries. This indicates that at least more than half the children are not attending their grade at the expected age. To investigate this further, I tabulated age frequencies per age in each country.

The proportion of students that were at their expected age or, at the most, one year late, was 86.01% in Bangladesh, 62.50% in Burundi, 42.55% in Ethiopia, 85.23% in Eswatini, 25.29% in Nepal, 40.65% in Ghana, 75.73% in India, 85.55% in Malawi, 75.54% in Rwanda. This suggests that either delayed enrollment or grade repetition - or both - are widespread across these countries. In fact, studies have shown that both are common issues in developing countries (Moyi, 2010; Gomes-Neto and Hanushek, 1994).

These findings will be important when interpreting the results of the regressions estimations, which are modeled in the next section.

4 Empirical Strategy

In this section, I present the econometric models used to estimate how the impact of Unlock Literacy varied across age groups.

4.1 Unlock Literacy treatment effects

The first specification serves primarily as a benchmark. It does not include the interaction term for the heterogeneity across ages, but only unrestricted age and treatment, student-level control variables, and country-level fixed effects.

$$\begin{aligned} LiteracyScoreEnd_{ij} &= \beta_0 + \beta_1 Treat_{ij} \\ + \sum_{n=5}^{15-1} \alpha_n dAge_{ijn} &+ \beta_2 LiteracyScoreBase_{ij} \\ &+ \lambda' X_{ij} + \delta_j + e_{ij} \end{aligned} \tag{1}$$

This is an ordinary least squares regression where the outcome variable is the literacy score at endline of a child i from country j. I used the term "literacy score" to represent both outcome variables: letter recognition and reading tier. The original values for letter recognition ranged from 0-100 (% of letters correctly identified) and reader tier assumed values of 0 for non-readers (those who could not read more than 5 words of the reading passage in 30 seconds); 1 for beginning readers (those who could read more than 5 words of the passage but could not correctly answer more than 80% of the fact-retrieval questions); 2 for those children who achieved minimum reading proficiency by successfully reading the reading passage and correctly answering 80% of the fact-retrieval questions. The literacy score for the regressions was standardized by subtracting the group average and dividing the demeaned value by the standard deviation. Therefore, each specification is run twice: one with letter score as the dependent variable, and another with reader tier. As stated in the previous section, those variables were chosen so I could capture the effect of the intervention in affecting both basic and advanced literacy skills.

$Treat$ is the treatment indicator, assuming values 1 if the child was in a school that was part of Unlock Literacy intervention and 0 if the child was in a control school.

The age variable was treated as categorical, so there were dummies for each one year of Age included as controls for a child's age. Here, age assumes values 5 to 15[19], as seen in figure 2. Therefore, 9 dummies were included and age 9 was chosen as a base.[20]

Given that endline scores are expected to build upon pretreatment scores, is also important to include baseline literacy score as an explanatory variable. Here, it is represented by $LiteracyScoreBase_{ij}$. X_{ijt} represents a vector of student-level controls: gender, attended preschool, having repeated grade 1, home literacy environment quantile (HLEq), and socioeconomic quantile (SESq). Those variables are defined in the previous section and are meant to capture a child's demographic, economic, and academic background, as well as the child's household educational support, to some degree. They are well-established predictors of cognitive skills in the literature and therefore, are potential confounding factors that need to be accounted for (Davis-Kean, 2005; Fryer et al., 2017).

At last, δ_j represents the country-level fixed-effects estimators, included in the model as one dummy for each country (India as the base). It captures unobserved variation between countries that affect students' literacy outcomes. Therefore, fixing for country, all the other estimated coefficients will explain the average expected variation in outcome within the same country.

This specification is consistent with research designs of other RCTs studies that sought to identify the causal effects of educational interventions (Banerjee et al., 2010; Borkum et al., 2012; Fryer et al., 2017; May and Philip, 2018). It is similar to the regression analysis of Ryall et al. (2020) in that they also control for baseline reading scores, HLE, and student-level covariates, although their specification differs in some other ways, which will be discussed in the Results section.

4.2 Unlock Literacy treatment effects per one year of age

Given the econometric specification to identify educational intervention effects in an RCT design, the second specification adds the heterogeneity component. I thus included dummies for each one year of age

[19] In the original data, age ranged from 0 to 23, but I considered those younger than 5 and older than 17 as outliers (dropped total of 8 children younger than 5 which I considered data entry errors, and 15 children older than 15). To make this choice, I looked at the distribution of the variable and identified a sudden drop in the frequency of observations below age 5. I also took into consideration that the earliest entry age for Grade 1 was 6 (in Bangladesh and Rwanda). Taking into consideration that some children might have entered school a little before completing 6, I considered that this margin was reasonable. There are 74 children age 5, and most of them are in Bangladesh and Rwanda. One in Ethiopia, 23 in India.

[20] Because it was closer to the average age and therefore, made interpretation more meaningful.

interacted with treatment in order to distinguish the effect of the intervention per each one year of age.[21]

$$\begin{aligned} LiteracyScoreEnd_{ij} = \beta_0 + \beta_1 Treat_{ij} + \sum_{n=5}^{15-1} \alpha_n dAge_{ijn} \\ + \sum_{n=5}^{15-1} \alpha_{n+10} (dAge_{ijn} * Treat_{ij}) \\ + \beta_2 LiteracyScoreBase_{ij} \\ + \lambda' X_{ij} + \delta_j + e_{ij} \end{aligned} \quad (2)$$

4.3 Unlock Literacy treatment effects per Age category

Lastly, for the third model, I use age groups as categories. This is similar to how Cunha and Heckman (2008) model the technology of skill formation. The authors found that the period consisting of ages 6 and 7 is the sensitive period for the development of cognitive skills, while the period of ages 8 and 9 is the sensitive period for non-cognitive skills.[22] Since children's median age in my sample varied from 7 to 10, I chose to define ages 8 to 10 as a base period. Therefore, I specify three separate age groups : (i) Ages 5 to 7, (ii) Ages 8 to 10, and (iii) Ages 11 to 15. The first category will have relatively younger children, the second category children who are closer to the mean and median ages, and period 3 will have children who are older (adolescents). Pruning of unused synapses begins between ages 7 and 11, depending on the child's onset of puberty. Thus, the last period should be able to capture pruning effects (Levitt and Eagleson, 2018).

$$\begin{aligned} LiteracyScoreEnd_{ij} = \beta_0 + \beta_1 Treat_{ij} \\ + \beta_2 Age7under_{ij} + \beta_3 (Age7under * Treat)_{ij} \\ + \beta_4 Age11up_{ij} + \beta_5 (Age11up * Treat)_{ij} \\ + \beta_6 LiteracyScoreBase_{ij} \\ \lambda' X_{ij} + \delta_j + e_{ij} \end{aligned} \quad (3)$$

In all specifications, standard errors were clustered at the level of randomization (school level), and e_{ijt} represents the error term.

[21] Avvisati et al. (2014) also use interaction terms to estimate the heterogeneous effects of an RCT intervention for high school students in Mexico.

[22] The metrics I have only directly measure cognitive skills, so I cannot directly measure the non-cognitive component.

5 Results

I begin by presenting the regressions estimations of the models detailed in the previous section for the aggregate dataset, then proceed to present the estimations by each country. Finally, I discuss the findings.

5.1 Aggregate Estimates

Tables 9 through 11 display the regressions estimations across nine countries. The results of the first equation in table 9 indicate that Unlock Literacy led to an average treatment effect of 0.175 standard deviations (σ) increase in letter score. The effect on reader tier achievement is shown in the first equation of table 11: children whose communities received the Unlock Literacy intervention had an expected 0.326 σ higher reader tier than children in control schools. These results show that the program had a positive average treatment effect on children's literacy outcomes for the children who were part of the program across the nine countries analyzed, which is in line with what was attested by Ryall et al. (2020). Children who participate in Unlock Literacy are more likely to recognize letters and also to read a passage with comprehension.

The second equation reveals that the treatment effect of Unlock Literacy on letter recognition was 0.141 σ for children at age 9. Children at age 6 had a 0.271 σ higher treatment effect, in comparison with children at age 9. That is, their total effect was a 0.141 + 0.271 = 0.412 σ higher letter score than children in the control group.[23] The variable "age 11" interacted with treatment had a negative coefficient (-0.188), indicating that children at age 11 had a 0.188 σ lower effect of the treatment in comparison with children at age 9. Children age 13 also had a lower treatment effect of 0.260 σ, as compared to the effect that children age 9 had. For reading tiers, the treatment effect for age 6 is positive 0.714 σ.[24] Age 7 has a 0.476 σ higher treatment effect than age 9, and age 8 a 0.212 σ higher treatment effect than age 9.

On the third equation, the coefficient for treatment indicates that the expected average effect of the program for children ages 8-10 is 0.149σ higher for letter recognition and 0.197σ higher for reader tier. This means that children ages 8 to 10 who were in schools where the Unlock Literacy activities were implemented scored 0.149σ higher than children ages 8-10 in control schools for the letter recognition subtest, and achieved a 0.197σ higher reader tier, averaged across all countries. The coefficient on treatment interacted with age under 7 indicates that the effect of the treatment was 0.132σ higher in the letter recognition subtest

[23] It is possible to arrive at the same numbers by estimating equation 1 on separate samples. That is, divide the dataset into 10 groups, one for each one year of age. Then, run the regression. The coefficient on treatment will give an equivalent result to the coefficient of base treatment plus the coefficient of the age, as I demonstrated for age 6.

[24] And the unrestricted coefficient at age 6 is now negative. This means that children at age 6 are scoring lower, but children at age 6 who are on Unlock Literacy are scoring higher.

and 0.436 σ higher in reader tier achievement for children that were under 7 years old, compared to the effect of the treatment for children who were 8 to 10 years old at the introduction of Unlock Literacy. The negative coefficient on treatment interacted with age above 11 indicates that the effect of the treatment was 0.119σ lower in letter recognition[25] for children that were older than 11 years old, compared to the effect of the treatment for children who were 8 to 10 years old when the program began in their communities.

Therefore, the results for letter recognition and reader tier achievement show that there is a similar pattern occurring for both lower and higher reading skills: younger children have higher treatment effects and older children have lower treatment effects.

5.2 Country Estimates

In the base model per country, it is possible to see a similar pattern that the one found by Ryall et al. (2020): Bangladesh, India, and Ethiopia have higher impacts, followed by Nepal and Malawi. Burundi, Rwanda, and Eswatini had no statistically significant positive effect (Eswatini was negative for letter recognition). The difference occurs in Ghana, where the effect is also not statistically different than zero, although Ryall et al. (2020) found large effects. The difference is that they evaluated for Twi language outcomes rather than English. A more complete approach would be to include Twi for Ghana, Swati for Eswatini, and Hindi for India to compare literacy acquisition gains when students have two main languages of instruction in each country.

Estimating per country, I find that the differential treatment effect is present for some countries, but not clearly distinguishable in all. The results for model 2 are presented in table 14. For Bangladesh, children age 10 had a treatment effect that was 1.125σ higher than children age 9. Note, however, that there are only 5 children age 10 in Bangladesh (less than 1% of the sample for that country), so this result should be interpreted very carefully. In Burundi and Eswatini, no treatment effect is distinguishable, except -0.902σ in reader tier achievement in Eswatini. Those countries were found to not have program effects that were statistically different from zero. In Ethiopia, there is a -0.210σ treatment effect in letter recognition and -0.805σ in reader tier for age 13 as compared with children age 9, which is in line with the findings of lower treatment effects for older children. In Ghana, there is a -0.593σ treatment effect for age 13 on letter recognition, and 1.197σ higher treatment effect for age 7 at reader tier achievement. In India, children age 5, 7, and 10 had higher treatment effects of 1.250, 0.611 and 0.645 σ for letter recognition as compared with age 9 children. For reader tier achievement, among the 5 children age 13, those who were in treatment schools

[25] Although the coefficient for reader tier was negative, it was not statistically significant.

gained 1.068σ more than children age 9.

In Nepal and Malawi, both letter recognition and reader tier achievement were lower for older children: for age 13, Nepali children had -0.786σ gain in the letter subtest and -1.774σ gain in the reader tier achievement than children age 9. Also, children age 10 had -0.219σ treatment effect for letter recognition in comparison with gains that children age 9 had. Malawi children had -0.632σ for letter recognition and -2.466σ for reader tier. Ages 6 and 7 had higher gains for reader tier in Malawi: 2.158 σ and 1.4σ.

In Rwanda, there is a higher treatment effect (0.475 σ) for letter recognition for children age 8 , -1.1 σ for children age 11 and -0.346σ for children age 12. In the reader tier achievement, this effect is larger for children age 6 (0.597σ), age 8 (0.707σ), age 12 (2.448σ) and age 14 (2.140σ) in comparison with the negative effect that children age 9 have (-0.643σ).

Therefore, overall the pattern among countries is that the most effective implementations of the program also tended to be associated with greater treatment effects for younger children and lower treatment effects for younger children.

When looking at the age groups modeled in equation 3 and presented in table 19, we see that the higher differential effect for children ages 7 and younger exists for Malawi and India (0.334 and 0.380 σ), but was negative for Ghana and Rwanda (-0.844 and -0.484σ). Rwanda and Burundi had lower treatment effects for ages 11 and older (-0.658 and -0.312σ). For reader tier achievement, there are positive and statistically significant treatment effects for children ages 7 and younger in Ethiopia (0.829σ), Ghana (1.174σ) and Malawi (1.053σ).

5.3 Discussion of findings

Generally speaking, children who were 7 or younger were either enrolled at their expected age, or were young for their cohort. Children who are older than their expected age either because of grade repetition or delayed enrollment, or both. In fact, this paper revealed the large proportion of students behind their expected age. On the aggregate estimations, they benefited less from the program.

Repetition in grade 1 was already included as a control variable, so I expect that the grade repetition effect has been controlled for, to a certain extent. It is possible, however, that some children repeated Grade 1 more than once, or maybe repeated Grade 2 or 3 (for the countries in which the assessment was done for higher grades). If grade repetition is still correlated with age, then the larger effect found for children under 7 might actually be reflecting that older children are children who are already struggling in school, lack motivation, or have increased burdens. Therefore, it is very likely that they struggle to either engage in the Unlock Literacy activities in a consistent, frequent, or more productive way.

Delayed enrollment is a widespread issue in developing countries, and persists over decades (Moyi, 2010). In Ghana, for example, about 60% of children enrolled in grade 1 after the official expected entry age of six (Akyeampong et al., 2007). Research by Moyi (2010) points out that that one of the main factors that are associated with late enrollment is the death of a parent, especially of the child's biological mother. This not only has psychological impacts but also increases the burden on children and the need to work for survival (higher opportunity costs of children's time). Another reason that caregivers delay sending young children is because "school is too far for a small child". Children in rural areas are more likely than those in urban areas to delay enrollment (about 20% vs. 6%). This is also a reflection of child malnourishment, which makes her smaller and weaker to walk the distance to school. Another factor reported as a reason for late enrollment is the concern for a child's safety. Therefore, mitigating those barriers involve a holistic strategy of nutrition, improved economic conditions, and community development.

Since Ryall et al. (2020) estimated a different outcome variable (in *Gains*), and the authors applied a different set of controls for each country, the result coefficients are not directly comparable. The methodology applied in this paper differs from their study in four ways : (i) their analysis was done separately for each country while this analysis pooled all the countries in a single dataset,[26] and only later disaggregated by country. To account for variation in literacy scores that can be explained by unobserved country differences, I included country-level fixed effects. (ii) they used a different set of individual-level controls for each country. That is, the variables used in the vector of controls were not exactly the same across the regressions. For example, dummies for " had breakfast today", and "repeated grade 2" were present in Nepal but not in India. This also means that they include school-level controls for some countries (such as a library for Nepal and class size for Malawi), but not all. I chose controls that were consistent across countries and still captured important confounding factors of family socioeconomic status[27], literacy engagement and past academic record, (iii) their reported outcome variables were letter recognition, fluency[28], and reading comprehension questions[29]. I also used letter recognition, however, I chose to use reader tier to capture the child's ability to read with comprehension, instead of the percentage of comprehension questions answered or the fluency of reading. (iv) The dependent variable they used was not scores at end-

[26]Except Senegal because of data acquisition issues on the age variable: half the children did not know their ages, so age was imputed as 8.09, the means of the age of the other children. Including those children would bias my estimation of age effects.

[27]Socioeconomic background was measured by an index created from a set of questions about a child's family possessions, such as the type of material their home was built from, the animals they possessed, etc. Children were then classified in quantiles.

[28]Defined as words that the child could read in the text passage, per minute.

[29]Defined as the percentage of correct comprehension questions answered, from the fact retrieval questions asked about the text passage.

line, but score gains. $LiteracyScoreGain_{ij}$ is defined as the difference between endline and baseline scores: $LiteracyScoreGain_{ij} = LiteracyScoreEnd_{ij} - LiteracyScoreBase_{ij}$.

It is also important to clarify that regression estimation was not the main strategy used by Ryall et al. (2020) to identify the effects of the Unlock Literacy. In their meta-analysis, the authors focused the report on Cohen's d effect size, which is calculated by taking the difference between the means of control and treatment groups and then dividing it by the pooled standard deviation.[30] Therefore, in the part of the study where they ran regression analysis, their focus was on equity dimensions. Of the five models they ran, one pertains to this discussion. The research question was stated as "How does Unlock Literacy impact reading gains, controlling for HLE and school-level covariates?". Even though the specification was not equal, we see that even in their study, the effects estimated by regression analysis spanned from negative to positive values, being statistically significant for some countries and not for others. Since entry age, cultural aspects, program dosage, and quality of implementation varied across countries, this might explain why age-specific effects were found in Rwanda, Malawi, India, Ghana, and Burundi but not in the other countries.

Overall, the results of this paper suggest that there are differential effects of Unlock Literacy according to age: younger children (ages 7 and younger) have on average larger gains, and older children (ages 11 and older), lower. This evidence suggests that addressing the root causes of late enrollment likely has great potential to significantly increase the program's efficiency and overall literacy acquisition for all children in the community. This logic holds whether the age-specific effects are explained by brain plasticity (Heckman et al., 2006; Heckman and Kautz, 2013; Knudsen et al., 2006) or underlying factors from children's backgrounds that cause deviation from the average school age. Or if they are a combination of both reasons. In the next section I summarize the research and go into more detail about potential implications.

[30] I also calculated Cohen's d effect size for the combined dataset and found it to be 0.14 σ for letter recognition.

6 Conclusion

Unlock Literacy interventions have sought to implement best practices in the intervention literature and contribute to children's literacy acquisition by seeking to develop teacher, parental, and community engagement. Children were given an opportunity to actively participate in frequent experiences that can potentially exercise a powerful influence on the development of their cognitive and social skills, brain architecture, and neurochemistry. These social and educational experiences occurred not only in the classroom but also in community settings such as reading camps.

The goal of this analysis was to identify if there was variation in how children benefited from the Unlock Literacy program, according to their ages. On the aggregate, I found that children ages 7 or under had higher treatment effects than children ages 8 to 10 both in the letter recognition subtest and in reader tier achievement, while children ages 11 and older had lower treatment effects. These findings are consistent with the literature on cognitive skill formation, neurobiology, and psychology, which have identified sensitive periods of brain development.

When disaggregating by country, I still find some evidence of age-specific treatment effects, although the coefficients are not always statistically significant. The pattern of higher treatment effects for ages 7 and under was found in India (letter subtest), Ethiopia (reader tier), Ghana (reader tier), Malawi (letter subtest and reader tier), and lower treatment effects for ages 11 and older in was found in Burundi and Rwanda (letter subtest) and Ghana (reader tier). Rwanda and Ghana, however, also have a negative coefficient for ages 7 and younger, indicating that their 8-10 age group benefited more than either younger or older children. For Ghana, only 1.16% of the sample was in the category of age 7 and under[31], so this has to be taken into consideration when interpreting the results for that age group. Also, since I chose to use English and not the local language for Eswatini, India, and Ghana, it would be valuable to see if the same pattern happens for the local languages: Swati, Hindi, and Twi.

Therefore, this research concludes that there is evidence of age-specific treatment effects. These effects could be further investigated in order to distinguish which mechanisms are operating in each country. One hypothesis to explain the higher treatment effects at ages 7 and under is that this difference is due to establishing synapses at the brain development stage where plasticity is higher, as evidenced by Cunha and Heckman (2007, 2008); Levitt and Eagleson (2018); Knudsen et al. (2006). If this explanation is true, it could indicate that intervening for children ages 7 and younger is the most effective. In communities where children face

[31] In fact, there was no child 6 or under, only 7 and older.

many economic and social barriers to early literacy acquisition, World Vision has the potential to increase community development, program efficiency, and efficacy by promoting preventive measures.

Raising parent's perception of the returns to early literacy by providing them the information in a clear way is a low or zero cost strategy that has been shown to be effective in the literature (Boneva and Rauh, 2016). Since school entry is primarily a household choice, sending a child to school depends on the parents' perception of implicit benefits and costs associated with this decision. Parents who are more educated tend to offer greater support for their children to go to school (in motivation and resources). Less-educated parents tend to have a lower perception of returns to schooling than the reality (Boneva and Rauh, 2016).[32] In places where the program has greater efficacy and is more successful at engaging, motivating and ultimately equipping children to learn, the returns to investment in education are higher and thus the family's perception of the returns to education naturally tends to be higher as well (Duflo and Banerjee, 2011).

Another strategy would be to provide additional special support to children who are most vulnerable due to malnourishment, orphanage (especially those who lost their biological mother), and living at a farther distance to school (Moyi, 2010) so they would be less likely to delay school enrollment, repeat a grade or drop out. Perhaps this could be done by targeting their caregivers, or giving teachers and reading camps volunteers the awareness of these children's need for additional encouragement and support.

A potential strategy to strenghten HLE and thus multiply brain stimulation for literacy in the households across the communities would be to encourage children to engage in literacy activities with their younger siblings, regardless of their parents' literacy status. That is: encourage students to read stories, teach letters, ask questions about a story to their pre-school siblings. In fact, Ryall et al. (2020) highlighted the importance of strengthening a child's Home Literacy Environment, pointing out that there was still a need for consistent impact of Unlock Literacy in this component.

Therefore, my recommendation, based on this analysis and extensive evidence in the literature is to consider the possibility of (i) strenghtening parents' awareness of returns to investment in education ; (ii) encouraging pupils to strenghten their own HLE for their sibling, cousins and neighbors and (iii) emphasize these two strategies for the caregivers of children who are vulnerable (orphans, remote living, malnourished). By addressing these root causes of inequality, these strategies would contribute to promoting the organization's "vision for every child, life in all its fullness". Further research could measure if these strategies are indeed successful to increase literacy outcomes for the communities in the short and long term.

[32] Another research in information initiatives that affected academic achievement is Avitabile and De Hoyos (2018), who found that reducing the lack of information of teenagers in Mexico about the returns to education was a cost-free initiative effective in increasing students' motivation

Additionally, further research could try to investigate if there was a relative age effect within schools that could be affecting teachers' perception and methods of engagement (such as giving more attention to a particular age group), and further understand the root causes of the large variation in age within each community.

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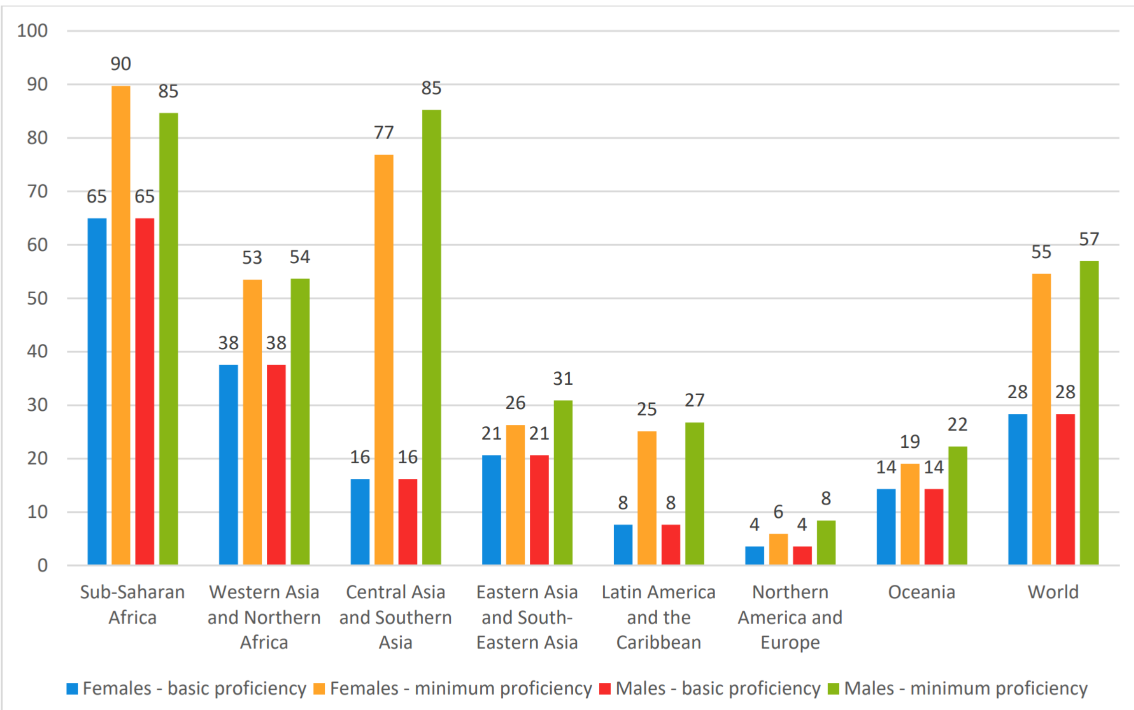
Appendix: Tables and Figures

Figure 1: Children who do not achieve minimum proficiency levels in reading

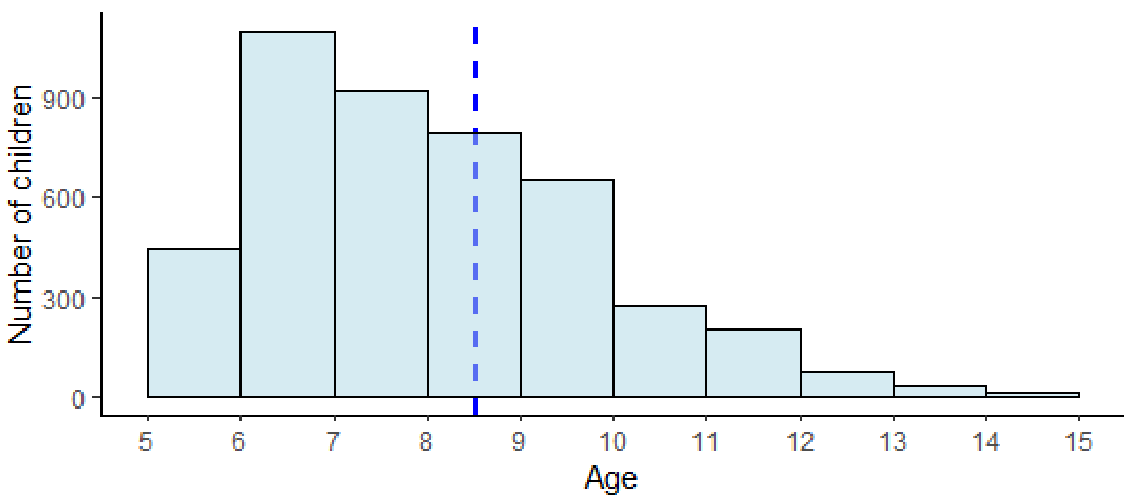


Source: *UNESCO Institute for Statistics*

Table 1: Proportion of sample per country

Country	Number of Children	Proportion of Total sample
Bangladesh	686	14.71 %
Burundi	232	4.98 %
Ethiopia	550	11.80 %
Eswatini	583	12.51 %
Ghana	775	16.62 %
India	309	6.63 %
Malawi	422	9.05 %
Nepal	688	14.76 %
Rwanda	417	8.94 %
Total	4,662	100 %

Figure 2: Histogram with the Distribution of Age (Nine countries aggregated)



Notes: Age of child at baseline for Bangladesh, Burundi, Ethiopia, Eswatini, India, Ghana, Rwanda, Nepal, Malawi

Figure 3: Histograms with the Distribution of Age per country

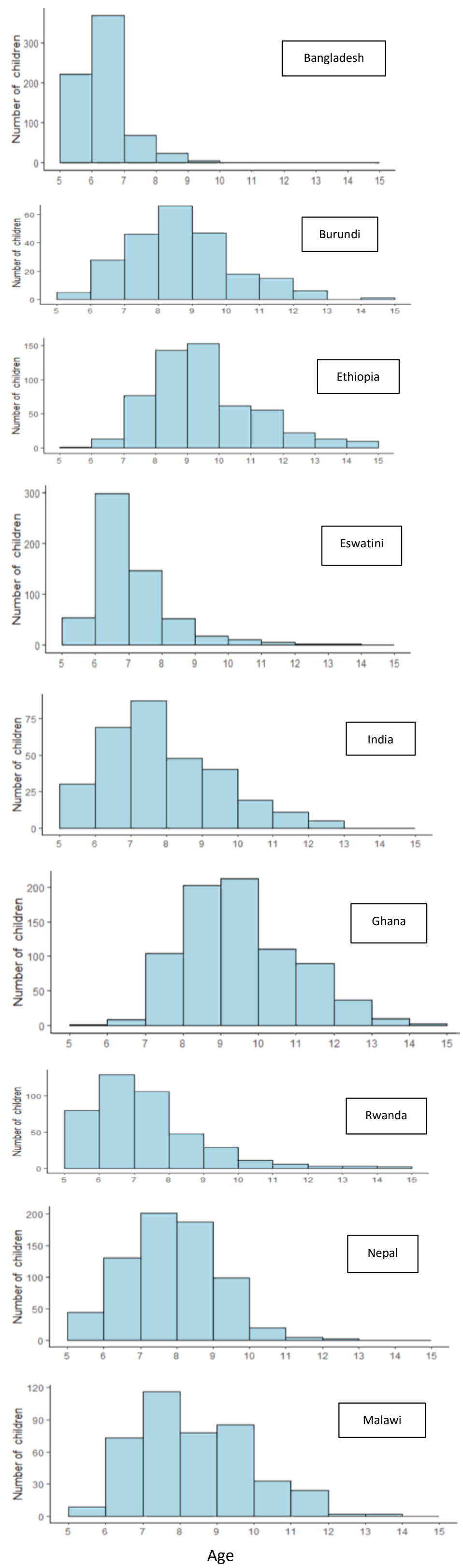


Table 2: Official Entry Age for Primary School (Grade 1) per country

Country	Entry Age	Grade at Baseline	Expected Age	Median	Average
Bangladesh	6	1	6	7	6.839650
Rwanda	7	1	7	7	7.741007
Eswatini	6	2	7	7	7.566038
Nepal	5	2	6	8	8.373547
India	6	2/3	7/8	8	8.375405
Malawi	6	2	7	9	8.886256
Burundi	7	2	8	9	9.176724
Ethiopia	7	2	8	10	10.001818
Ghana	6	3	8	10	10.014194

Source: compilation of data from InformEd Report, World Bank at https://data.worldbank.org/indicator/SE.PRM.AGES and Summary Statistics from this study

Table 3: Tabulation of Age Frequency per Country

Bangladesh

Age	Freq.	Percent	Cum.
5	17	2.48	2.48
6	205	29.88	32.36
7	368	53.64	86.01
8	68	9.91	95.92
9	23	3.35	99.27
10	5	0.73	100.00
Total	686	100.00	

Burundi

Age	Freq.	Percent	Cum.
6	5	2.16	2.16
7	28	12.07	14.22
8	46	19.83	34.05
9	66	28.45	62.50
10	47	20.26	82.76
11	18	7.76	90.52
12	15	6.47	96.98
13	6	2.59	99.57
15	1	0.43	100.00
Total	232	100.00	

Ethiopia

Age	Freq.	Percent	Cum.
5	1	0.18	0.18
7	13	2.36	2.55
8	77	14.00	16.55
9	143	26.00	42.55
10	153	27.82	70.36
11	62	11.27	81.64
12	56	10.18	91.82
13	22	4.00	95.82
14	13	2.36	98.18
15	10	1.82	100.00
Total	550	100.00	

Eswatini

Age	Freq.	Percent	Cum.
6	53	9.09	9.09
7	298	51.11	60.21
8	146	25.04	85.25
9	51	8.75	94.00
10	17	2.92	96.91
11	10	1.72	98.63
12	5	0.86	99.49
13	2	0.34	99.83
14	1	0.17	100.00
Total	583	100.00	

Nepal

Age	Freq.	Percent	Cum.
6	44	6.40	6.40
7	130	18.90	25.29
8	201	29.22	54.51
9	187	27.18	81.69
10	99	14.39	96.08
11	20	2.91	98.98
12	5	0.73	99.71
13	2	0.29	100.00
Total	688	100.00	

Ghana

Age	Freq.	Percent	Cum.
6	1	0.13	0.13
7	8	1.03	1.16
8	104	13.42	14.58
9	202	26.06	40.65
10	212	27.35	68.00
11	110	14.19	82.19
12	89	11.48	93.68
13	37	4.77	98.45
14	10	1.29	99.74
15	2	0.26	100.00
Total	775	100.00	

India

Age	Freq.	Percent	Cum.
5	9	2.91	2.91
6	21	6.80	9.71
7	69	22.33	32.04
8	87	28.16	60.19
9	48	15.53	75.73
10	40	12.94	88.67
11	19	6.15	94.82
12	11	3.56	98.38
13	5	1.62	100.00
Total	309	100.00	

Malawi

Age	Freq.	Percent	Cum.
6	9	2.13	2.13
7	73	17.30	19.43
8	116	27.49	46.92
9	78	18.48	65.40
10	85	20.14	85.55
11	33	7.82	93.36
12	24	5.69	99.05
13	2	0.47	99.53
14	2	0.47	100.00
Total	422	100.00	

Rwanda

Age	Freq.	Percent	Cum.
5	29	6.95	6.95
6	51	12.23	19.18
7	129	30.94	50.12
8	106	25.42	75.54
9	48	11.51	87.05
10	29	6.95	94.00
11	11	2.64	96.64
12	6	1.44	98.08
13	3	0.72	98.80
14	3	0.72	99.52
15	2	0.48	100.00
Total	417	100.00	

Table 4: Summary Statistics

Statistic	Min	Max	Median	Mean	St. Dev.
Treatment	0	1	1	0.511	0.500
Age	5	15	8	8.542	1.799
Age 11up	0	1	0	0.132	0.339
Age 8to10	0	1	1	0.533	0.499
Age 7under	0	1	0	0.335	0.472
Letters Score Baseline (% correct)	0	100	69.388	57.632	36.409
Letters Score Endline (% correct)	0	100	92.308	81.149	26.276
Standardized Letters Score Baseline	−2.050	0.904	−0.0001	−0.347	1.075
Standardized Letters Score Endline	−2.050	0.904	0.677	0.347	0.776
Reader Tier Baseline	0	2	0	0.237	0.533
Reader Tier Endline	0	2	1	0.867	0.909
Standardized Reader Tier Baseline	−0.682	1.790	−0.682	−0.389	0.659
Standardized Reader Tier Endline	−0.682	1.790	0.554	0.389	1.124
Male	0	1	0	0.488	0.500
Socioeconomic Quintle	1	5	2	2.466	1.333
Attended Preschool (ECD)	0	1	1	0.582	0.493
Home Literacy Environment Quintile	1	5	3	2.704	1.323
Repeated Grade 1	0	1	0	0.276	0.447

Notes:Reading Tier represents 0 = Non-Reader; 1 = Beginner Reader; 2 = Achieves Minimum Reading Proficiency with Comprehension. Standardized Scores are calculated by subtracting the average and dividing by the pooled standard deviation. Unless otherwise indicated, covariates are from baseline assessment.

Table 5: Summary Statistics per Treatment Group

Variable	Control	Treatment
Standardized Letters Score Baseline	-0.357	-0.338
	(1.070)	(1.081)
Standardized Letters Score Endline	0.247	0.443
	(0.816)	(0.723)
Standardized Reader Tier Baseline	-0.402	.148
	(0.637)	(0.680)
Standardized Reader Tier Endline	0.223	0.548
	(1.028)	(1.148)
Age	8.551	8.532
	(1.836)	(1.763)
Age7under	.344	.326
	(0.475)	(0.469)
Age8to10	.518	.547
	(0.500)	(0.498)
Age11up	.138	.127
	(0.345)	(0.333)
Male	.481	.495
	(0.500)	(0.500)
Socioeconomic Quintile (SESq)	2.365	2.563
	(1.298)	(1.360)
Home Literacy Environment Quintile (HLEq)	2.634	2.771
	(1.288)	(1.352)
Attended Preschool (ECD)	.573	.591
	(0.495)	(0.492)
Repeated Grade 1	.255	.297
	(0.436)	(0.457)
Total Observations	2278	2384

Notes:Reading Tier represents 0 = Non-Reader; 1 = Beginner Reader; 2 = Achieves Minimum Reading Proficiency with Comprehension. Standardized Scores are calculated by subtracting the average and dividing by the pooled standard deviation. Unless otherwise indicated, covariates are from baseline assessment.

Table 6: Summary Statistics per Country

Variable	Bangladesh	Burundi	Ethiopia	Eswatini	Ghana	India	Malawi	Nepal	Rwanda
Treat	0.485	0.539	0.442	0.485	0.547	0.573	0.536	0.476	0.549
	(0.500)	(0.500)	(0.497)	(0.500)	(0.498)	(0.495)	(0.499)	(0.500)	(0.498)
Age	6.840	9.177	10.002	7.566	10.014	8.375	8.374	8.886	7.741
	(0.820)	(1.587)	(1.672)	(1.154)	(1.488)	(1.681)	(1.267)	(1.540)	(1.703)
Male	0.491	0.513	0.495	0.487	0.440	0.502	0.522	0.479	0.494
	(0.500)	(0.501)	(0.500)	(0.500)	(0.497)	(0.501)	(0.500)	(0.500)	(0.501)
SESq	2.994	2.828	1.856	1.870	2.970	3.129	1.637	2.727	2.710
	(1.428)	(1.416)	(0.784)	(0.753)	(1.408)	(1.438)	(0.745)	(1.542)	(1.310)
Attended Preschool	0.389	0.147	0.060	0.770	0.939	0.375	0.785	0.789	0.513
	(0.488)	(0.354)	(0.238)	(0.421)	(0.239)	(0.485)	(0.411)	(0.408)	(0.500)
HLEq	2.949	2.974	2.916	2.503	3.027	2.165	1.997	2.948	2.875
	(1.430)	(1.417)	(1.378)	(1.112)	(1.415)	(0.757)	(0.813)	(1.423)	(1.421)
Repeated Grade 1	0.219	0.664	0.195	0.242	0.188	0.084	0.219	0.500	0.484
	(0.414)	(0.473)	(0.396)	(0.429)	(0.391)	(0.278)	(0.414)	(0.501)	(0.500)
Age7under	0.860	0.142	0.025	0.602	0.012	0.320	0.253	0.194	0.501
	(0.347)	(0.350)	(0.158)	(0.490)	(0.107)	(0.467)	(0.435)	(0.396)	(0.501)
Age8to10	0.140	0.685	0.678	0.367	0.668	0.566	0.708	0.661	0.439
	(0.347)	(0.465)	(0.468)	(0.482)	(0.471)	(0.496)	(0.455)	(0.474)	(0.497)
Age11up	0.000	0.172	0.296	0.031	0.320	0.113	0.039	0.145	0.060
	(0.000)	(0.379)	(0.457)	(0.173)	(0.467)	(0.317)	(0.194)	(0.352)	(0.238)
Std Tier Base	−0.385	−0.423	−0.301	−0.679	0.029	−0.550	−0.461	−0.403	−0.417
	(0.759)	(0.814)	(0.800)	(0.196)	(1.079)	(0.453)	(0.722)	(0.491)	(0.646)
Std Tier End	0.385	0.423	0.301	0.679	−0.029	0.550	0.461	0.403	0.417
	(1.062)	(0.991)	(1.086)	(1.019)	(0.914)	(1.091)	(1.026)	(1.198)	(1.112)
Std Letter Base	−0.123	−0.450	−0.211	−0.508	−0.241	−0.492	−0.321	−0.643	−0.603
	(1.069)	(1.088)	(1.042)	(1.021)	(1.105)	(0.888)	(1.126)	(0.596)	(0.918)
Std Letter End	0.123	0.450	0.211	0.508	0.241	0.492	0.321	0.643	0.603
	(0.910)	(0.643)	(0.909)	(0.665)	(0.814)	(0.855)	(0.727)	(0.905)	0.656

Standardized Scores are calculated by subtracting the average and dividing by the pooled standard deviation. Unless otherwise indicated, covariates are from baseline assessment.

Table 7: Survey Dates per Country

Country	Baseline	Endline
Bangladesh	May-Jun 2015	Nov-Dec 2016
Burundi	October 2012	June 2014
Eswatini	Feb 2015	April 2016
Ethiopia	April 2012	April 2013
Ghana	March 2015	July 2016
India	August 2014	August 2016
Malawi	April 2012	Nov 2013
Nepal	January 2015	September 2016
Rwanda	September 2013	May 2015
Senegal	Nov 2014	July 2016

Source: *Ryall et al. (2020)*

Table 8: Letters Score Regressions - Main Variables

VARIABLES	Standardized Letter at Endline		
	(1)	(2)	(3)
Treated = 1	0.175***	0.141***	0.149***
	(0.0317)	(0.0479)	(0.0367)
Age 7 or younger = 1			0.0199
			(0.0476)
Treat X Age7under			0.132**
			(0.0604)
Age 11 or older = 1			-0.0230
			(0.0435)
Treat X Age11up			-0.119*
			(0.0639)
Age5	-0.0130	-0.0639	
	(0.142)	(0.178)	
Age6	0.0543	-0.0858	
	(0.0496)	(0.0742)	
Age7	0.135***	0.0858	
	(0.0368)	(0.0538)	
Age8	0.0414	0.00524	
	(0.0315)	(0.0510)	
Age10	0.0101	0.0422	
	(0.0315)	(0.0473)	
Age11	-0.0792*	0.00693	
	(0.0466)	(0.0565)	
Age12	-0.0360	-0.0193	
	(0.0493)	(0.0763)	
Age13	-0.0455	0.0973	
	(0.0776)	(0.0814)	
Age14	-0.156	-0.263	
	(0.148)	(0.220)	
Age15	-0.137	-0.181	
	(0.126)	(0.157)	
Treat X Age5		0.120	
		(0.290)	
Treat X Age6		0.271***	
		(0.0955)	
Treat X Age7		0.0905	
		(0.0689)	
Treat X Age8		0.0649	
		(0.0640)	
Treat X Age10		-0.0677	
		(0.0628)	
Treat X Age11		-0.188**	
		(0.0905)	
Treat X Age12		-0.0305	
		(0.0973)	
Treat X Age13		-0.260*	
		(0.141)	
Treat X Age14		0.256	
		(0.272)	
Treat X Age15		0.0980	
		(0.256)	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: (Continuation) Letters Score Regressions - Control Variables

VARIABLES	Standardized Letter at Endline			
	(1)	(2)	(3)	
Std Letter Base	0.379***	0.380***	0.381***	
	(0.0167)	(0.0167)	(0.0166)	
Male	0.00746	0.00838	0.00736	
	(0.0203)	(0.0202)	(0.0203)	
Socioeconomic Quantile	-0.00125	-0.00198	-0.00185	
	(0.00948)	(0.00939)	(0.00940)	
Home Literacy Environment Quantile	0.0202**	0.0206**	0.0200**	
	(0.00834)	(0.00826)	(0.00841)	
Attended Preschool	-0.0149	-0.0176	-0.0160	
	(0.0254)	(0.0252)	(0.0254)	
Repeated Grade 1	-0.0533**	-0.0501**	-0.0550**	
	(0.0250)	(0.0252)	(0.0250)	
Bangladesh	-0.104	-0.104	-0.107	
	(0.0867)	(0.0835)	(0.0843)	
Burundi	0.388***	0.379***	0.379***	
	(0.0736)	(0.0728)	(0.0732)	
Ethiopia	-0.0148	-0.0269	-0.0312	33
	(0.0780)	(0.0796)	(0.0794)	
Eswatini	0.309***	0.310***	0.322***	
	(0.0833)	(0.0842)	(0.0843)	
Ghana	0.0995	0.0969	0.0932	
	(0.0797)	(0.0789)	(0.0795)	
Malawi	-0.0748	-0.0816	-0.0739	
	(0.0915)	(0.0917)	(0.0923)	
Nepal	0.142**	0.141**	0.141**	
	(0.0698)	(0.0697)	(0.0697)	
Rwanda	0.445***	0.440***	0.442***	
	(0.0796)	(0.0798)	(0.0796)	
Constant	0.208***	0.232***	0.248***	
	(0.0787)	(0.0814)	(0.0766)	
Observations	4,662	4,662	4,662	
R-squared	0.340	0.345	0.341	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Reader Tier Regressions - Main Variables

VARIABLES	Standardized Tier at Endline		
	(1)	(2)	(3)
Treated = 1	0.326***	0.0968	0.197***
	(0.0530)	(0.0681)	(0.0509)
Age 7 or younger = 1			-0.162**
			(0.0732)
Treat X Age7under			0.436***
			(0.0971)
Age 11 or older = 1			-0.0149
			(0.0563)
Treat X 1.age11up			-0.105
			(0.0803)
Age5	0.0679	-0.147	
	(0.156)	(0.192)	
Age6	0.0783	-0.295**	
	(0.0793)	(0.121)	
Age7	0.114*	-0.139	
	(0.0606)	(0.0911)	
Age8	0.0924*	-0.0217	
	(0.0526)	(0.0849)	
Age10	-0.0548	-0.0857	
	(0.0460)	(0.0685)	
Age11	-0.0954	-0.0991	
	(0.0600)	(0.0886)	
Age12	0.0100	-0.0229	
	(0.0628)	(0.0822)	
Age13	-0.00155	0.137	
	(0.0927)	(0.144)	
Age14	-0.0823	-0.204	
	(0.109)	(0.158)	
Age15	-0.435	-0.337	
	(0.266)	(0.289)	
Treat X Age5		0.471	
		(0.320)	
Treat X Age6		0.714***	
		(0.153)	
Treat X Age7		0.476***	
		(0.119)	
Treat X Age8		0.212**	
		(0.103)	
Treat X Age10		0.0483	
		(0.0914)	
Treat X Age11		-0.0198	
		(0.116)	
Treat X Age12		0.0663	
		(0.122)	
Treat X Age13		-0.243	
		(0.179)	
Treat X Age14		0.246	
		(0.211)	
Treat X Age15		-0.218	
		(0.497)	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: (Continuation) Reader Tier Regressions - Control Variables

VARIABLES	Standardized Tier at Endline		
	(1)	(2)	(3)
Std Tier Base	0.466***	0.466***	0.465***
	(0.0303)	(0.0299)	(0.0300)
Male	0.0528*	0.0555*	0.0557*
	(0.0303)	(0.0299)	(0.0299)
Socioeconomic Quantile	0.0111	0.0104	0.0106
	(0.0131)	(0.0125)	(0.0126)
Home Literacy Environment Quantile	0.0255*	0.0269**	0.0262**
	(0.0136)	(0.0131)	(0.0132)
Attended Preschool	-0.00994	-0.0174	-0.0127
	(0.0475)	(0.0467)	(0.0466)
Repeated Grade 1	-0.0677*	-0.0580	-0.0687*
	(0.0391)	(0.0395)	(0.0395)
Bangladesh	-0.0796	-0.0732	-0.0630
	(0.139)	(0.127)	(0.128)
Burundi	-0.0751	-0.0937	-0.104
	(0.119)	(0.118)	(0.117)
Ethiopia	-0.256**	-0.280***	-0.306***
	(0.102)	(0.103)	(0.103)
Eswatini	-1.068***	-1.068***	-1.095***
	(0.0944)	(0.0909)	(0.0913)
Ghana	-0.280**	-0.299**	-0.299**
	(0.121)	(0.120)	(0.121)
Malawi	0.0802	0.0850	0.0809
	(0.0997)	(0.0987)	(0.0990)
Nepal	-0.263**	-0.267**	-0.254**
	(0.116)	(0.119)	(0.118)
Rwanda	0.412***	0.422***	0.436***
	(0.139)	(0.142)	(0.142)
Constant	0.477***	0.602***	0.578***
	(0.109)	(0.111)	(0.102)
Observations	4,662	4,662	4,662
R-squared	0.279	0.291	0.287

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Letter Recognition Regression per Country - Model 1

VARIABLES	Standardized Letter Score at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Treated	0.901***	0.0838	0.384***	-0.153**	-0.0135	0.313***	0.153***	0.153	0.0341
	(0.105)	(0.0893)	(0.0852)	(0.0710)	(0.0943)	(0.112)	(0.0496)	(0.130)	(0.0845)
Age5	0.236		-0.827***			-0.345			-0.0489
	(0.391)		(0.108)			(0.263)			(0.161)
Age6	0.154	-0.329		0.255*	-1.541***	0.326	0.131	0.399	-0.0449
	(0.180)	(0.354)		(0.131)	(0.147)	(0.231)	(0.0799)	(0.299)	(0.103)
Age7	0.304	0.0375	0.147	0.404***	-0.682	0.186	0.0846	0.141	0.0808
	(0.192)	(0.0802)	(0.182)	(0.110)	(0.513)	(0.139)	(0.0574)	(0.138)	(0.0923)
Age8	0.279	-0.00475	-0.0646	0.335***	-0.00376	0.0275	0.0308	0.0481	-0.0577
	(0.201)	(0.0701)	(0.0911)	(0.119)	(0.0659)	(0.146)	(0.0584)	(0.104)	(0.104)
Age10	-0.425	-0.223**	-0.0782	0.168	-0.0299	0.138	-0.0382	0.219	-0.118
	(0.511)	(0.102)	(0.0543)	(0.167)	(0.0740)	(0.142)	(0.0631)	(0.130)	(0.129)
Age11		-0.172	0.0645	0.151	-0.151*	0.00798	0.250	-0.232	-0.735**
		(0.160)	(0.0885)	(0.207)	(0.0855)	(0.178)	(0.156)	(0.181)	(0.344)
Age12		0.0265	-0.0404	-0.0212	-0.126	-0.170	-0.0532	0.0944	0.139
		(0.0877)	(0.0906)	(0.406)	(0.106)	(0.209)	(0.119)	(0.178)	(0.133)
Age13		0.0939	-0.0742	-0.321	-0.140	0.187	-0.241	-1.056***	0.153**
		(0.115)	(0.135)	(0.733)	(0.116)	(0.617)	(0.300)	(0.154)	(0.0709)
Age14			-0.458**	-1.904***	0.182			-0.511	0.261**
			(0.217)	(0.134)	(0.205)			(0.312)	(0.119)
Age15		-0.0765	-0.375**		0.711**				0.0775
		(0.0810)	(0.169)		(0.273)				(0.0828)
Std Letter Base	0.268***	0.291***	0.642***	0.263***	0.368***	0.490***	0.413***	0.789***	0.131***
	(0.0332)	(0.0673)	(0.0444)	(0.0393)	(0.0327)	(0.0440)	(0.0296)	(0.0662)	(0.0266)
Male	0.0882	0.145*	0.0262	0.0729	-0.00607	-0.00258	-0.00202	-0.0946	0.0394
	(0.0689)	(0.0730)	(0.0554)	(0.0566)	(0.0567)	(0.0718)	(0.0435)	(0.0815)	(0.0657)
Socioeconomic Quantile	0.000967	-0.0162	0.0406	-0.0420	-0.0305	0.0232	0.0347	0.0135	-0.0115
	(0.0232)	(0.0214)	(0.0339)	(0.0316)	(0.0238)	(0.0426)	(0.0307)	(0.0254)	(0.0225)
Home Literacy Environment Quantile	0.0258	0.0147	-0.0219	0.0109	0.0336	-0.0101	0.0322	0.0520*	0.0258
	(0.0288)	(0.0234)	(0.0229)	(0.0207)	(0.0215)	(0.0523)	(0.0254)	(0.0268)	(0.0165)
Attended Preschool	0.0148	0.0488	-0.00311	-0.0398	-0.168**	0.0655	0.0189	-0.0283	-0.108
	(0.0629)	(0.0985)	(0.0932)	(0.0541)	(0.0729)	(0.0765)	(0.0521)	(0.0944)	(0.0736)
Repeated Grade 1	-0.0753	-0.0554	-0.0481	-0.0155	-0.0763	-0.316**	-0.0205	-0.112	0.0870
	(0.0797)	(0.0681)	(0.0758)	(0.0529)	(0.0758)	(0.140)	(0.0604)	(0.108)	(0.0745)
Constant	-0.633***	0.552***	0.208*	0.449***	0.556***	0.430*	0.207*	0.940***	0.635***
	(0.220)	(0.129)	(0.112)	(0.127)	(0.131)	(0.233)	(0.112)	(0.194)	(0.129)
Observations	686	232	550	583	775	309	688	422	417
R-squared	0.421	0.341	0.568	0.272	0.281	0.336	0.425	0.340	0.095

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Letter Recognition Regression per Country - Model 2

VARIABLES	Standardized Letter Score at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Treated = 1	1.184***	0.0914	0.499***	-0.202	0.145	-0.110	0.155	0.0819	0.0307
	(0.289)	(0.0765)	(0.103)	(0.210)	(0.140)	(0.224)	(0.0931)	(0.203)	(0.108)
Age5	0.285		-0.761***			-0.861***			0.100
	(0.608)		(0.104)			(0.268)			(0.190)
Age6	0.203	-0.331		0.313*	-1.605***	-0.0816	0.0936	0.0722	0.0769
	(0.276)	(0.424)		(0.181)	(0.147)	(0.395)	(0.111)	(0.182)	(0.151)
Age7	0.442	0.221	0.144	0.368**	0.0249	-0.178	0.0246	-0.00188	0.141
	(0.307)	(0.153)	(0.276)	(0.155)	(0.135)	(0.221)	(0.0854)	(0.196)	(0.137)
Age8	0.504	0.0143	-0.0633	0.261	0.0929	-0.214	0.0132	0.0951	-0.331*
	(0.354)	(0.0978)	(0.139)	(0.175)	(0.104)	(0.255)	(0.103)	(0.135)	(0.186)
Age10	-1.437***	-0.382	0.0142	0.384*	0.0997	-0.240	0.0702	0.193	-0.207
	(0.273)	(0.231)	(0.0684)	(0.218)	(0.124)	(0.195)	(0.0874)	(0.154)	(0.272)
Age11		-0.00143	0.167	0.213	-0.0618	-0.0316	0.382**	-0.268	-0.143
		(0.0504)	(0.111)	(0.219)	(0.113)	(0.241)	(0.153)	(0.218)	(0.262)
Age12		0.0832	0.0321	-0.00265	-0.0500	-0.214	-0.157*	-0.0654	0.423***
		(0.112)	(0.0876)	(0.391)	(0.179)	(0.345)	(0.0804)	(0.238)	(0.119)
Age13		0.0757	0.0445	-0.306	0.160	0.344**	0.153**	-1.162***	0.151**
		(0.130)	(0.154)	(0.756)	(0.139)	(0.163)	(0.0703)	(0.135)	(0.0617)
Age14			-0.439	-1.947***	0.0988			-0.183	0.376**
			(0.304)	(0.168)	(0.278)			(0.172)	(0.142)
Age15		-0.0926	-0.377*		0.643**				0.0727
		(0.0655)	(0.201)		(0.268)				(0.0708)
Treat X Age5	-0.123					1.250**			-0.413
	(0.674)					(0.487)			(0.287)
Treat X Age6	-0.160	0.146		-0.127		0.733	0.0831	0.457	-0.194
	(0.286)	(0.409)		(0.255)		(0.454)	(0.162)	(0.410)	(0.195)
Treat X Age7	-0.345	-0.226	0.00832	0.0772	-0.864	0.611**	0.116	0.277	-0.135
	(0.322)	(0.146)	(0.347)	(0.225)	(0.582)	(0.287)	(0.124)	(0.252)	(0.171)
Treat X Age8	-0.478	-0.0159	-0.0196	0.146	-0.172	0.410	0.0307	-0.0780	0.475**
	(0.365)	(0.152)	(0.183)	(0.246)	(0.144)	(0.307)	(0.125)	(0.219)	(0.205)
Treat X Age10	1.125*	0.281	-0.210**	-0.474	-0.238	0.645**	-0.219*	0.0617	0.147
	(0.563)	(0.254)	(0.101)	(0.303)	(0.145)	(0.270)	(0.128)	(0.271)	(0.291)
Treat X Age11		-0.514	-0.265	-0.259	-0.156	0.0504	-0.219	0.0920	-1.100**
		(0.387)	(0.169)	(0.344)	(0.154)	(0.326)	(0.272)	(0.403)	(0.535)
Treat X Age12		-0.139	-0.156		-0.136	0.0375	0.179	0.360	-0.346*
		(0.146)	(0.191)		(0.214)	(0.440)	(0.154)	(0.368)	(0.179)
Treat X Age13		0.0162	-0.252		-0.593***	-0.103	-0.786***	0.235	
		(0.212)	(0.245)		(0.208)	(0.806)	(0.138)	(0.200)	
Treat X Age14			-0.00545		0.190			-0.632***	-0.197
			(0.314)		(0.380)			(0.206)	(0.134)
Treat X Age15			0.145						
			(0.335)						

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: (Continuation) Letter Recognition Regression per Country - Model 2

VARIABLES	Standardized Letter Score at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Std Letter Base	0.263***	0.286***	0.643***	0.261***	0.369***	0.506***	0.413***	0.783***	0.130***
	(0.0332)	(0.0683)	(0.0472)	(0.0396)	(0.0317)	(0.0471)	(0.0297)	(0.0689)	(0.0271)
Male	0.0957	0.128*	0.0287	0.0701	-0.00386	0.0196	0.00191	-0.110	0.0199
	(0.0718)	(0.0735)	(0.0557)	(0.0580)	(0.0568)	(0.0657)	(0.0438)	(0.0867)	(0.0622)
Socioeconomic Quantile	-0.00390	-0.0173	0.0356	-0.0483	-0.0329	0.0226	0.0354	0.00994	-0.0103
	(0.0231)	(0.0236)	(0.0337)	(0.0305)	(0.0236)	(0.0422)	(0.0315)	(0.0249)	(0.0235)
Home Literacy Environment Quantile	0.0216	0.0175	-0.0236	0.0104	0.0352	-0.0355	0.0352	0.0523*	0.0214
	(0.0289)	(0.0241)	(0.0222)	(0.0209)	(0.0215)	(0.0518)	(0.0266)	(0.0277)	(0.0160)
Attended Preschool	0.000357	0.0485	0.00289	-0.0428	-0.150*	0.0797	0.0209	-0.0245	-0.0969
	(0.0659)	(0.0895)	(0.0983)	(0.0512)	(0.0766)	(0.0803)	(0.0520)	(0.0953)	(0.0726)
Repeated Grade 1	-0.0661	-0.0310	-0.0352	-0.00758	-0.0837	-0.292*	-0.0181	-0.121	0.0606
	(0.0778)	(0.0750)	(0.0763)	(0.0534)	(0.0774)	(0.152)	(0.0623)	(0.107)	(0.0711)
Constant	-0.716**	0.530***	0.165	0.488***	0.454***	0.725***	0.194	0.982***	0.666***
	(0.283)	(0.133)	(0.119)	(0.155)	(0.140)	(0.244)	(0.125)	(0.210)	(0.135)
Observations	686	232	550	583	775	309	688	422	417
R-squared	0.427	0.365	0.571	0.281	0.289	0.363	0.432	0.347	0.159

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Letter Recognition Regression per Country - Model 3

VARIABLES	Standardized Letter Score at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Treated = 1	0.874***	0.162**	0.406***	-0.162*	0.0140	0.239*	0.125**	0.0590	0.330**
	(0.205)	(0.0780)	(0.0978)	(0.0863)	(0.112)	(0.126)	(0.0546)	(0.143)	(0.135)
Age 7 or younger = 1	0.0559	0.0797	0.0261	0.124**	-0.0195	-0.0919	0.0222	-0.101	0.344**
	(0.191)	(0.237)	(0.227)	(0.0543)	(0.113)	(0.175)	(0.0523)	(0.145)	(0.127)
Treat X Age7under	0.0287	-0.0664	0.214	0.00917	-0.844*	0.380*	0.135	0.334*	-0.484***
	(0.201)	(0.226)	(0.310)	(0.0937)	(0.487)	(0.213)	(0.0841)	(0.171)	(0.145)
Age 11 or older = 1		0.143**	0.0207	-0.254	-0.0787	0.0984	0.244*	-0.311**	0.231
		(0.0656)	(0.0842)	(0.351)	(0.0928)	(0.127)	(0.145)	(0.129)	(0.136)
Treat X Age11up		-0.312**	-0.0799	-0.0732	-0.0567	-0.283	-0.148	0.181	-0.658**
		(0.120)	(0.138)	(0.467)	(0.124)	(0.221)	(0.226)	(0.234)	(0.298)
Std Letter Base	0.273***	0.303***	0.632***	0.271***	0.368***	0.506***	0.413***	0.795***	0.141***
	(0.0348)	(0.0709)	(0.0445)	(0.0391)	(0.0313)	(0.0467)	(0.0289)	(0.0695)	(0.0261)
Male	0.0932	0.106	0.0188	0.0753	-0.00569	0.0265	0.00536	-0.112	0.0543
	(0.0676)	(0.0649)	(0.0549)	(0.0556)	(0.0561)	(0.0681)	(0.0425)	(0.0772)	(0.0606)
Socioeconomic Quantile	-0.00370	-0.0190	0.0376	-0.0363	-0.0337	0.0240	0.0364	0.0111	-0.0125
	(0.0235)	(0.0253)	(0.0328)	(0.0324)	(0.0236)	(0.0421)	(0.0307)	(0.0248)	(0.0224)
Home Literacy Environment Quantile	0.0264	0.0110	-0.0182	0.00891	0.0339	-0.0471	0.0355	0.0454	0.0207
	(0.0308)	(0.0230)	(0.0230)	(0.0226)	(0.0214)	(0.0543)	(0.0259)	(0.0269)	(0.0164)
Attended Preschool	0.0176	0.0539	0.0263	-0.00782	-0.143*	0.0940	0.0176	-0.0394	-0.0844
	(0.0642)	(0.0956)	(0.0918)	(0.0590)	(0.0784)	(0.0780)	(0.0530)	(0.0873)	(0.0742)
Repeated Grade 1	-0.0966	-0.0770	-0.0293	-0.0304	-0.0630	-0.300*	-0.0199	-0.152	0.0431
	(0.0822)	(0.0695)	(0.0746)	(0.0556)	(0.0721)	(0.158)	(0.0605)	(0.0987)	(0.0637)
Constant	-0.427*	0.501***	0.143	0.678***	0.512***	0.576***	0.215**	1.135***	0.442**
	(0.230)	(0.109)	(0.104)	(0.103)	(0.122)	(0.206)	(0.104)	(0.173)	(0.162)
Observations	686	232	550	583	775	309	688	422	417
R-squared	0.410	0.323	0.557	0.237	0.276	0.334	0.424	0.328	0.097

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Reader Tier Regression per Country - Model 1

VARIABLES	Standardized Reader Tier Achievement at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Treated	1.394***	0.0535	0.336***	-0.263	-0.0338	0.532***	0.335***	0.379*	-0.0779
	(0.102)	(0.141)	(0.100)	(0.162)	(0.0450)	(0.166)	(0.0785)	(0.189)	(0.137)
Age5	0.121		-0.679***			-0.691**			0.0154
	(0.380)		(0.110)			(0.338)			(0.294)
Age6	0.129	-0.396		0.203	-0.0663	-0.116	0.215	0.0600	0.101
	(0.183)	(0.684)		(0.197)	(0.0535)	(0.274)	(0.153)	(0.460)	(0.183)
Age7	0.178	-0.115	0.0469	0.330**	-0.237	-0.108	0.352***	-0.0159	-0.139
	(0.170)	(0.236)	(0.242)	(0.153)	(0.155)	(0.216)	(0.0983)	(0.246)	(0.242)
Age8	0.400*	-0.0744	-0.116	0.504***	-0.0619	0.0501	0.109	-0.227	-0.192
	(0.200)	(0.179)	(0.116)	(0.166)	(0.0628)	(0.242)	(0.0942)	(0.220)	(0.176)
Age10	-0.235	-0.240	-0.0623	-0.0888	-0.0675	-0.315	0.108	-0.310	-0.193
	(0.441)	(0.174)	(0.107)	(0.260)	(0.0451)	(0.245)	(0.105)	(0.191)	(0.260)
Age11		-0.364	-0.284*	-0.153	-0.172*	-0.0242	0.229	-0.550**	0.299
		(0.261)	(0.146)	(0.431)	(0.0865)	(0.265)	(0.228)	(0.224)	(0.308)
Age12		-0.227	-0.00182	-0.0136	-0.101	-0.741**	-0.0698	0.154	0.373
		(0.181)	(0.127)	(0.298)	(0.0637)	(0.301)	(0.355)	(0.327)	(0.587)
Age13		-0.435	-0.0240	0.191	-0.134*	-0.345	0.00210	0.243	0.151
		(0.399)	(0.221)	(0.852)	(0.0750)	(0.415)	(0.644)	(1.057)	(0.627)
Age14			0.00615	-1.084***	-0.0970**			-0.820***	-0.154
			(0.190)	(0.216)	(0.0435)			(0.250)	(0.507)
Age15		-1.558***	-0.635**		-0.0805				0.254
		(0.141)	(0.285)		(0.0542)				(0.920)
Std Tier Base	0.221***	0.337***	0.678***	0.598***	0.717***	0.743***	0.636***	0.214	-0.119
	(0.0428)	(0.0664)	(0.0556)	(0.112)	(0.0686)	(0.0968)	(0.0410)	(0.145)	(0.113)
Male	0.0534	0.123	0.00297	0.344***	0.0294	0.0516	0.00944	-0.0964	-0.0210
	(0.0751)	(0.136)	(0.0913)	(0.0769)	(0.0429)	(0.0935)	(0.0828)	(0.0988)	(0.0985)
Socioeconomic Quantile	-0.00425	-0.0215	-0.0149	0.0331	-0.00837	0.0374	0.120**	0.0277	-0.0478
	(0.0253)	(0.0425)	(0.0509)	(0.0719)	(0.0157)	(0.0561)	(0.0473)	(0.0374)	(0.0399)
Home Literacy Environment Quantile	0.0554*	0.0841	0.0144	-0.0315	0.00468	-0.0143	-0.0992**	0.0361	0.0654
	(0.0318)	(0.0566)	(0.0324)	(0.0342)	(0.00844)	(0.0665)	(0.0383)	(0.0447)	(0.0410)
Attended Preschool	0.0223	-0.195	-0.116	-0.110	0.0861	0.0200	-0.0846	-0.0370	0.111
	(0.0878)	(0.151)	(0.151)	(0.130)	(0.0843)	(0.119)	(0.0947)	(0.183)	(0.0994)
Repeated Grade 1	-0.0495	-0.216	0.0510	-0.0179	-0.0229	-0.189	-0.0666	-0.166	0.0626
	(0.0987)	(0.206)	(0.106)	(0.141)	(0.0436)	(0.243)	(0.0780)	(0.133)	(0.116)
Constant	-0.557**	0.603**	0.417***	0.846***	-0.0374	0.663**	0.518***	0.448	0.352
	(0.218)	(0.220)	(0.139)	(0.226)	(0.102)	(0.308)	(0.134)	(0.304)	(0.314)
Observations	686	232	550	583	775	309	688	422	417
R-squared	0.500	0.150	0.282	0.095	0.716	0.204	0.258	0.070	0.032

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Reader Tier Regression per Country - Model 2

VARIABLES	Standardized Reader Tier Achievement at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Treated = 1	1.474***	-0.000990	0.386**	-0.237	-0.0568	0.256	0.303**	-0.227	-0.643**
	(0.285)	(0.209)	(0.154)	(0.336)	(0.0941)	(0.352)	(0.126)	(0.285)	(0.293)
Age5	0.260		-0.642***			-0.866***			-0.398
	(0.520)		(0.126)			(0.282)			(0.321)
Age6	0.150	-0.230		0.260	-0.0529	-0.388	0.208	-1.355***	-0.235
	(0.250)	(0.812)		(0.334)	(0.0716)	(0.438)	(0.253)	(0.287)	(0.268)
Age7	0.194	-0.0772	-0.304	0.326	-1.283***	-0.199	0.341***	-0.693**	-0.430
	(0.228)	(0.449)	(0.228)	(0.276)	(0.350)	(0.315)	(0.126)	(0.297)	(0.332)
Age8	0.530	-0.254	-0.174	0.487	-0.140*	-0.251	0.0521	-0.476	-0.592**
	(0.338)	(0.227)	(0.195)	(0.292)	(0.0784)	(0.406)	(0.161)	(0.313)	(0.257)
Age10	-0.189	-0.244	-0.0338	0.339	-0.0592	-0.476	0.0388	-0.479	-0.540*
	(0.250)	(0.285)	(0.130)	(0.404)	(0.0744)	(0.345)	(0.175)	(0.284)	(0.290)
Age11		-0.642*	-0.234	0.118	-0.145**	0.0347	0.572	-0.547	0.0114
		(0.324)	(0.172)	(0.573)	(0.0646)	(0.404)	(0.367)	(0.373)	(0.420)
Age12		0.0245	0.0498	-0.0210	-0.163	-0.886**	-0.223**	-0.339	-1.505***
		(0.206)	(0.134)	(0.292)	(0.104)	(0.362)	(0.105)	(0.394)	(0.250)
Age13		-0.195	0.368	0.180	-0.127*	-1.138***	0.881***	1.561***	0.402
		(0.747)	(0.378)	(0.844)	(0.0652)	(0.258)	(0.102)	(0.277)	(0.679)
Age14			-0.0393	-1.077***	-0.128*			-0.881***	-1.508***
			(0.257)	(0.305)	(0.0660)			(0.285)	(0.213)
Age15		-1.493***	-0.508		-0.0636				0.519
		(0.166)	(0.339)		(0.0664)				(0.938)
Treat X Age5	-0.387					0.326			0.806
	(0.699)					(0.875)			(0.522)
Treat X Age6	-0.0603	-0.950		-0.104		0.486	0.00269	2.158***	0.597*
	(0.338)	(0.889)		(0.387)		(0.581)	(0.300)	(0.530)	(0.335)
Treat X Age7	-0.0501	-0.0234	0.764	0.0264	1.197***	0.163	0.0174	1.400***	0.509
	(0.302)	(0.492)	(0.460)	(0.325)	(0.362)	(0.439)	(0.187)	(0.373)	(0.465)
Treat X Age8	-0.253	0.313	0.0959	0.0425	0.127	0.516	0.0997	0.633	0.707**
	(0.389)	(0.313)	(0.240)	(0.344)	(0.119)	(0.506)	(0.198)	(0.385)	(0.314)
Treat X Age10	-0.0979	0.00567	-0.0710	-0.902*	-0.0156	0.280	0.131	0.432	0.613
	(0.584)	(0.372)	(0.230)	(0.496)	(0.104)	(0.477)	(0.213)	(0.328)	(0.475)
Treat X Age11		0.784	-0.143	-0.873	-0.0575	-0.110	-0.566	0.125	0.507
		(0.501)	(0.315)	(0.608)	(0.152)	(0.512)	(0.445)	(0.419)	(0.571)
Treat X Age12		-0.616	-0.117		0.112	0.247	0.269	1.145*	2.448***
		(0.374)	(0.264)		(0.120)	(0.594)	(0.576)	(0.574)	(0.624)
Treat X Age13		-0.467	-0.805*		-0.0123	1.068*	-1.774***	-2.466***	
		(0.918)	(0.446)		(0.144)	(0.557)	(0.154)	(0.356)	
Treat X Age14			0.173		0.0691			0.270	2.140***
			(0.312)		(0.0918)			(0.287)	(0.343)
Treat X Age15			-0.623						
			(0.404)						

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 18: (Continuation) Reader Tier Regression per Country - Model 2

VARIABLES	Standardized Reader Tier Achievement at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Std Tier Base	0.220***	0.327***	0.683***	0.598***	0.725***	0.741***	0.639***	0.228	-0.142
	(0.0430)	(0.0736)	(0.0568)	(0.108)	(0.0691)	(0.0986)	(0.0411)	(0.142)	(0.115)
Male	0.0540	0.154	0.00763	0.336***	0.0312	0.0319	0.00879	-0.143	-0.0331
	(0.0769)	(0.138)	(0.0917)	(0.0796)	(0.0436)	(0.0897)	(0.0845)	(0.102)	(0.0958)
Socioeconomic Quantile	-0.00484	-0.0318	-0.0219	0.0238	-0.00729	0.0410	0.120**	0.00915	-0.0442
	(0.0252)	(0.0446)	(0.0520)	(0.0719)	(0.0153)	(0.0581)	(0.0480)	(0.0365)	(0.0416)
Home Literacy Environment Quantile	0.0536	0.0782	0.0132	-0.0320	0.00462	-0.0168	-0.0928**	0.0430	0.0648
	(0.0326)	(0.0617)	(0.0317)	(0.0356)	(0.00825)	(0.0610)	(0.0378)	(0.0446)	(0.0407)
Attended Preschool	0.0188	-0.158	-0.135	-0.108	0.0663	0.0220	-0.0904	-0.0586	0.123
	(0.0894)	(0.172)	(0.160)	(0.126)	(0.0786)	(0.120)	(0.0991)	(0.182)	(0.0997)
Repeated Grade 1	-0.0535	-0.208	0.0907	-0.0165	-0.0243	-0.178	-0.0768	-0.165	0.0643
	(0.1000)	(0.202)	(0.109)	(0.141)	(0.0450)	(0.253)	(0.0781)	(0.141)	(0.116)
Constant	-0.578**	0.647***	0.405***	0.846***	-0.0100	0.825**	0.533***	0.760**	0.652**
	(0.261)	(0.189)	(0.143)	(0.290)	(0.108)	(0.349)	(0.159)	(0.345)	(0.273)
Observations	686	232	550	583	775	309	688	422	417
R-squared	0.501	0.175	0.292	0.104	0.719	0.215	0.264	0.120	0.050

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 19: Reader Tier Regression per Country - Model 3

VARIABLES	Standardized Reader Tier Achievement at Endline								
	(Bangladesh)	(Burundi)	(Ethiopia)	(Eswatini)	(Ghana)	(India)	(Nepal)	(Malawi)	(Rwanda)
Treated = 1	1.315***	0.0821	0.371***	-0.315	-0.0381	0.582***	0.368***	0.170	-0.147
	(0.184)	(0.134)	(0.122)	(0.214)	(0.0423)	(0.175)	(0.0921)	(0.200)	(0.167)
Age 7 or younger = 1	-0.165	-0.0203	-0.305	-0.0869	-1.225***	-0.0958	0.274**	-0.396	0.0340
	(0.181)	(0.465)	(0.200)	(0.110)	(0.340)	(0.215)	(0.131)	(0.234)	(0.143)
Treat X Age7under	0.0952	-0.0820	0.829*	0.0825	1.174***	-0.0295	-0.0429	1.053***	0.0936
	(0.204)	(0.507)	(0.417)	(0.173)	(0.345)	(0.305)	(0.168)	(0.302)	(0.212)
Age 11 or older = 1		-0.203	-0.0392	-0.390	-0.0971*	-0.135	0.425	-0.0599	0.00302
		(0.176)	(0.112)	(0.488)	(0.0504)	(0.281)	(0.315)	(0.247)	(0.459)
Treat X Age11up		-0.132	-0.152	-0.108	-0.000379	-0.188	-0.564	0.00700	0.549
		(0.305)	(0.170)	(0.568)	(0.0892)	(0.356)	(0.402)	(0.325)	(0.521)
Std Tier Base	0.222***	0.338***	0.679***	0.604***	0.724***	0.743***	0.642***	0.201	-0.124
	(0.0421)	(0.0700)	(0.0525)	(0.114)	(0.0700)	(0.104)	(0.0412)	(0.138)	(0.108)
Male	0.0619	0.104	0.0145	0.361***	0.0294	0.0189	0.0104	-0.132	-0.0141
	(0.0750)	(0.129)	(0.0901)	(0.0795)	(0.0432)	(0.0856)	(0.0833)	(0.0993)	(0.0938)
Socioeconomic Quantile	-0.00692	-0.0275	-0.00245	0.0357	-0.00690	0.0408	0.118**	0.0123	-0.0499
	(0.0255)	(0.0420)	(0.0542)	(0.0709)	(0.0156)	(0.0555)	(0.0464)	(0.0349)	(0.0391)
Home Literacy Environment Quantile	0.0581*	0.0840	0.0104	-0.0329	0.00519	-0.0232	-0.0953**	0.0382	0.0729*
	(0.0326)	(0.0554)	(0.0317)	(0.0361)	(0.00815)	(0.0628)	(0.0383)	(0.0459)	(0.0400)
Attended Preschool	0.0237	-0.173	-0.143	-0.0643	0.0671	0.0291	-0.0913	-0.0249	0.115
	(0.0866)	(0.151)	(0.156)	(0.135)	(0.0726)	(0.117)	(0.0942)	(0.186)	(0.0957)
Repeated Grade 1	-0.0667	-0.237	0.0469	-0.0413	-0.0245	-0.213	-0.0791	-0.173	0.0902
	(0.102)	(0.203)	(0.107)	(0.148)	(0.0449)	(0.245)	(0.0780)	(0.135)	(0.116)
Constant	-0.241	0.534***	0.336**	1.185***	-0.0630	0.610**	0.573***	0.391	0.211
	(0.234)	(0.185)	(0.131)	(0.225)	(0.0889)	(0.242)	(0.140)	(0.267)	(0.238)
Observations	686	232	550	583	775	309	688	422	417
R-squared	0.494	0.135	0.277	0.072	0.716	0.178	0.258	0.079	0.027

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1