



Save the Children®

**Early Literacy & Maths Initiative
(ELMI)
Rwanda
Baseline Report**

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Country Team**

Special thanks to the enumerators



I. Executive Summary

Save the Children's Early Literacy and Maths Initiative (ELMI), a project supported by Innovation for Education, a partnership between the Governments of Rwanda and the UK, was initiated in Rwanda in January 2013. Early literacy and maths (ELM) skills are essential components of quality education. Children need the opportunity and support to gain these skills during pre-primary years. Yet, there is a shortfall of resources, expertise and investment in supporting pre-primary ELM teaching in Rwanda.

ELMI aims to demonstrate techniques that are pedagogically sound, scalable, and which will ensure that during the critical early years Rwandan children benefit from inclusive, effective teaching and learning opportunities that support ELM skills development at pre-primary level, and improve school readiness and long-term learning outcomes for young learners. This includes piloting the introduction of ELM-specific techniques for caregivers in existing Early Childhood Care and Development (ECCD) Centres as well as designing and piloting a new parent outreach component for parents in communities whose children do not attend ECCD Centres. Evidence gathered through this project will enable Save the Children, the Rwandan Government and other relevant actors in this field to develop cost-effective, replicable models, which are appropriate for scale up to achieve maximum impact for children. To support learning and enable meaningful evidence of the project's results to be produced, a rigorous evaluation process was developed, commencing with a baseline assessment.

The following report outlines the results of the baseline assessment of four and five year olds' school readiness skills, prior to the start of program activities. The baseline data collection also sought to better understand the quality of the home environment for children in the study, as well as the current quality of the ECCD centers that some children attend. This information will be used to gauge the progress children in Save the Children's ELMI program in Rwanda will make compared with that of students not in the program.

The study tested over 800 young children, some of who will be part of the ELMI ECCD intervention, some who will be part of the ELMI parent intervention and two types of control students—those in ECCD centres that will not receive the ELM booster and those not attending any type of ECCD program. Information was also collected on the student's background and learning environment at home and in ECCDs. This information will help us monitor both the intermediary changes in learning environment and support we hope to see from the program and the ultimate goal of better school readiness for students.

First, the report looks at whether the school readiness assessment is a reliable and rigorous tool as well as if it adequately captures children's skills. This report shows that we find the tool is very rigorous and that most of the questions were able to capture a variance in children's skills. Composite measures of emergent literacy, emergent mathematics, motor skills, socio-emotional intelligence, health and hygiene, and persistence were created based on questions that captured this variance.

Second, we find that the two treatment groups (ELMI preschool and ELMI parent intervention) and two control groups (non ELMI ECCD and no ECCD) are different on a variety of background characteristics and baseline school readiness levels. This stems from multiple factors, including how the intervention areas were initially targeted and the types of students who tend to be in non ELMI ECCD or no ECCD at all. Since students were not randomly assigned to the treatment and control, we would expect there to be differences among the groups. We will control for these differences when we do the endline analysis of the difference in gains over the years between treatment and control children.

However, there may be significant challenges in being able to attribute causation for improved performance to the program alone because while we can control for observable factors like socio-economic status and initial scores there are likely other unobservable variables, like motivation, parents' interest in education, etc. that we cannot measure well enough and might influence what group the child may have ended up in. Additionally, we would expect there to be differences between children who attend an ECCD center and those who do not.

The third section looks at what background factors were related to higher levels of school readiness. In a multivariate regression looking at what factors are related to school readiness skills (literacy, math, socio-emotional intelligence, health and hygiene and persistence), we find several characteristics that are related to these outcome variables. Age, socio-economic status, mother and father's education and parent-child interactions (quality home environment) were all positively correlated with several of the outcomes. Whether the student has reading materials at home was also positively correlated with emergent literacy. While this does not prove that these factors cause these better outcomes, there appears to be a strong relationship between these factors and a young child's skill level.

Finally, the last section reports on the overall quality of the ECCD centers children in the study are attending. We find that the quality of the centers along most dimensions the assessment tool included (such as language and literacy, math, activities and overall structure) can be improved. The ELMI initiative aims to focus specifically on improving the focus on emergent literacy and math, but the approach of the program and training will also support other indicators of the environment – thus we expect to see significant gains in overall ECCD quality by the end of the program.

The data collected for this baseline and reflected in this report provides information that will not only support the generation of evidence of the project's effectiveness, but provides important information that will be helpful for informing the project implementation.

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II. Overview

The following report presents the results of a baseline school readiness assessment for four and five year olds in the Innovation for Education-funded ELMI program and in control groups. This section (Section II) outlines the main questions investigated during this baseline and provides background information about the program intervention. Section III presents information on what kinds of data were collected and information about the sample. In Section IV, we examine how students performed in each area of the assessment, determine the rigor of the school readiness tool and assess what questions were effective in capturing the children's skill level in each area: motor development, emergent literacy, emergent math, socio-emotional intelligence, health & hygiene and persistence to learning. Section V provides a comparison between the different groups in the study. Section VI outlines the background characteristics that may predict performance on areas of school readiness and Section VII presents data on the quality of the ECCD centers that are a part of the ELMI project.

The report looks to answer four main questions:

1. Is the school readiness assessment a reliable and rigorous tool that captures variations in young learners' skills across developmental indicators?
2. Are assessment components included in the tool most effectively capturing the intended skills/developmental indicators? How might each scale be improved for future assessments in Rwanda?
3. What is the benchmark for children in each of the groups in terms of emergent literacy, mathematics, socio-emotional skills, and personal health and hygiene before the ELMI program begins, as well as what is the current level of engagement of parents in the learning and development of children?
4. What factors are correlated with the children's performance on the school readiness assessment at baseline?

Background

Research on literacy development suggests that the foundations of learning to read and write are set long before a child enters first grade. The process of becoming literate is intertwined with the development of emergent literacy skills and the experiences children have with language and print during early childhood years (Mullis, Martin, Kennedy, & Foy, 2007). Similarly, even before children learn to add, subtract, multiply or divide, they learn concepts about numbers that are a part of emergent maths and that pave the way to more complex maths competencies and proficiency in early primary grades and beyond.

Save the Children believes that these foundational skills can be supported meaningfully during the early childhood years both in the home as well as in ECCD centres. The overarching objective of this project is to develop an evidence-based, scalable program that effectively supports ELM skills of ECCD age children (3-6 years) in Rwanda by:

- 1) Training ECCD caregivers in 21 existing ECCD centres to effectively support ELM skills development among children;
- 2) Train parents to actively support children's ELM skills development at home;

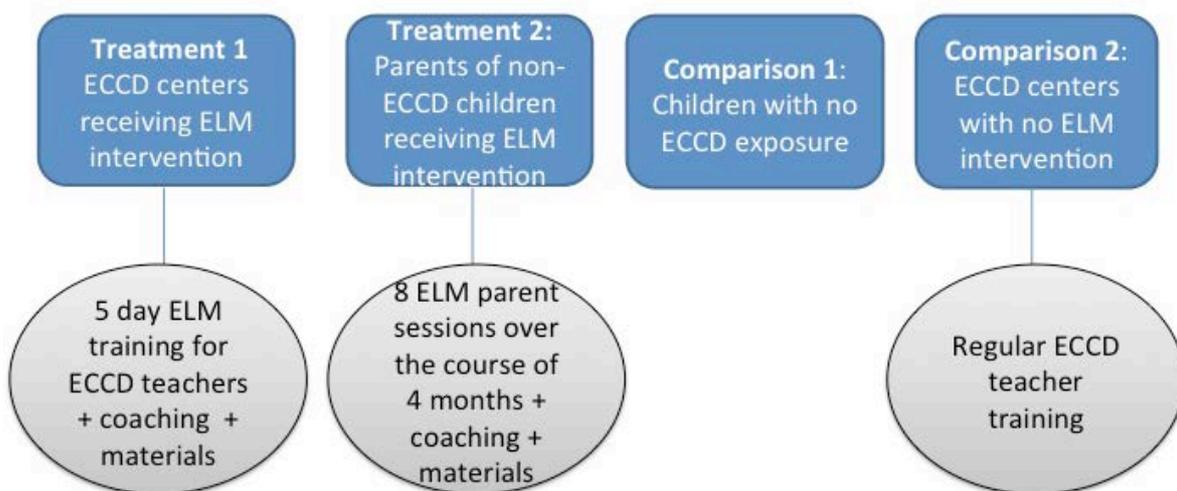
- 3) Advocacy to build leadership and commitment to the ELM approach within the Government of Rwanda.

In order to demonstrate the effectiveness of the ELMI approach, a comprehensive set of evaluation tools were developed and adapted to the Rwandan context prior to conducting the baseline study. This report highlights the methodology that was applied, the results that were drawn from the data collected on school readiness skills, a results comparison across four different groups, broken down according to background factors, the degree of predictability that these factors have on school readiness skills, and recommendations for programming in light of the findings.

III. Methodology

The evaluation design for the ELMI project involves an intervention-comparison pre-post and prospective assessment of children participating in each of the interventions (ELMI ECCD and ELMI parenting), and two types of control children – some attending non ELMI ECCD Centres and some with no exposure to any ECCD services.

Summary of Intervention and Comparison Groups



The School Readiness Assessment tool was used to assess child level outcomes. In addition, we included a rigorous parent questionnaire to document the changes in parenting practices over the course of the program. Finally, we used the Early Childhood Environment Rating Scale (ECERS) to assess the overall quality of the existing ECCD centers. These tools have been used and validated in more than 5 countries by Save the Children, but they were new to Rwanda. Thus, substantial effort and time went into adapting, piloting and validating the tools to the Rwandan context to ensure relevance.

Ten (10) enumerators¹ were hired and trained together with Save the Children project staff for 12 days from 15th to 26th April 2013 during which period they also pilot-tested the tools in both in Save the Children supported communities, as well as non-supported communities to ensure adequacy

¹ Although ten enumerators were hired and began the training, one dropped out in the middle of training, thus leaving nine enumerators plus the four ELMI project staff to collect the data.

and relevance. The training was intensive and included not only guidance on the assessment administration but also issues of ethics, child safe guarding as well inter-rater reliability. Following this, a data collection process took place in the 4 districts of the project implementation (on treatment and control groups) throughout the month of May, before program implementation had begun. To ensure reliability of data, ELMI project staff closely supervised the data collection.

School readiness assessments were carried out with children estimated to be starting primary school in January 2015 (aged 4 or 5 this year, to be 6 or 7 in 2015 and attending P1). The assessment consisted of 2 components per family:

- 1) A direct assessment of school readiness skills for the child.
- 2) A household and parenting questionnaire for the parent.

A consent form was signed by each parent prior to the child assessment, and a conversation to ascertain consent was held with each child prior to the assessment. Each child/parent pair was randomly selected from the all the children that could be identified (by SCI ELMI Officers in conjunction with the local authorities for those in non-ECCD centres) who fit the criteria for each group. We ensured gender balance as closely as possible in each target group in each location.

More than 800 assessments were collected across the project targeting 4 distinct groups of children/parent pairs as outlined above. To determine the sample size we used power calculations. In previous studies we have conducted we have found an effect size of at least 0.33, therefore in our calculations we used 0.33 as an effect size. Being able to detect an effect this size using a series of group means comparisons (two tailed t-test) between each of the four groups at 0.8 power requires a sample size of at least 200 for each group. While we would have liked to have a larger sample size to look at disaggregated effects, we were limited financially to about 200 children per group. Non-ELMI ECCD had a smaller sample size because Save the Children did not operate additional centers in the districts where the intervention is to take place.

In addition, ECERS data was collected by trained staff in the 25 ECCD centres across the 4 districts. Data was entered by both enumerators and project staff and cross-checked on more than one occasion.

Instruments

This School Readiness Assessment tool includes items related to six developmental indicators of preschool children: Motor Development (fine and gross motor skills), Emergent Literacy, Emergent Math, Socio-Personal Development, Personal Health & Hygiene and Persistence. The table below outlines the key constructs assessed under each indicator with corresponding number of items.

Indicator	Constructs assessed	# of items	# of questions
Motor Development	Fine Motor Skills	4	11
	Gross Motor Skills	4	5
Emergent Literacy	Print awareness and book knowledge	1	10
	Alphabet Awareness (Expressive &	2	2

	Receptive) Oral language (Expressive, Receptive & Comprehension) Phonological Awareness Writing	6 2 3	28 5 3
Emergent Math	Number awareness Measurement Geometry Sorting & Classification Patterns	7 3 1 2 3	18 10 7 6 3
Socio-emotional Development	Emotional awareness, conflict resolution, preferences, personal information, sharing, friends, strengths	8	19
Personal Health and Hygiene	Hand washing, latrines, bed nets	6	18
Persistence	Puzzle, writing, folding, object	5	5

The parent questionnaire includes a number of aspects. First it covers key socio-demographic characteristics of the family including number of children in the family, parent education, parent work, socio-economic status among others. In addition, the questionnaire includes questions capturing the quality of parent-child interactions (including items such as how often parents play with child, read stories with child etc.), the home literacy environment (including number of books available in the household, are parents seen reading etc.), the toys and learning materials available for the child at home (i.e. puzzles, drawing materials, among others), as well as the discipline style of the parents – i.e. positive discipline vs. punitive discipline. All tools used are attached to this report in Appendix 1.

The adapted ECERS consists of 27 items measuring 5 different dimensions of ECCD program quality. Those include 1) Space and Furnishings, 2) Program Activities, 3) Interactions between teachers and students, 4) Early Language and Literacy, and 5) Math. In addition, all 27 items comprise a total score for the ECERS.

Sample

Although children aged 3-6 years can be assessed using the school readiness assessment tool, the target group in this study was 4 and 5 years olds (98 percent of the sample), and analyses will only focus on these children. In addition, overall the sample is 53 percent male and 47 percent female. Where information between child and parent-reported ages or sex differed, parent reported information was used as the gold standard. While some children had precise information about their age in years and months, only years was used in the analysis.

Age Group (Years)	Total		Gender			
			Male		Female	
	N	%	N	%	N	%
3	6	.7%	5	1.1%	1	0.3%

4	252	30.6%	134	30.6%	118	30.6%
5	553	67.1%	292	66.7%	261	67.6%
6	13	1.6%	7	1.6%	6	1.6%
Total	824	100%	438	100%	386	100%

Children were sampled from 4 different districts in Rwanda – Burera², Gicumbi³, Rubavu and Ruhango. Further as discussed above, children were sampled in four different conditions – two treatment groups (ELMI ECCD and ELMI parenting) and two controls – see table below. Sampling from these different groups will allow us to see how children in these different situations progress over several years.

District	ELMI ECCD	ELMI Parent Intervention	Non-ELMI ECCD	No ECCD
Burera	47	61	120	42
Gicumbi	55	0	0	58
Rubavu	48	83	0	50
Ruhango	48	49	0	50
Other/No answer	2	53	1	52
Total	200	246	121	252

Analysis

Ideally we would like to have an instrument with strong internal validity, and that accurately measures children’s true skills in emergent literacy, math, etc. This includes having an instrument that is not too hard, not too easy and provides a spread of scores amongst the children to understand how they perform relative to each other. If the assessment captures variation in young children’s developmental outcomes for school readiness, then we would expect that:

1. Scores across developmental indicators should reflect some increase by age (though this is not necessarily expected for all indicators).
2. Scores across developmental indicators should correlate with each other, and sub-scale scores within individual indicators should correlate as well (Dowd & Friedlander, 2009).

Analyses in this report focus mainly on correlations and internal validity tests measured by Cronbach’s alpha. Generally, Cronbach’s alpha scores above .8 are considered good and scores below .5 are unacceptable⁴. Individual items (as opposed to composite scores) were used to calculate internal reliability scores as available because they produce more reliable measures of item performance. Some caution should be used in interpreting internal reliability calculations from this assessment because of the large number of zero scores on some items. Finally, total scores for items were created by summing equally weighted individual items.

² The Non-ELMI ECCD Control centres are all located in Burera district; these centres were selected because they are also Save the Children supported, though in an earlier stage of support than the ELMI ECCD centres at the time of the baseline data collection.

³ Note that the ELMI parenting component will not be implemented in Gicumbi district.

⁴ George and Mallery (2003) provide the rules of thumb for interpreting Cronbach’s alpha: $\alpha > .9$ is Excellent, $\alpha > .8$ is Good, $\alpha > .7$ is Acceptable, $\alpha > .6$ is Questionable, $\alpha > .5$ is Poor, and $\alpha < .5$ is Unacceptable (p. 231).

In order to compare students in ELMI ECCD with their peers that will receive the ELMI parenting intervention, those attending an ECCD program without ELMI and those with no ECCD and no parenting, we used ANOVA and Tukey-Kramer post-hoc pairwise comparison tests to compare these four groups along a variety of baseline characteristics.

Within the ECERS data, Cronbach’s alpha was computed to understand how well the different items hang together. Descriptive data for the twenty-seven individual items in the ECERS allows us to understand trends among the different districts and gives information about the areas that most need to be improved in the ELMI centres.

IV. Results – School Readiness Skills

The following section establishes the internal validity of each indicator of the school readiness assessment, describes the overall results for each indicator and examines how much variance each question captures. Results were disaggregated by gender across all indicators, but no significant difference was noted between sexes and therefore the gender disaggregation is not reflected in this section’s presentation of results. The summary of gender-disaggregated data according to overall score on each indicator is, however, presented in the “Conclusion” section.

Motor Development

Gross Motor Development

We find that in our sample, on average, children have high scores on the gross motor items catching a ball, walking in a line, hopping, and balancing. There is some significant variation between the scores of 4 and 5 year olds, with walking in line and overall gross motor scale showing significant variation between groups. The total gross motor score and all other total indicator scores presented in this report were created by adding equally weighted totals of relevant items. Internal reliability of items in this report is measured using Cronbach’s alpha, and $\alpha = .70$ for this group of gross motor skill items, which is generally classified as acceptable.

Table 1. Summary of Gross Motor Development

	Min	Mean	Median	Max	Sd	N	Significant Difference between 4 & 5 year olds?
Catch a ball	0	2.63	3	3	1	805	
Walk in a line	0	1.38	1	2	1	803	*
Hop	0	8.97	10	10	2	795	
Balance 1	0	5.48	6	6	1	796	
Balance 2	0	5.32	6	6	1	796	
Total Gross Motor	0	4.28	5	5	1	792	*

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

The data suggest that these items can be combined into a meaningful scale score if desired. However, in order to save time and resources, the strong correlation between walking in a line and

the total gross motor score ($r = .61, p < .05$) suggests that walking in a line can be used to represent a child's gross motor skills.

Fine Motor Development

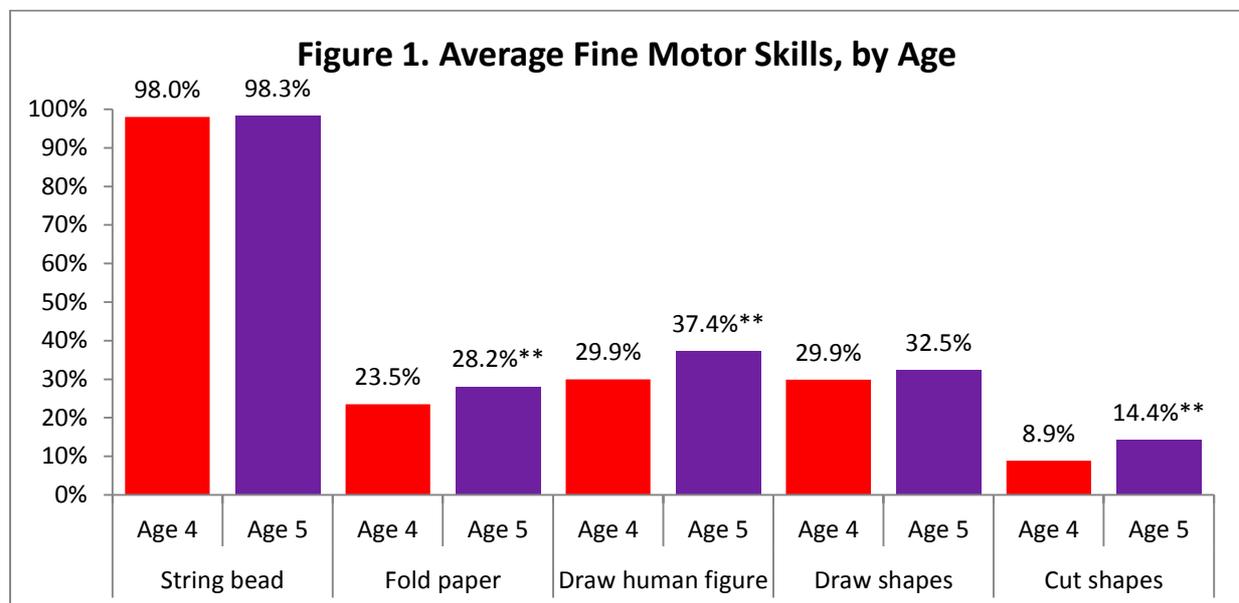
Overall in this sample, children have weaker fine motor skills than gross motor skills, which is to be expected, since children have fewer chances to practice fine motor activities in their daily lives. However, 98 percent of children were able to string 3 beads, indicating that this item is too easy for the children in this sample. The most difficult task for children was folding paper into simple shapes. It is not clear whether children's difficulty was related to the folding tasks, their knowledge of the shapes they were being asked to create, or both. Age is significantly and positively related to folding paper, drawing a human figure, cutting shapes and the total fine motor score. Cronbach's alpha for all of these items together is .85, but when excluding the stringing beads item, internal reliability increases to .87 which is excellent.

Table 2. Summary of Fine Motor Development

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
String beads	0	0.98	1	1	0	789	
Fold paper	0	1.87	1	7	2	794	**
Draw human figure	0	2.45	2	7	2	805	**
Draw shapes	0	0.95	1	2	1	805	
Total cutting shapes	0	0.38	0	2	1	805	**
Total Fine Motor¹	0	5.71	5	18	4	772	***

¹Total Fine Motor score does not include stringing bead item.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$



*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Overall Motor Development

In order to create this composite score for overall motor development, all items were weighted equally and added together. Overall, children had an average overall motor score of 10.0 out of 23

possible points (43 percent correct), and data show that 5-year-olds tend to score slightly higher than 4-year-olds. Still, the data indicates moderately low levels of overall motor skills.

Emergent Literacy

Concepts about Print

Overall, children in this sample have very limited knowledge of printed materials. On average, children correctly identified 2 out of 9 items related to knowledge of printed materials, so this is clearly an area where the ELMI program will contribute. The easiest task for children was to open the book and the most difficult were identifying the first word and identifying where the story ends. The only significant difference between 4 and 5-year-olds was with the proportion of students who can identify individual words on a page.

Table 3. Summary of Concepts about Print

	Min	Mean	Media n	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Book cover	0	50.4%	1	1	1	797	
Book open	0	72.2%	1	1	0	798	
Book title	0	20.5%	0	1	0	797	
Book topic	0	16.1%	0	1	0	797	
Separate words	0	27.2%	0	1	0	797	*
First word	0	9.1%	0	1	0	798	
Read direction	0	13.2%	0	1	0	798	
Read lines	0	10.8%	0	1	0	797	
Book end	0	9.4%	0	1	0	798	
CAP total	0	2.29	2	9	2	793	

*** p<0.001, ** p<0.01, * p<0.05

Cronbach's alpha for all of these items is .59. However, identifying the book cover is least correlated with the other items, and when it is excluded, Cronbach's alpha increases to .61. Thus, future assessments could consider dropping this item.

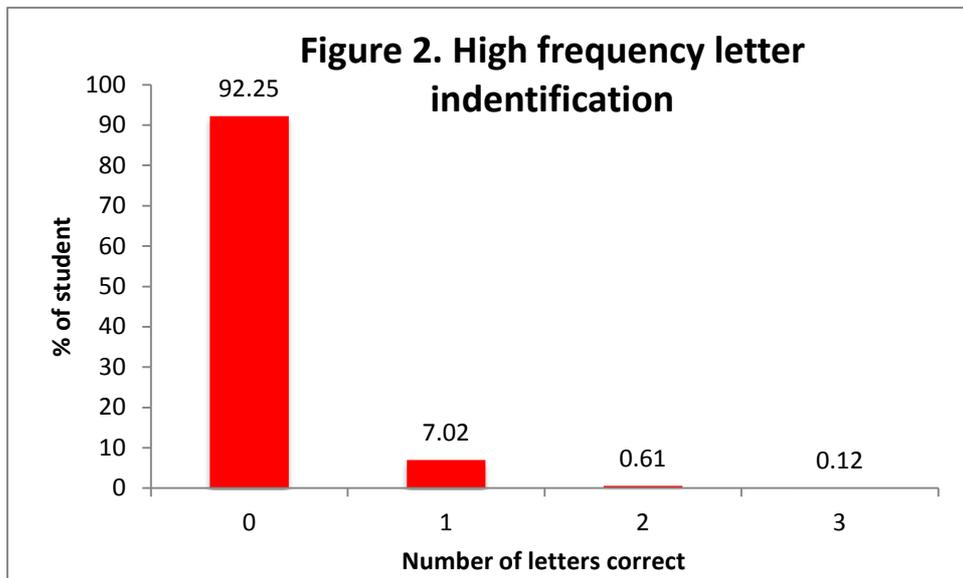
Letter Identification

Generally, children in this sample have very limited letter knowledge with children identifying only 2 letters on average. In fact, 92 percent of children could not identify a single letter.

Table 4. Summary of Letter Identification

High Frequency Letters			
# Correct	Freq.	Percent	Cum.
0	762	92.25	92.25
1	58	7.02	99.27

2	5	0.61	99.88
3	1	0.12	100
Low Frequency Letters			
# Correct	Freq.	Percent	Cum.
0	820	99.51	99.51
1	3	0.36	99.88
2	1	0.12	100
Total	824	100	
Medium Frequency Letters			
Total	Score	Freq.	Percent
0	770	92.33	92.33
1	55	6.59	98.92
2	6	0.72	99.64
3	3	0.36	100



Phonological Awareness

On average, phonological awareness is another relatively difficult indicator for children in this sample with an average total rhyming score of 15.8 percent correct, and 18 percent of first letter word sounds correct. In other words, very few children were able to successfully complete the phonological awareness items.

Table 5. Summary of Phonological Awareness

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Rhyme 1	0	9.7%	0	1	0	796	
Rhyme 2	0	6.3%	0	1	0	796	
Total Rhyme	0	0.158	0	2	0	796	
Word Sounds 1	0	7.2%	0	1	0	796	
Word Sounds 2	0	6.3%	0	1	0	795	

Word Sounds 3	0	4.9%	0	1	0	796	
Total Word Sounds	0	.181	0	3	0	796	

*** p<0.001, ** p<0.01, * p<0.05

Interestingly the rhyming and first letter word sound tasks are not significantly correlated, indicating that either they are measuring different aspects of this indicator or that children are not answering enough questions correctly to find relationships between these items. Internal reliability for rhyming tasks was $\alpha = .64$, and $\alpha = .44$ for word sounds, suggesting that rhyming tasks are a better fit for children in this sample and possibly others with similar characteristics.

Oral language

Oral language is a crucial aspect of the assessment and multiple items were included in the assessment to measure that. The expressive vocabulary task was the most difficult for children, while the multistep direction (i.e. asking children to remember a 3 step instruction and execute it in order) and receptive vocabulary (identifying pictures with different actions) were the easiest. Children also struggled with the listening comprehension task and were able to answer only 2 out of 8 questions on average.

Table 6. Summary of Oral Language

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Listening comprehension	0	2.23	2	8	2	805	
Identifying Actions	0	3.53	4	6	2	805	
Multistep Directions	0	1.68	2	3	1	805	
Story Construction	0	1.21	1	4	1	805	
Expressive Vocabulary	0	1.43	0	8	2	794	

*** p<0.001, ** p<0.01, * p<0.05

The total scores for all items are significantly correlated. Taken together these items have an internal reliability of .87, suggesting that they create a reliable measure of children's oral language skills.

Writing

On average, children were classified as level 1 writers (wrote a design or scribbles without order) and 5-year-olds performed better on the word copying task than 4-year-olds. Overall, children have lots of room for improvement on this task. Writing level and ability to copy words were highly correlated with each other ($r = .57$) while mature grip was not as highly correlated with writing levels, indicating that children were able to produce some symbols or letters without being able to demonstrate mature grip of pencil. Cronbach's alpha for all three items is .65, but when only analyzing writing level and copying words internal consistency rises to $\alpha = .73$. This suggests that in the future mature writing grip could be removed from the assessment of children's writing skills and instead added to the fine motor skills scale, where it fits much better.

Table 7. Summary of Writing Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Writing level	0	1.26	1	4	1	790	
Mature grip	0	0.62	1	1	0	788	

Copying words	0	1.36	1	4	1	785	*
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*** p<0.001, ** p<0.01, * p<0.05

Overall Emergent Literacy

In order to create this composite score for emergent literacy, all items were weighted equally and added together. Overall, children had an average emergent literacy score of 16.5 out of 47 possible points (35 percent correct), and data show that 5-year-olds tend to score slightly higher than 4-year-olds. Still, the data indicates very low levels of emergent literacy skills, substantiating the need for the ELMI program.

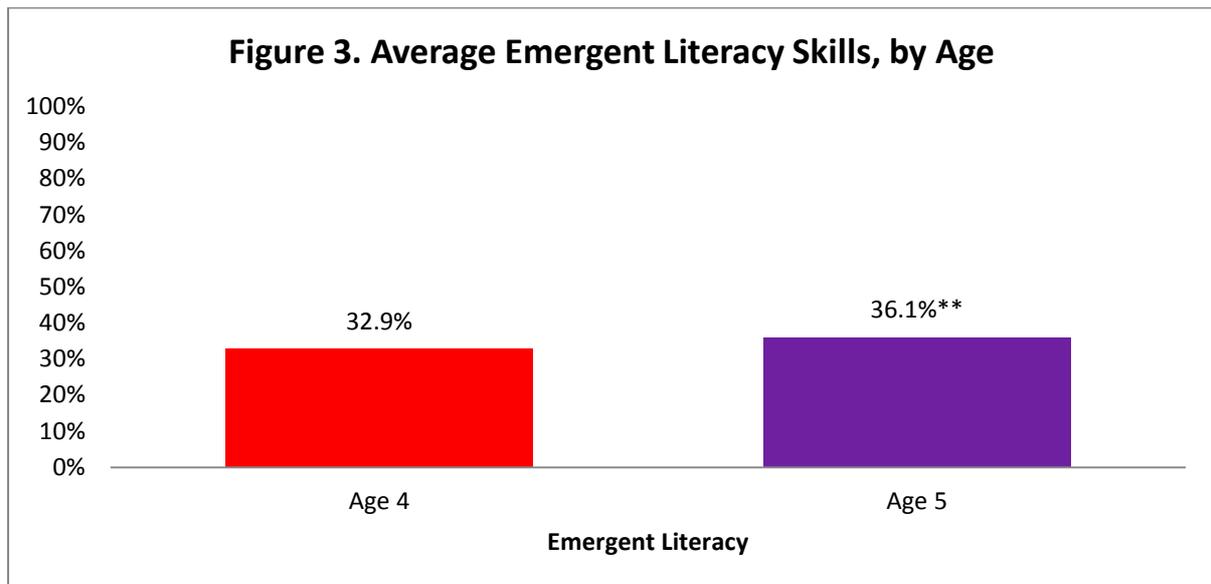


Table 8. Summary of Overall Emergent Literacy Skills, by Age

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Overall Literacy Score	0	16.50	17	35	7	752	**
4-year-olds	0.5	15.46	16	35	7	237	
5-year-olds	0	16.97	17	35	7	515	

*** p<0.001, ** p<0.01, * p<0.05

Despite varied internal reliability of individual items, Cronbach's alpha for all of the literacy items together is $\alpha = .87$, indicating that overall this assessment provides a very strong measure of young children's emergent literacy skills.

Emergent Math

Numbers

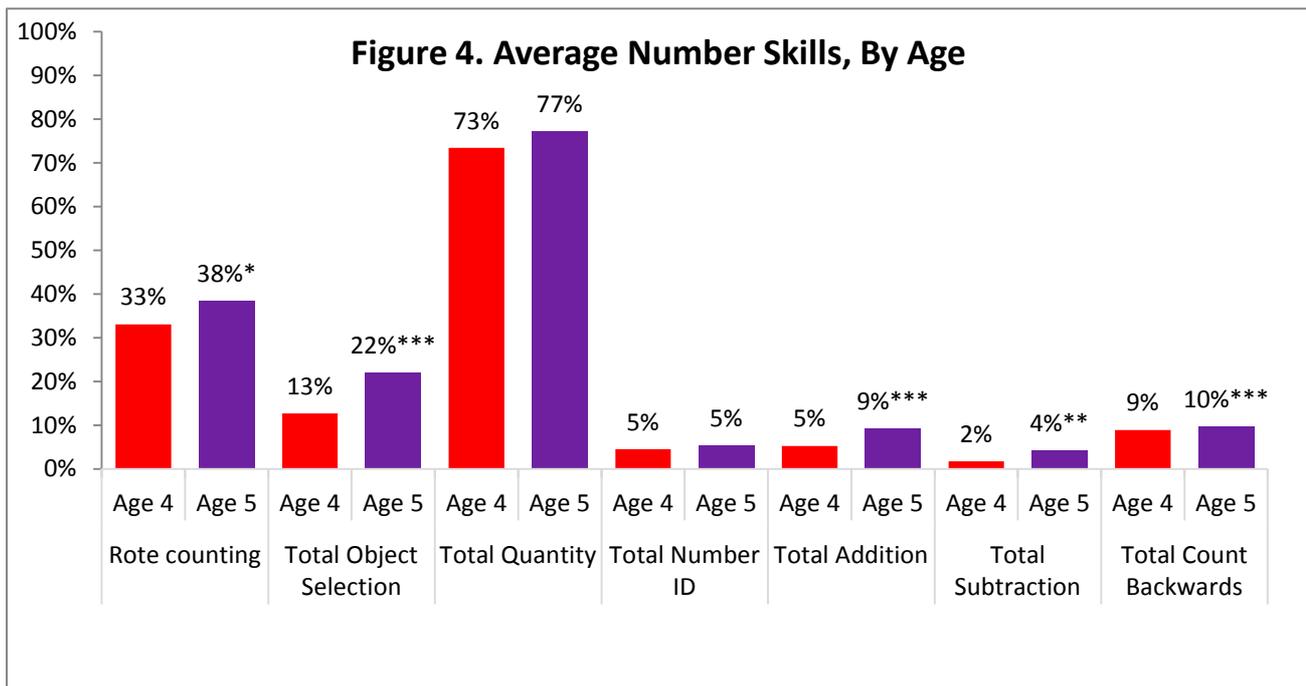
In general, students can count to 7 successfully. Number knowledge items were difficult for children, including identifying numbers, simple addition, subtraction, and selecting the correct number of objects when told a particular quantity (one to one correspondence). Children had an easier time identifying whether one number was relatively larger or smaller than another (quantity concepts).

The most difficult item for students was number identification, during which children were shown a list of numbers and asked to identify them. On average, students could only identify one number presented to them. Overall, these measures of number knowledge are significantly correlated and all together, the items are reliable ($\alpha = .76$). Finally, 5-year-olds tended to perform better on number tasks than 4-year-olds.

Table 9. Summary of Number Skills

	Min	Mean	Median	Max	Std	N	Sig. Diff btw 4 & 5 year olds?
Rote counting	0	7.34	8	20	6	797	*
Total Object Selection	0	1.10	1	4	1	805	***
Total Quantity Concepts	0	3.04	3	4	1	805	
Total Number ID	0	1.03	0	18	2	805	
Total Addition	0	0.24	0	3	1	805	***
Total Subtraction	0	0.10	0	3	0	805	**
Total Count Backwards	0	0.19	0	2	0	805	
Total Numbers Score	0	4.65	4	16	2	771	***

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$



*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

All items in this indicator are significantly correlated, with rote counting and object selection being the most highly correlated. ($r = .41$, $p < .05$). Given the number of items included in this section and the high correlation between some items, it could be possible to consolidate this section of the assessment in the future.

Concepts of measurement and time

These items were not significantly correlated with one another and are better analyzed as independent items. They were grouped together only for ease of presentation but they don't form a "measurement scale". Further investigation should be leveraged to include additional items capturing different aspects of children's knowledge of measurement. Of the three items, students had the easiest time determining the relative length of sticks/straws and the hardest time identifying the days of the week.

Table 10. Summary of Measurement Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Total Length Calculation	0	2.04	2	3	1	805	
Total Week Day Identification	0	0.39	0	4	1	805	
Total Left/Right Identification	0	1.46	1	3	1	805	

*** p<0.001, ** p<0.01, * p<0.05

Sorting

Sorting tasks were divided into two categories: Identification tasks asked children to recognize an item that did not belong with others in a group, and classification asked children to create their own system of sorting objects. Looking at the classification items data show that, in general, children were successful when asked to sort items by one noticeable characteristic, but had difficulty thinking of more than one way to sort a group of items (Classification item #4). The identification tasks significantly correlate with the classification items, and when combined these items have an internal reliability score of $\alpha = .61$. When classification items only are considered, internal reliability increases to .64 and when only classification items 1-3 are combined, internal reliability increases to .69. Future assessments could consider only using classification items.

Table 11. Summary of Sorting Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Identification 1	0	68.9%	1	1	0	797	
Identification 2	0	49.1%	0	1	1	797	
Total Identification	0	1.17	1	2	1	805	
Classification 1	0	81.4%	1	1	0	796	
Classification 2	0	60.7%	1	1	0	794	
Total Classification 1	0	1.40	2	2	1	805	
Classification 3	0	71.0%	1	1	0	794	
Classification 4	0	9.0%	0	1	0	793	
Total Classification 2	0	0.79	1	2	1	805	

*** p<0.001, ** p<0.01, * p<0.05

Patterns

Pattern completion was generally difficult for children in this sample. Copying a pattern of beads was easier for children than competing a pattern, and yet only 12 percent of children completed this task correctly. Patterns are a very important early math skill predictive of future outcomes and clearly there is a lot of room for supporting these skills.

Table 12. Summary of Pattern Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Copy Bead Pattern	0	0.12	0	1	0	796	
Complete Pattern	0	0.24	0	3	1	805	

*** p<0.001, ** p<0.01, * p<0.05

Puzzle- Problem Solving

Puzzle completing was also a surprisingly challenging task. Close to 60% of the children in the sample could not complete the puzzle despite sufficient time to think and a picture provided as a model.

Puzzles are a good proxy for problem solving and again the results indicate a critical need to support children’s skills in this area.

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
# of puzzle pieces fit together ¹	0	0.24	0	5	1	791	

*** p<0.001, ** p<0.01, * p<0.05

¹ 84% of students could not fit at least one set of puzzle pieces together. On average students fit 0.24 pieces together but the scores ranged from 0 to 5.

Geometry

Overall, children were able to correctly identify two out of eight possible shapes. The final two questions asked students to identify something in their environment that had the specified shape (i.e. something that is shaped like a circle). The easiest shapes for children to identify were circles and stars and the most difficult was a rectangle. Only circle identification shows differentiation between 4 and 5-year-olds. Taken together, these items have a low internal reliability of $\alpha = .55$. This suggests these are not reliable measures together of geometry skills.

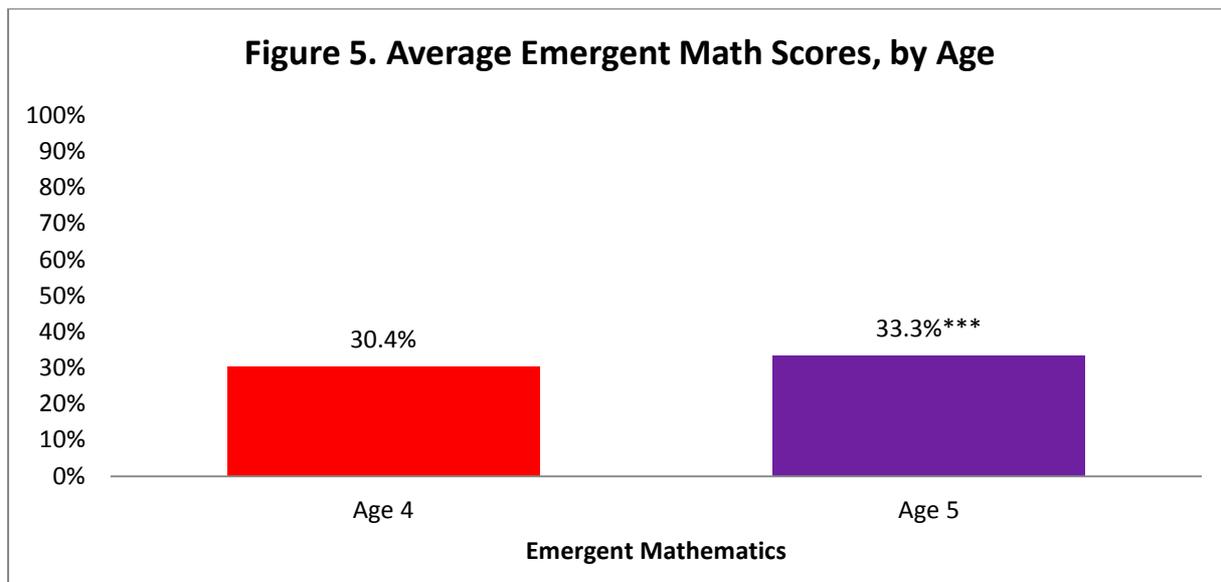
Table 13. Summary of Geometry Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Circle	0	61.3%	1	1	0	795	*
Star	0	62.4%	1	1	0	796	
Oval	0	18.0%	0	1	0	794	
Triangle	0	15.0%	0	1	0	794	
Square	0	13.3%	0	1	0	795	
Circle ID	0	20.0%	0	1	0	795	
Rectangle ID	0	8.3%	0	1	0	795	
Total Shape Score	0	2.07	2	7	2	805	

*** p<0.001, ** p<0.01, * p<0.05

Overall Emergent Mathematics Score

In order to create this composite score all items were weighted equally and added together. Overall, children had an average emergent mathematics score of 14 out of 44 possible points (32 percent correct), and data show that 5-year-olds tend to score slightly higher than 4-year-olds. Similar to our findings on emergent literacy, we see critical gaps in children’s early math skills, making the ELMI program very relevant.



*** p<0.001, ** p<0.01, * p<0.05

Table 14. Summary of Overall Emergent Mathematics Skills, by Age

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Overall Math Score	0	14.25	14	33	5	751	***
4-year-olds	0	13.37	14	27	5	238	
5-year-olds	0	14.66	14	33	5	513	

*** p<0.001, ** p<0.01, * p<0.05

Despite varied internal reliability of individual sub-scales, Cronbach’s alpha for all of the mathematics items together is high ($\alpha = .82$), indicating that overall this part of the assessment provides a good measure of young children’s emergent mathematics skills.

Socio-emotional development

Multiple items were used to assess children’s socio-emotional development.

- Perspective taking: Looking at the item of perspective taking, children were generally able to answer 1 of 4 questions correctly, and 5-year-olds were better able to answer these questions than 4-year-olds.
- Expressing preference: Children could generally identify 4 things they like to eat and 1 thing they like to play with. Overall, 93 percent of children identified at least one thing they like to eat and 77 percent named something they liked to play with. There were no differences between 4 and 5-year-olds on this item.
- Conflict resolution: Overall, conflict resolution was difficult for children, with less than 30 percent being able to identify one way to resolve a conflict. Older children were better able to identify one way to resolve a conflict but there were no age-related differences with being able to identify more than one method of conflict resolution or with the total score.
- Recognizing emotions: On average, children were able to identify one out of three emotions presented to them, with older children being better able to complete this task than younger children.

- Personal information: Almost two-thirds of children knew their mother and/or father’s names, and far fewer knew information about which community and country they lived in. Five-year-olds tended to be better able to answer these questions than 4-year-olds.
- Sharing: About one-third on children were able to give one appropriate response to sharing a toy with another child, and older children were better able to correctly respond to this question than younger children.
- On average, children were able to name 2-3 friends and identify 1-2 personal strengths. Seventy-eight (78%) percent of children identified the name of at least one friend and 75 percent named one or more strength. These responses did not vary significantly with age.

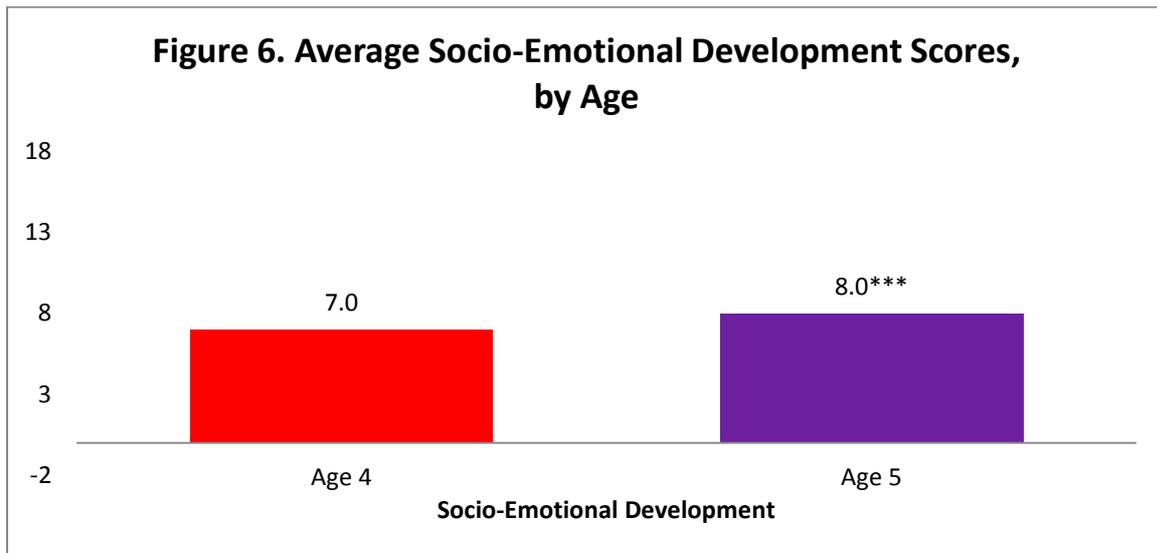


Table 15. Summary of Socio-emotional Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Perspective taking 1	0	31.8%	0	1	0	795	
Perspective taking 2	0	28.0%	0	1	0	797	
Perspective taking 3	0	28.4%	0	1	0	796	***
Perspective taking 4	0	16.8%	0	1	0	797	
Total Perspective Taking	0	1.04	1	4	1	805	*
Express Preference - Eat	0	3.93	4	11	2	793	
Express Preference - Play	0	1.28	1	6	1	788	
Total Express Preference	0	5.12	5	13	3	804	
Conflict Resolution 1	0	27.0%	0	1	0	796	*
Conflict Resolution 2	0	9.2%	0	1	0	796	
Total Conflict Resolution	0	0.36	0	2	1	805	
Recognize emotions-Happy	0	37.3%	0	1	0	794	*
Recognize emotions-Sad	0	20.7%	0	1	0	793	*
Recognize emotions-Angry	0	21.4%	0	1	0	791	
Total Recognize Emotions	0	0.78	0	3	1	805	*
Personal information-Mother's name	0	66.4%	1	1	0	794	

Personal information-Father's name	0	60.1%	1	1	0	789	**
Personal information-Community	0	31.4%	0	1	0	793	*
Personal information-Country	0	5.2%	0	1	0	793	
Total Personal information	0	1.63	2	4	1	784	**
Sharing 1	0	39.2%	0	1	0	795	*
Sharing 2	0	16.1%	0	1	0	795	*
Total Sharing	0	0.55	0	2	1	805	*
Friends	0	2.54	2	13	2	784	
Personal Strengths	0	1.532	1	6	1	774	
Overall Socio-emotional Score	0	7.68	7	18	4	775	***
Note: Overall Socio-emotional score uses dichotomous variables for preferences, friend, and strength identification.							

*** p<0.001, ** p<0.01, * p<0.05

All of these items were significantly positively correlated with one another, and despite varied internal reliability of individual items, Cronbach's alpha for all of the socio-emotional items together is $\alpha = .81$. This indicates that together these items provide a relatively reliable measure of young children's socio-emotional knowledge.

On average children scored 7.68 out of 18, representing 42% of correct responses.

Personal Health and Hygiene

Numerous health items were also included in the assessment. On average, children know less than half of the information presented about hand washing, teeth brushing and using bed nets. However, older children tend to know more about hand washing than younger children. In addition, about three-fourths of children use latrines alone at home.

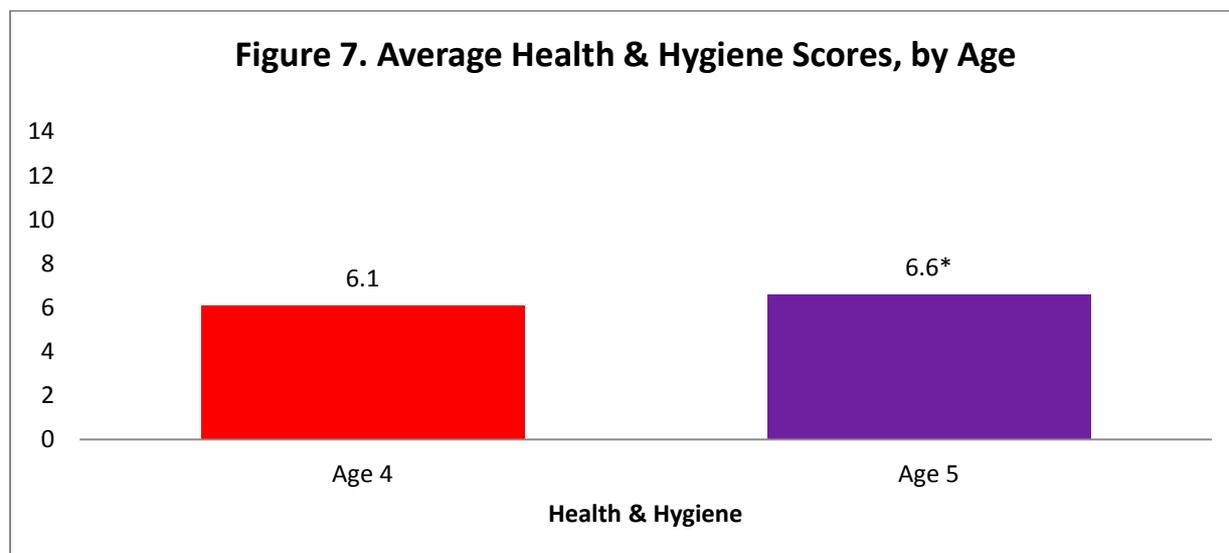
Table 16. Summary of Health and Hygiene Skills

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Total Hand Wash Knowledge	0	1.73	2	5	1	805	**
Knows how to use latrine at home	0	86.0%	1	1	0	795	
Uses latrine alone	0	77.5%	1	1	0	795	
Total Healthy Food Knowledge	0	1.51	2	4	1	805	
Total Teeth Brushing Knowledge	0	0.36	0	2	1	803	
Total Bed Net Knowledge	0	0.93	1	3	1	805	
Total health and hygiene Score	0	6.40	6	15	3	782	

*** p<0.001, ** p<0.01, * p<0.05

All of these items were significantly positively correlated to one another, and despite varied internal reliability of individual items, Cronbach's alpha for all of the health and hygiene items together is $\alpha = .74$. Similar to previous indicators discussed, children need a lot of support in this area and existing

ECD programs should focus attention on teaching children about health and hygiene habits. At baseline, children were only able to answer 42% of the questions correctly in this indicator.



Persistence

In addition to items related to emergent literacy, math, socio-emotional, and personal health and hygiene skills, five items asked assessors to evaluate children’s persistence in attempting to answer complicated items. These items attempted to get at non-cognitive skills which are very important as we consider holistic development. Persistence is shown to be associated with learning motivation as well as with overall school success later on. On average, students were able remain on task for 3 of the 5 tasks assessed, and as expected older children tended to be more persistent with these tasks than younger children.

Table 17. Summary of Persistence

	Min	Mean	Median	Max	Sd	N	Sig. Diff btw 4 & 5 year olds?
Persistence - Rote counting	0	69.5%	1	1	0	796	*
Persistence - Object selection	0	54.9%	1	1	0	794	
Persistence – Folding paper	0	68.1%	1	1	0	789	**
Persistence - Writing	0	67.3%	1	1	0	787	**
Persistence - Puzzle solving	0	41.4%	0	1	0	794	*
Persistence Total	0	3.03	3	5	2	773	***

*** p<0.001, ** p<0.01, * p<0.05

Persistence was significantly correlated with overall literacy, numeracy, socio-emotional, and personal hygiene and health skills, and significantly positively predicts all of these total scores, even

after controlling for age. Overall internal reliability for these different measures of persistence was 0.71, showing that they substantively capture the construct of persistence.

“Results – School Readiness Skills” Conclusion

When analyzing the composite scores for motor development, emergent literacy, emergent math, socio-emotional intelligence, health & hygiene and persistence, data show that children have room to improve in all of these areas. At the same time we see that all items are highly statistically significantly related to another. High correlation between these scores is a further indication that these measures are appropriate for the sample of children selected and that performance in different indicators can be meaningful compared to one another.

Table 18. Correlation between Overall Indicator Scores

	Motor	Literacy	Math	Socio-emotional	Health	Persistence
Motor	1					
Literacy	0.6224***	1				
Math	0.6281***	0.6723*	1			
Socio-emotional	0.5446***	0.6541*	0.6233*	1		
Health & Hygiene	0.5198***	0.5743*	0.5654*	0.6362*	1	
Persistence	0.5054***	0.5354***	0.460***	0.3721***	0.3421***	1

*** p<0.001, ** p<0.01, * p<0.05

Additionally, despite varied internal reliability of individual items, the Cronbach’s alpha internal validity score for 4 of the overall indicators is $\alpha > .8$, representing “good”, and $\alpha > .7$ for 2 overall indicators, representing “acceptable”. This demonstrates that the instrument used accurately measures children’s skills in each indicator.

Table 19. Internal Validity Scores per Overall Indicator

<u>Overall Indicator</u>	<u>Cronbach’s alpha validity score</u>
Gross Motor	$\alpha = .70$
Fine Motor	$\alpha = .87$
Literacy	$\alpha = .87$
Math	$\alpha = .82$
Socio-emotional	$\alpha = .81$
Health and Hygiene	$\alpha = .74$
Persistence	$\alpha = .71$

Finally, as demonstrated by scores in each indicator, there is a lot of room for improvement across all indicators. Particular areas of weakness, however, include: Concepts about Print, Writing Skills, Alphabet Knowledge, Number Knowledge, Patterns, Puzzles and Health & Hygiene. These are skill areas that are already inherent within the ELMI curriculum, thus ones that we can expect to see significant change as a result of the planned intervention.

V. Results- Comparing Groups

In order to compare students in ELMI ECCD with their peers that will just receive the ELMI parenting intervention, those attending an ECCD program without ELMI and those with no ECCD and no parenting, we used ANOVA and Tukey-Kramer post-hoc pairwise comparison tests to compare these four groups along a variety of baseline characteristics. From this analysis there are quite a few statistically significant differences between students in centres which will receive ELMI, those who will be receiving the parenting intervention, those attending non ELMI ECCD centres and those with no ECCD exposure in baseline skill-level and background characteristics.

Background & Family Characteristics

Table 20 summarizes the main background characteristics where one or more groups had a statistically significantly different score than at least one other group. The fourth column presents whether there is a statistically significant difference between the four groups in general, and column five explains which groups are the ones with significant differences.

Table 20: Family characteristics by treatment and control groups

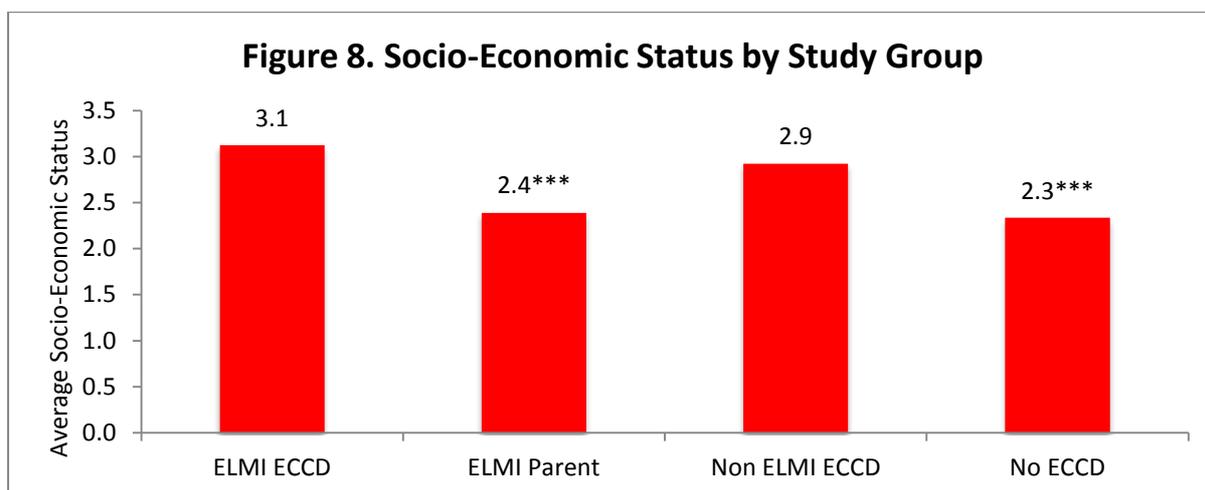
Variable	School Type	Mean	Sig. dif between groups	Which groups are different?
Family Characteristics				
Age of child	ELMI ECCD	4.6	***	Those in ELMI ECCDs are statistically significantly younger than all three other groups.
	ELMI Parent	4.7		
	Non ELMI ECCD	4.7		
	No ECCD	4.8		
	Total Sample	4.7		
Socio-economic status (Scale 1-5)	ELMI ECCD	3.1	***	Those in ELMI ECCDs have statistically significantly higher SES than those in parenting intervention and no ECCD.
	ELMI Parent	2.4		
	Non ELMI ECCD	2.9		
	No ECCD	2.3		
	Total Sample	2.6		
Parents work	ELMI ECCD	0.5	***	Those in the parenting intervention statistically significantly more likely to have a parent work than those in another and no ECCD.
	ELMI Parent	0.6		
	Non ELMI ECCD	0.3		
	No ECCD	0.4		
	Total Sample	0.5		
Mother's education¹	ELMI ECCD	1.8	***	Statistically significant difference comparing those in ELMI ECCDs and those in the parent intervention and no ECCD.
	ELMI Parent	1.3		
	Non ELMI ECCD	1.5		
	No ECCD	1.4		
	Total Sample	1.5		
Father's education	ELMI ECCD	2.0	***	Statistically significant difference comparing those in ELMI ECCDs and those in the parent intervention and no ECCD.
	ELMI Parent	1.6		
	Non ELMI ECCD	1.8		
	No ECCD	1.4		
	Total Sample	1.7		
Mother can read	ELMI ECCD	73%		n/a
	ELMI Parent	62%		
	Non ELMI ECCD	64%		
	No ECCD	65%		

	Total Sample	66%		
Father can read	ELMI ECCD	82%	***	Statistically significant difference comparing those in no ECCD program and all three other groups
	ELMI Parent	75%		
	Non ELMI ECCD	82%		
	No ECCD	64%		
	Total Sample	75%		
Mother's age	ELMI ECCD	34.1		n/a
	ELMI Parent	33.8		
	Non ELMI ECCD	34.1		
	No ECCD	34.0		
	Total Sample	34.0		
Number of children	ELMI ECCD	3.9	*	Statistically significant difference comparing those in the parent intervention and those in no ECCD.
	ELMI Parent	3.8		
	Non ELMI ECCD	3.9		
	No ECCD	4.3		
	Total Sample	4.0		

¹ 0 = no education, 1=ECD attend, 2=Primary education, 3=vocational, 4=secondary

*** p<0.001, ** p<0.01, * p<0.05.

Students in ELMI treatment centres are different from other groups in a variety of background characteristics. ELMI students are on average younger and the difference is statistically significant when comparing to all other groups. They also come from a higher socio-economic status than those who do not attend ECCD or who will receive the parenting intervention. Socio-economic status was determined using information about the students' home and family possessions. This was then compiled into a scale of 1 to 5 with 5 being the highest socio-economic status. It is not surprising there are differences between groups because there are differences in geography as well as it is possible that wealthier families value ECCD services more and thus are more represented among the ELMI preschool group.



*** p<0.001, ** p<0.01, * p<0.05.

Significance for the above diagrams indicates that the given group is different from ELMI students. For example, in Figure 8, socio-economic status for children receiving the parenting intervention and no ECCD is statistically significantly different from those attending ELMI treatment centres.

There were several differences between parents' backgrounds among the groups. Fathers and mothers' education are significantly higher for students who are part of ELMI. Parental work levels are significantly higher among students who were part of the parenting intervention than those in other ECCD programs or no ECCD. However, there were no significant differences among groups along mother's age or literacy level. Parenting approaches, including punishment and hugging, were also different among the groups with parents in other ECCD programs generally reporting punishing their children less frequently than other parent groups.

Quality of Home Environment

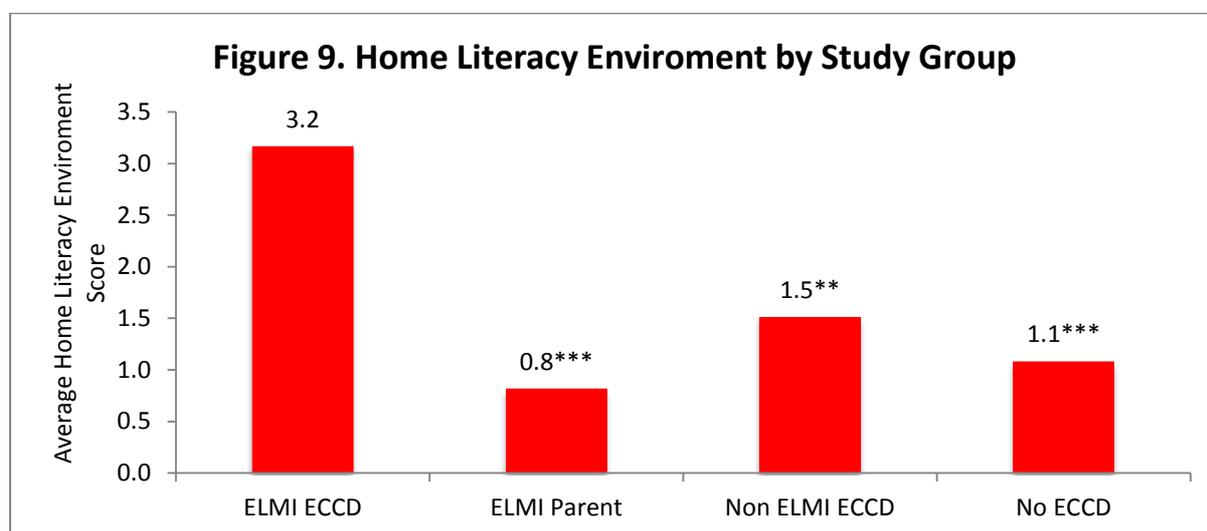
Table 21. Quality of home environment

Variable	School Type	Mean	Sig. dif between groups	Which groups are different?
Home Environment				
% with books at home	ELMI ECCD	26%	***	Those in ELMI ECCDs have statistically significantly more books at home than all three other groups.
	ELMI Parent	9%		
	Non ELMI ECCD	10%		
	No ECCD	12%		
	Total	14%		
Number of reading materials at home	ELMI ECCD	1.0	***	Those in ELMI ECCDs have statistically significantly more reading materials at home than all three other groups.
	ELMI Parent	0.6		
	Non ELMI ECCD	0.7		
	No ECCD	0.5		
	Total	0.7		
Home literacy environment (Scale 1-5)	ELMI ECCD	3.2	***	Those in ELMI ECCDs have a statistically significantly more supportive home literacy environment than all three other groups.
	ELMI Parent	0.8		
	Non ELMI ECCD	1.5		
	No ECCD	1.1		
	Total	1.6		
Hours mother spends with child	ELMI ECCD	4.4	***	Statistically significant difference comparing those in ELMI ECCDs and those in another and no ECCD.
	ELMI Parent	6.3		
	Non ELMI ECCD	3.9		
	No ECCD	6.1		
	Total	5.4		
Hours father spends with child	ELMI ECCD	2.4	*	Statistically significant difference comparing those in the parent intervention and those in ELMI and non-ELMI ECCD programs.
	ELMI Parent	3.1		
	Non ELMI ECCD	2.4		
	No ECCD	2.5		
	Total	2.6		
Activities with child (Scale 0-16)	ELMI ECCD	4.8	***	Those in ELMI ECCDs participate in statistically significantly more children's activities than all three other groups.
	ELMI Parent	2.1		
	Non ELMI ECCD	2.5		
	No ECCD	3.2		
	Total	3.1		
Number of toys/learning materials	ELMI ECCD	3.0	***	Those in non ELMI ECCD have statistically significantly fewer toys than all three other groups.
	ELMI Parent	2.9		
	Non ELMI ECCD	1.6		
	No ECCD	2.5		
	Total	2.6		
Positive discipline	ELMI ECCD	2.2	**	Statistically significant difference comparing those in other ECCD and all
	ELMI Parent	2.2		

(Scale 1-4)	Non ELMI ECCD	2.6		three other groups.
	No ECCD	2.1		
	Total	2.3		

*** p<0.001, ** p<0.01, * p<0.05.

Along characteristics of a supportive or quality home environment, again students who are part of ELMI treatment centres are significantly better off. ELMI ECCD children are much more likely to have books at home, with 26% of students reporting having at least one book at home, compared to the three other groups with 9%, 10% and 12% for ELMI parent intervention, non-ELMI ECCD and no ECCD, respectively. ELMI students also have more types of reading materials as well as toys and learning materials at home than their peers in other groups. Parents of ELMI students were significantly more likely to engage child in literacy and math activities than the other three groups. On the other hand, children from the ELMI parenting group seem to spend significantly more hours with both mother and father at home, compared to their peers. This will only support the work we plan to do with parents as a part of the ELMI program.



*** p<0.001, ** p<0.01, * p<0.05

School Readiness Skills by Treatment Group

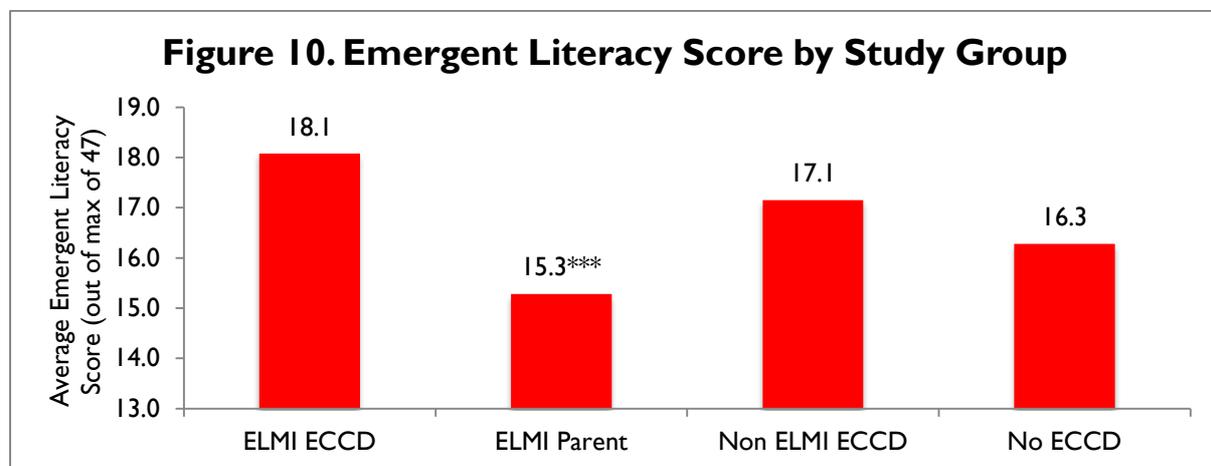
Students in centres that will receive ELMI (ELMI ECCD treatment centres) have significantly higher baseline emergent literacy and math scores than students' that will be receiving the ELMI parenting intervention (Figures 10 & 11). While students from ELMI treatment centres do have higher emergent average literacy and math scores than children attending non-ELMI ECCD or no ECCD, this difference is not statistically significant.

Table 22: School readiness skills by treatment groups

Variable	School Type	Mean	Sig. dif between groups	Which groups are different?
Skills				
Emergent Literacy (Scale 1-47)	ELMI ECCD	18.1	***	Statistically significant difference between students in ELMI and those in parenting intervention.
	ELMI Parent	15.3		
	Non ELMI ECCD	17.1		

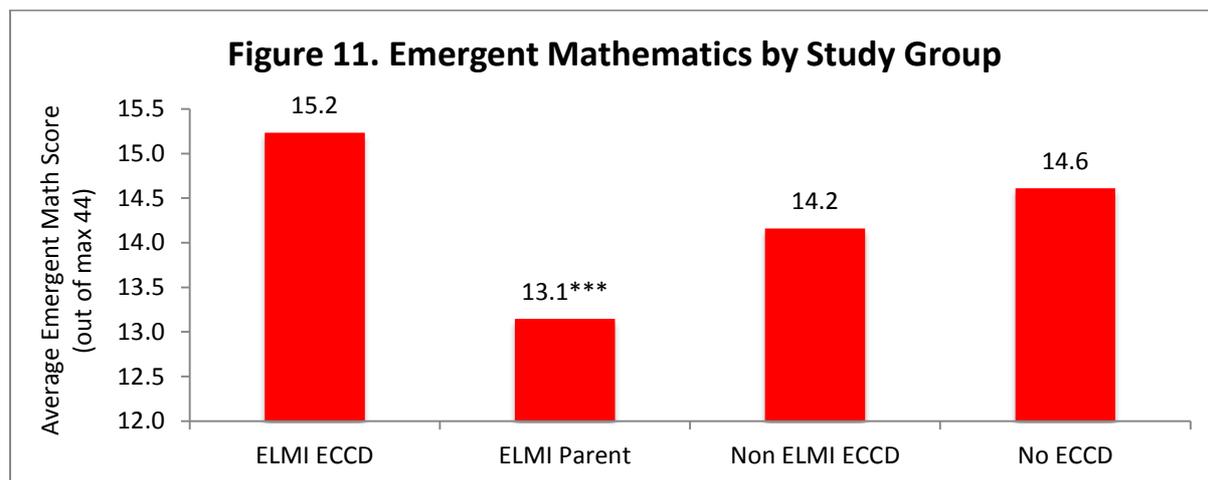
	No ECCD	16.3		
	Total	16.5		
Emergent Math (Scale 1-44)	ELMI ECCD	15.2	***	Statistically significant difference comparing those in parenting intervention to ELMI and no ECCD.
	ELMI Parent	13.1		
	Non ELMI ECCD	14.2		
	No ECCD	14.6		
	Total	14.3		
Persistence (Scale 1-5)	ELMI ECCD	3.5	***	Statistically significant difference comparing those in ELMI and those in parenting intervention and no ECCD.
	ELMI Parent	2.7		
	Non ELMI ECCD	3.1		
	No ECCD	3.0		
	Total	3.0		
Health & Hygiene (Scale 1-15)	ELMI ECCD	6.7		n/a
	ELMI Parent	6.3		
	Non ELMI ECCD	5.9		
	No ECCD	6.6		
	Total	6.4		
Total Motor (Scale 1-23)	ELMI ECCD	11.4	**	Statistically significant difference comparing those in other ECCD and those in all three other groups.
	ELMI Parent	8.8		
	Non ELMI ECCD	9.4		
	No ECCD	10.3		
	Total	10.3		
Socio-emotional development (Scale 1-18)	ELMI ECCD	8.2		n/a
	ELMI Parent	7.4		
	Non ELMI ECCD	7.8		
	No ECCD	7.7		
	Total	7.7		

When we examine different sub-tests within the emergent literacy and math composite score, the differences are fairly consistent. For the early literacy questions, ELMI ECCD students tended to have higher scores and those who are in the parent intervention or no ECCD had lower average scores. The differences were statistically significant for almost every literacy question except a few judging the students understanding of print—identify individual words, the end of the book and the direction one reads.



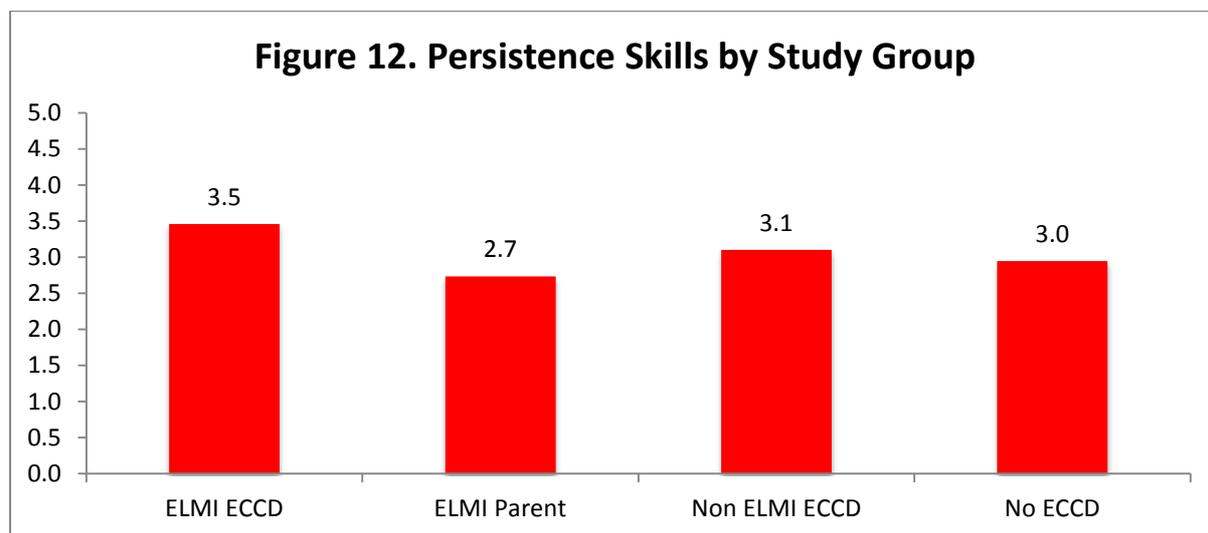
*** p<0.001, ** p<0.01, * p<0.05.

Similarly within the different skills tested to measure emergent math skills (understanding quantities, addition, subtraction, number identification, length, shapes and patterns) there was a statistically significant difference between groups for all skills but addition. ELMI ECCD students and those in non ELMI ECCD programs generally had higher scores than those in the parent intervention or no ECCD, indicating that ECCD experience matters in supporting school readiness overall.

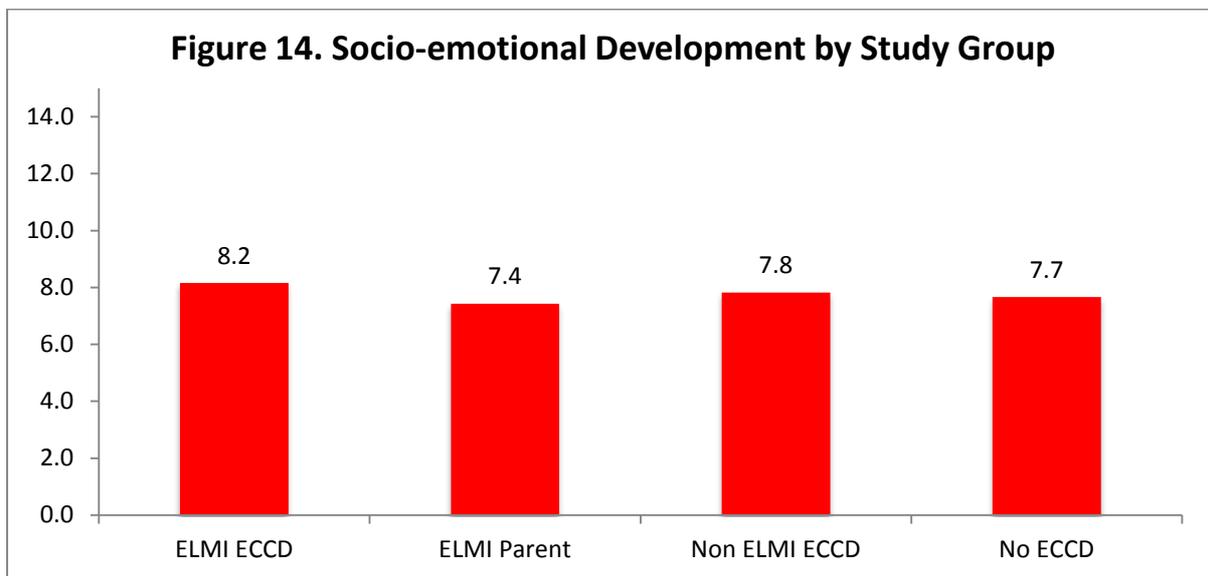
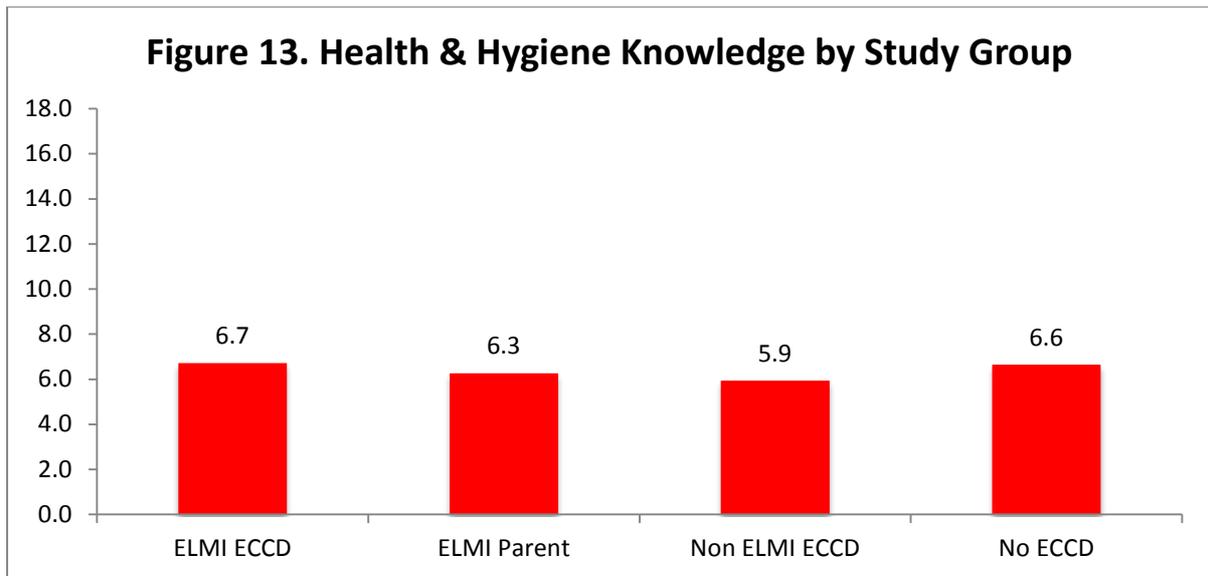


*** p<0.001, ** p<0.01, * p<0.05.

Students in ELMI ECCDs also had significantly higher average persistence scores than those receiving the parenting intervention or no ECCD program. Again, this makes sense as ECCD programs are meant to foster motivation for learning and persistence on tasks.



There was no statistically significant difference between students in the treatment and control groups in their initial socio-emotional intelligence and hygiene and health knowledge (Figure 10 & 11).



“Results- Comparing Groups” Conclusion

Overall the results show that students in the ELMI ECCD group are generally more well off than their peers in other groups and also have higher school readiness skills. Children who are part of the parenting intervention and those who do not attend any ECCD tend to be lower performing and come from lower socio-economic families. Children who attend a non ELMI ECCD program fall in the middle of the spectrum. Those in the ELMI ECCD centres also have a much more supportive home environment than those in the parenting intervention and those who do not attend ECCD.

As ELMI ECCD centres have been supported by Save the Children for 3+ years (some since 2009, others since 2010), the differences in school readiness skills between children in these groups at Baseline could be attributed to the effects that integrated ECCD in the community have had on children (for example, there can be a “knock on effect” from siblings who’ve attended the centres,

and some children may have attended centres from the age of 3). Likewise, the higher levels of home literacy/numeracy environment items may be a reflection of the fact that work has been done over the past 3 years on sensitization of parents by Save the Children project staff and by the teachers themselves, even though there was not a specific focus on literacy/numeracy. The parenting programme started early 2012 with a focus on integration of health, hygiene and child protection where parents' educators were selected by community members and trained by Save the Children on Integrated ECCD. These parents' educators have been conducting monthly sessions with parents mainly on nutrition, health and hygiene practices at home. In addition to that, parents in the ELMI/ECCD centres benefited from intense sensitizations (around the 2012 Global Education Campaign) on appropriate parents-children interactions at home accompanied with distribution of fliers and booklets at a large scale as well as involvement of local authorities. This probably contributed significantly to changing the behavior of parents with regard the interactions that can support children learning at home.

The control ECCD centres ("non ELMI ECCD"), in contrast, have been only been operational since 2012, though at the time when the assessment was conducted, the caregivers at these centres had been trained, but the infrastructure, equipment and learning materials were not yet delivered. In addition, the parents have not received the intense sensitization as is the case in ELMI/ECCD centres. Therefore it makes sense that the performance of students in this group and home environment scores are lower than those in the ELMI ECCD centres, but demonstrates more exposure than the two other groups.

Additionally, differences in the socio-economic status of families within ELMI treatment centres and non ELMI ECCD centre groups vis-à-vis those from parenting and no ECCD groups are not entirely surprising. Although the sectors in which the ELMI ECCD centres are located were originally selected due to their classification as the most vulnerable sector in the District, children from the parenting treatment group and no ECCD group are living in areas that have no existing ECCD centres, which may be indicative of the requirement of communities to contribute towards the costs of ECCD centres. Likewise, there may be a relationship between the requirement of parents to contribute towards the ECCD centre costs and their socio-economic status.

VI. Predicting School Readiness Skills

In order to understand what factors are related to students' school readiness level, we performed a multivariate regression of background characteristics on each area of school readiness: literacy, mathematics, socio-emotional intelligence, health and hygiene knowledge and persistence. Several variables ended up being related to the student's school readiness skills. These included the student's socio-economic status, age, books at home, parents' education and participation in children's activities. Table 23 shows the regression for each aspect of school readiness. Many other background variables were included in the model and were not correlated, so they have been removed from the regression. While the variables presented are statistically significant the model only explains a small amount of the total variance in the school readiness indicators, at most an R^2 of 8.2% for emergent literacy.

Table 23: Prediction of School Readiness Indicators through Background Characteristics

VARIABLES	Emergent literacy	Emergent math	Socio-emotional intelligence	Health & hygiene	Persistence
Age	2.207*** (0.566)	1.590*** (0.397)	1.267*** (0.301)		0.577*** (0.132)
Socio-economic status	0.624*** (0.188)	0.493*** (0.135)	0.209* (0.0995)		
Has books at home	1.839* (0.853)				
Parent-Child activities	0.165* (0.0723)	0.111* (0.0526)	0.116** (0.0403)	0.111** (0.0336)	0.0421** (0.0149)
Mother's Education	0.762** (0.258)			0.427*** (0.114)	0.160** (0.0554)
Father's Education		0.433* (0.175)	0.466*** (0.132)	0.268* (0.108)	
Constant	2.671 (2.748)	4.442* (1.965)	0.120 (1.476)	4.933*** (0.247)	-0.0745 (0.635)
Observations	697	641	670	705	730
R-squared	0.082	0.070	0.074	0.063	0.047
F statistic	12.95	11.35	13.29	15.34	12.16

Coefficient displayed; Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Some of the variation in baseline scores in skills among the different treatment and control groups stems from differences in the students background characteristics among these groups. These characteristics help us understand what levers matter most in influencing students' skills. As expected we see that age of children matters and as children mature they do better on the school readiness indicators. We saw these trends in the first part of the report. We also see that of high significance is the availability of books at home. This is an important finding in the context of the ELMI as the ELMI parent component ensures that books are indeed available in the homes of children.

VII. Early Childhood Environment Rating Scale

In order to understand the students' learning environment in ECCD centres, extensive data was collected on the space and facilities, program activities and structure, interactions between teachers and students as well as the literacy and math focus of the program. Preschool centres were observed and rated using the ECERS - Revised Space and Furnishings, Activities, Program Structure and Interactions subscales (ECERS-R, Harms, Clifford, & Cryer, 1998) and ECERS – Extension Literacy and Math subscales (ECERS-E Sylva, Siraj-Blatchford, Taggart, 2003). These subscales were singled out for attention because they form the basis of a preschool curriculum and prepare children for primary school. There are 27 items each rated on a 1 to 5 scale. The items have a clear description of what is to be observed for ratings of 1, 3, or 5. A final rating for each item is then determined based on a set of rules. The descriptions were modified for a number of items based on what was reasonable to expect in terms of resources and cultural traditions. For example, it was not expected that there would be much storage space, but story books and play materials would be abundant.

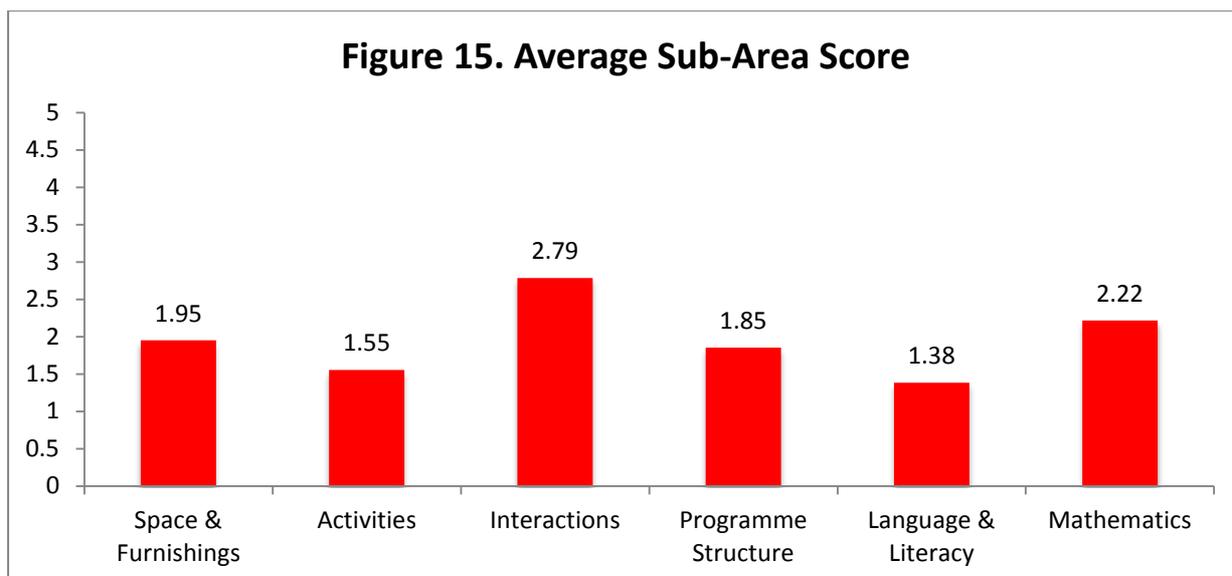
Further some items were omitted from the scales based on what the team considered to be non-applicable items to Rwanda.

Data was collected from twenty-one ELMI centres and four other control ECCD centres. Centres were assessed along 27 different items including everything from adequate lighting, availability of materials, daily schedule and access to counting activities. The 27 items are categorized into six indicators.

Indicator	Item	Mean	Max	Min
Space and Furnishings	Indoor space	1.0	1	1
	Furniture for routine, play and learning	3.4	5	1
	Room arrangement for play	1.0	1	1
	Gross motor equipment	2.4	3	1
Activities	Fine motor equipment	1.7	3	1
	Art materials	1.3	3	1
	Music and movement	2.2	3	2
	Blocks	1.4	2	1
	Sand/water	1.0	1	1
	Nature/Science/Health materials	1.7	2	1
Interactions	Discipline	2.1	4	1
	Caregiver-Child Interactions	3.8	5	1
	Interactions among Children	2.4	5	1
Programme Structure	Free Play	2.1	3	1
	Group Time	1.4	3	1
	Schedule	2.0	3	1
Language and Literacy	Print Environment	1.6	4	1
	Book and Literacy Area	1.0	2	1
	Adult Reading with Children	1.2	3	1
	Sounds	1.2	3	1
	Emergent Writing/Mark Making	1.0	2	1
	Talking and Listening	2.6	4	1
	Books and Pictures	1.1	2	1
Mathematics	Math and Numbers	2.0	3	1
	Counting and Application of Counting	2.4	3	1
	Representing Simple Numbers	2.2	3	1
	Sorting, Matching and Comparing	2.3	3	1
TOTAL ECERS		1.84	2.4	1.3

Overall the 27 items had good internal reliability with an alpha of 0.80. All of the indicators have potential for significant improvement. Each item is ranked on a five-point scale from inadequate (1) to good (5). A score of 3 is considered minimal in terms of quality. Almost every item had significant room for growth.

The mean rating of all 25 preschools on the ECERS was 1.84 (SD = 0.29) with a range of 1.3 to 2.4. The Program Interactions and Math Subscales received the highest ratings at 2.79 and 2.22, which is close to what is considered adequate in terms of quality. Language & Literacy and Activities indicators were lowest at 1.38 and 1.55 respectively, which is considered inadequate. The Figure 15 below provides the overall means for each sub scale across the 25 schools observed.



In Appendix 2 we also show the means for each item in the assessment. For many items there was variability across ECCD centres in terms of performance but there are certain items where all ECCD centres are performing well below expected. In addition to inadequate art, blocks and science materials, activities that children generally love, the language and literacy program was very poor across the board. Books and reading materials were available only in two centers and read alouds or book sharing was taking place only in 3 out of the 25 centers. Print in the environment across all centers was typically lacking as well.

Given large class sizes in most centers (40-50 students per center), unsurprisingly group work is missing across all centers and children sitting and listening quietly for long periods of time is common.

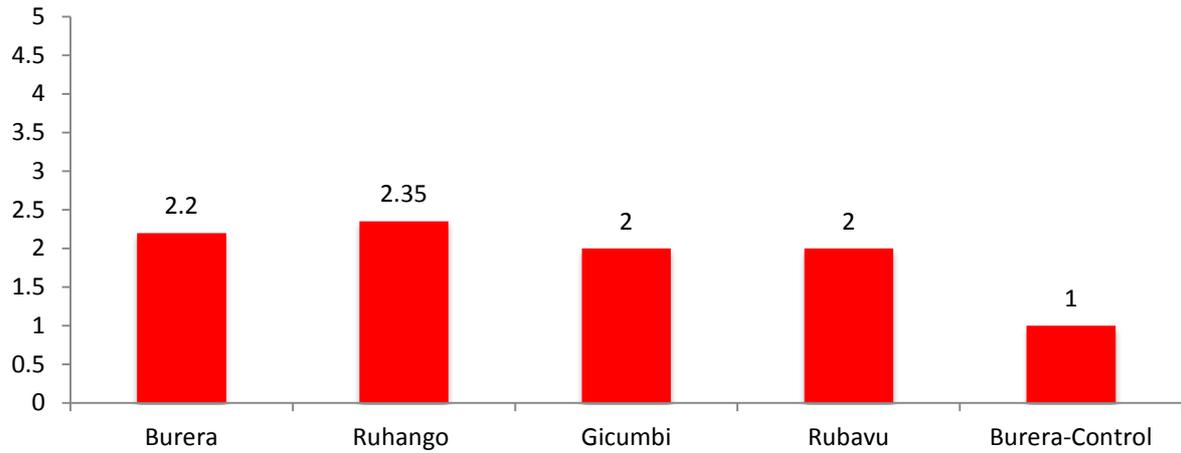
On the positive side, we see good interactions between students and teachers across most ECCD centres, which is a wonderful starting point. Teachers care about the children in their classrooms, treat them with respect and very rarely use harsher discipline. In addition, it is great to see that talking and listening is promoted in at least half of the ECCD centres. Room for improvement is there but overall it is a good place to start. Finally, we see that the ECCD centres on average have good facilities and furnishings and access to good gross motor development equipment and playgrounds.

Space & Furnishings

Within the space and furnishings sub-indicator, preschools did well in providing children with furniture for play and learning, especially items for gross motor development. However, all twenty-five schools scored one (inadequate) for providing specific interest/play areas within the classroom and having an indoor space with adequate lighting, ventilation and temperature control.

Control ECCD schools ranked significantly lower in this area with all items scoring one (inadequate) in this indicator.

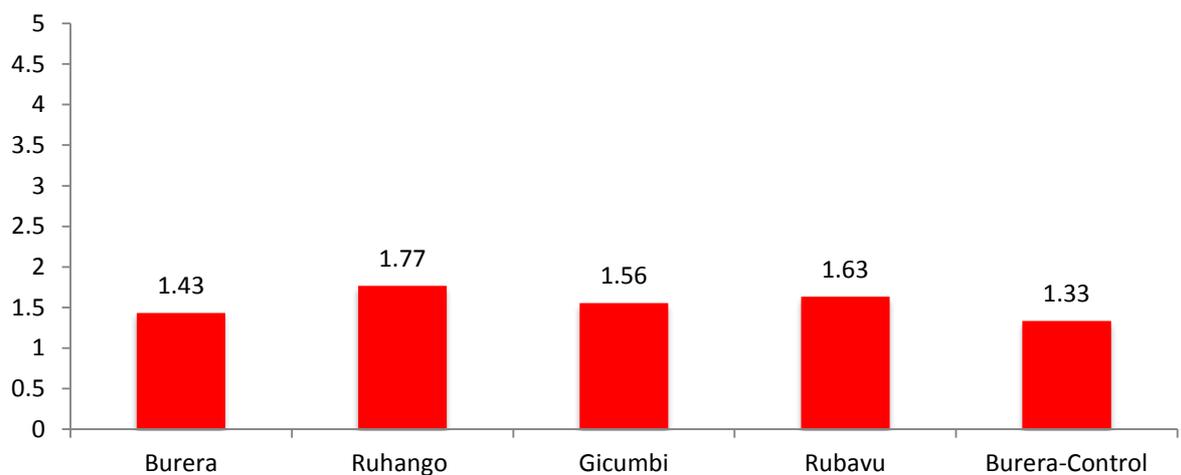
Figure 16. Avg. Space & Furnishings Score by District



Activities

All schools ranked very low in being able to provide students with materials for a variety of play and activities. No schools provided students with water/sand for play and learning, however this has not been a focus to date in these ECCD programs, so this is not surprising. A few had art materials or blocks available for students but in most cases they were not sufficient in number for the students present in the classroom. Many schools had students participate in music activities, which is wonderful to see, but often did not have any materials for students to use as “instruments”. Again, control ECCD centers scored the lowest of the districts, but overall performance was low on this sub-scale across all districts. Attention should be paid to learning and play materials in the months ahead and ensuring that sufficient variety and quantity is available for children’s play.

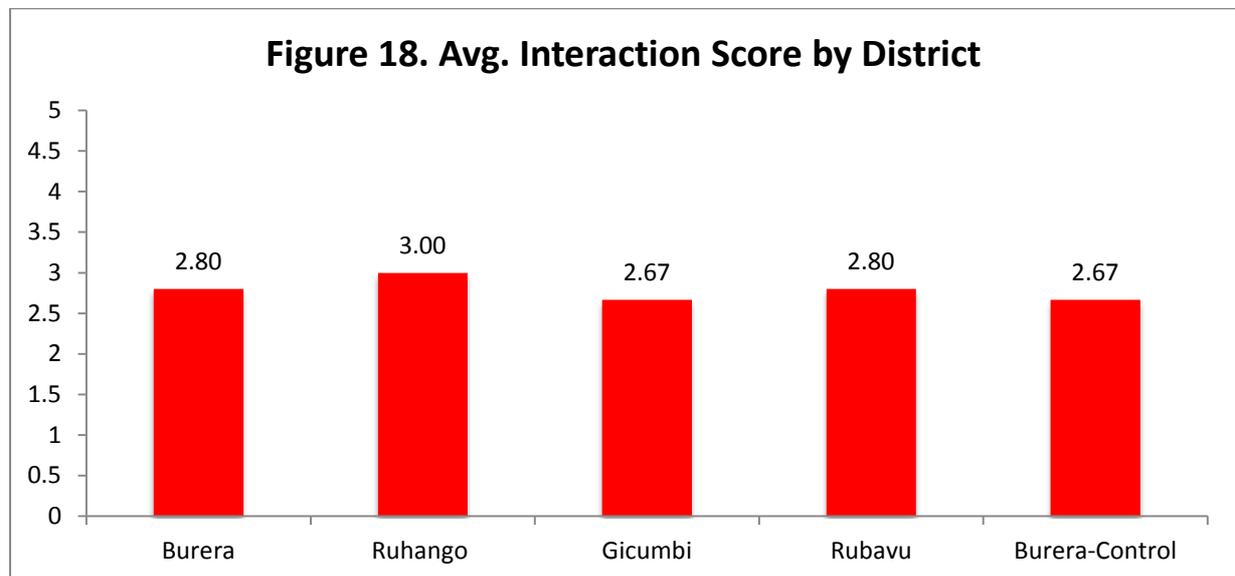
Figure 17. Avg. Activities Score by District



Interactions

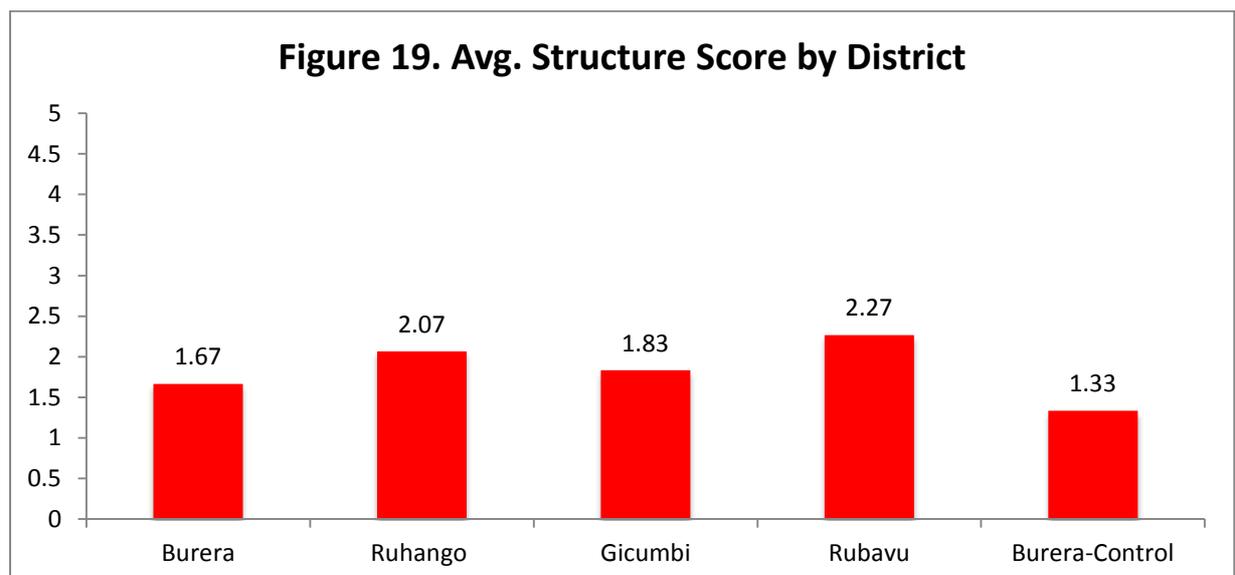
The Interactions sub-indicator was the highest scoring overall. Students frequently had opportunities to interact positively with caregivers and other students at most schools with all centres receiving

over a score of 2.5. However, within the sub indicator, the discipline item had the lowest score (2.1), indicating that there is still progress to be made in ensuring teachers use positive discipline methods in the classrooms.



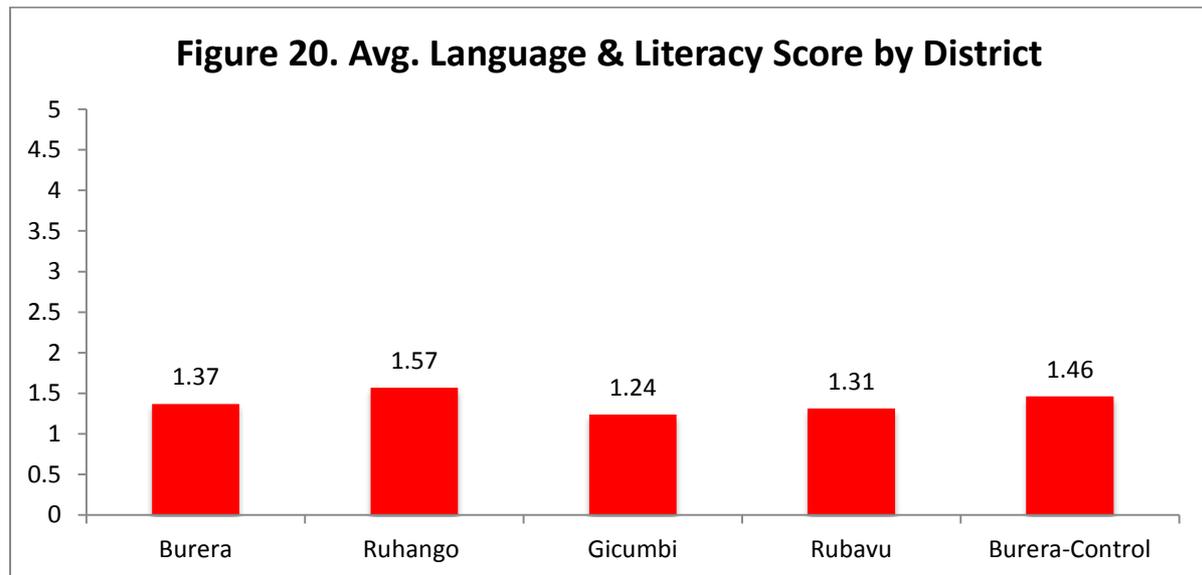
Programme Structure

This sub-area includes the time given for playing, the structure of the day that the children experience and the availability of varied instruction methods- such as small group activities. It also examines whether there are routines in place for students but also flexibility when necessary in the schedule. Very few schools provided the students with any time to split into groups to participate in activities, with an average score of 1.4. The majority of schools used a “whole class” instruction method for most of the day – this should be a focus for the ELMI intervention as it is not a developmentally appropriate practice to have children sit for long periods of time and listen. Control schools performed particularly low in this area as well.



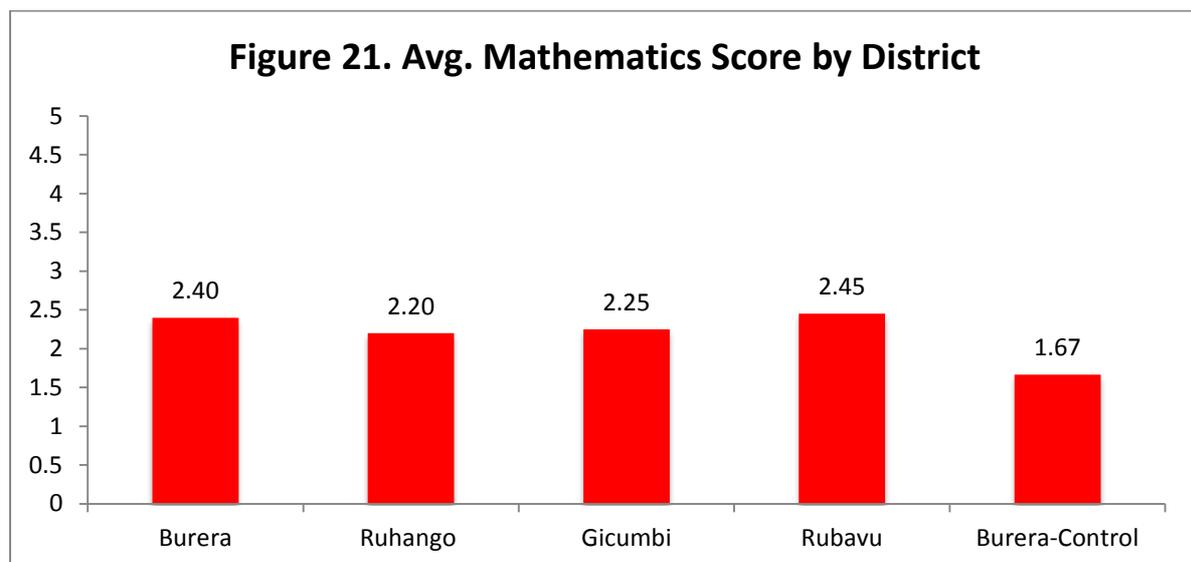
Language & Literacy

Language and literacy scores were very low across all districts showing that students are getting little exposure to concepts of print, reading and writing in ECCD schools. Almost no schools provided students time or access to materials to learn letters, sounds, practice writing or interact with text. Within this indicator, items for giving students space to talk and listen was the highest scoring (2.6). Given that ELMI is heavily focused on this area, we expect to see significant gains at endline on this sub-scale.



Mathematics

Schools performed significantly better in providing students with objects for counting, sorting and learning numbers. There is room for improvement but overall it is good to see that the benchmark is higher for this sub-scale. It is possible that ECCD caregivers feel more comfortable in supporting math skills vs, language and emergent literacy. As with the other areas, control ECCD centres performed worse on this measure.



Overall the ECERS assessment shows that in every district there are significant areas for improvement, so all students can have a safe, positive environment for learning and growth. Monitoring how the classroom environment changes over time will also help us better understand the effect of the program and some of the causal mechanisms in the theory of change for the gains we see in student outcomes. Of all the districts, it appears that Ruhango demonstrates higher quality across sub-indicators, followed by Rubavu. As control ECCD centres were significantly lower performing than the other ECCD centres, endline analysis should keep this in mind when we look at changes in ECERS scores over the years. The sample size is too small to be able to report on significance level of these differences but controlling for these baseline differences will be critical.

VIII. Conclusions

Summary of Findings

The goals of this baseline included:

1. To ascertain the validity and rigor of our adapted tools.
2. To assess whether the components included in the tool effectively capture the intended skills/developmental indicators, and provide recommendations on improvements for future assessments in Rwanda.
3. To provide a benchmark for where children in each of the groups are in terms of their development before the ELMI program begins, as well as what is the current level of engagement of parents in the learning and development of children.
4. To identify what factors are most correlated with children's school readiness performance.

The analysis of the data collected through this baseline enabled us to draw the following conclusions:

1. Validity and Rigor of Tools:

Ultimately this report found that the instrument used was a good measure of school readiness. Although some caution should be used in interpreting internal reliability calculations due to the large number of zero scores on some items, generally the internal validity scores using Cronbach's alpha were rated as "good". Furthermore, we were able to detect that scores across relevant developmental indicators reflect some increase by age, scores across developmental indicators correlate with each other, and sub-scale scores within individual indicators also correlate. Furthermore, we found that the parent questionnaire adequately captures the quality of home environment, literacy environment as well as socio-economic background of families.

2. Assessment of Tool Effectiveness and Recommendations on Improvements in the Future

An analysis of the scores across all indicators (motor development, emergent literacy, emergent math, socio-emotional intelligence, health & hygiene and persistence) demonstrated that the items used were highly statistically significantly related to each other. Additionally, the high correlation between these scores demonstrates the appropriateness of these measures. Thus, the items on these instruments used can be considered effective for the intended purposes of this evaluation process.

There were, however, several recommendations that should be taken into consideration for future assessments. Suggestions were made on specific components within school readiness assessment. These included:

- The strong correlation between walking in a line and the total gross motor score, which suggests that walking in a line can be used to represent a child's gross motor skills (reference page 11);
- Rhyming tasks are more suitable for measuring phonological awareness than word sounds (reference page 15);

- Mature writing grip could be removed from the general assessment of children’s writing skills and instead added to the fine motor skills scale, where it fits better (reference page 15);
- Given the high number of items included in the ‘Number Skills’ section, and the high correlation between some items, it could be possible to consolidate this section of the assessment in the future (reference pg 17);
- Further investigation should be leveraged for items in ‘Concepts of Measurement & Time’ in the future to determine whether they are reliably capturing children’s knowledge of measurement (reference pg 18);
- Future assessments could consider only using classification items rather than classification and identification items to assess ‘Sorting’ skills (reference pg 18).

This information will be useful for guiding future assessments to potentially save on time and resources.

3. Current benchmarks for outcome indicator monitoring

A summary of the values at baseline against which the project outcome indicators will be measured is given below in Table 24.

Table 24: Baseline values for project outcome indicators (disaggregated by gender and foundational skills indicators)

Project outcome Indicators		Baseline values		
		Total ⁵	Boys	Girls
[ELMI] ECCD children’s scores in school readiness assessment	Motor Development	11.4	11.1	11.6
	Emergent Literacy	18.1	17.4	18.7
	Emergent Mathematics	15.2	15.7	14.9
	Socio-emotional intelligence	8.2	7.9	8.4
	Hygiene & health	6.7	6.3	7.1
	Persistence	3.5	3.5	3.4
Non-ECCD [parent ELMI intervention] children’s scores in school readiness assessment	Motor Development	8.8	8.6	9.0
	Emergent Literacy	15.3	15.9	14.6
	Emergent Mathematics	13.1	12.6	13.6
	Socio-emotional intelligence	7.4	7.1	7.7
	Hygiene & health	6.3	6.3	6.2
	Persistence	2.7	2.5	2.9
Parents/guardians’ scores in home environment assessment	Positive discipline	2.3	2.3	2.3
	Activities with children	3.1	3.1	3.1
ECCD teachers’ scores in classroom environment assessment	Total for all schools	1.84	n/a	n/a

⁵ Totals at baseline are out of maximum totals for each indicator as follows: Motor Development: 5, Emergent Literacy: 47, Emergent Math: 44, Socio-emotional Intelligence: 18, Health & Hygiene: 15, Persistence: 5, Positive discipline: 4, Activities with children: 16, and ECERS: 5.

These values are expected by endline to have increased by 35% in the case of ELMI ECCD children's scores in school readiness assessment, 20% for non-ECCD (ELMI parenting component) children's scores in school readiness assessment, 20% for parents' scores in home environment assessment and 25% for ECCD teachers' scores in classroom assessment. These target increases, which were set prior to the baseline, have been deemed to be reasonable targets to aim to achieve, though it should be noted that, whilst data has been disaggregated to all indicators, only the indicators of "Emergent Literacy" and "Emergent Maths" are expected to meet this target, as the other indicators are not specifically addressed through the intervention.

Two additional outcome indicators are included in the project M&E Plan:

- Evidence of inclusion of ELM in GoR's revised ECD curriculum
- G1 children's scores in literacy and maths skills

It is not possible to obtain baseline data for either outcome indicator and therefore there is no reference within the report to these indicators.

For the outcome indicator relating to inclusion of ELM in the Government of Rwanda's ECD curriculum, the curriculum revision has not yet formally begun and therefore evidence of ELM inclusion cannot be generated. However, Save the Children is collaborating with the Rwandan Education Board (REB) on this area and specific mention of SCI support to REB on the ECCD curriculum revision was included in a Memorandum of Understanding signed between Save the Children and REB in June 2013.

In reference to the G1 literacy and maths scores indicator, the target stated of '20% increase *on baseline*' was not an appropriate measure, as the G1 literacy and maths scores will only be measured at endline; the target should read "20% higher scores amongst children exposed to ELMI than those of the control 'no-ECCD' children". This change will be requested from the Innovation for Education fund.

All Innovation process issues are likewise not applicable to a baseline. These issues will rely on qualitative sources of evidence to be monitored throughout the project and reported against at midline and endline.

4. Correlated factors of children's school readiness performance

Finally, the initial exploratory regression analysis showed that age, socio-economic status, mother and father's education and parent's engaging children in learning activities were all positively correlated with several of the outcomes of interest. Whether the student has reading materials at home was also positively correlated with emergent literacy skills. These correlations demonstrate the predicted influence of the parenting component of the project on improving children's school readiness skills.

Recommendations for Programming

The baseline provided accessible measures on children's school readiness skills (across a number of developmental indicators) that can make sense to stakeholders from policymakers to parents and at all levels in between. The deficiencies noted across all indicators through the baseline analysis clearly demonstrate the need for the ELMI interventions.

The program team plans to use this data to critically consider key gaps and needs in existing ECCD centers and identify ways to strengthen ELMI implementation. By drawing out the particularly weak constructs noted within this baseline, such as “concepts about print”, “writing skills”, “patterns”, etc, project staff will be able to improve the tailoring of their mentoring support to caregivers to further support these areas. Additionally, although the information has been condensed within this report to the level of presentation of scores by district, the data has been provided to project staff at an even more localized level, enabling them to support particular weaknesses identified per centre.

We have also seen that there are some important differences between students in the ELMI ECCD centres, ELMI parent intervention, non ELMI ECCD centres and no ECCD exposure in their background, learning environment and baseline school readiness skills. These are important differences to keep in mind and keep exploring as the program unfolds. They will certainly bear relevance in our analysis of endline data later on, but can also be used to support our project planning and implementation process.

The background information drawn from this assessment will be particularly useful for informing the ELMI Parenting component’s implementation design as well as analysis of eventual results. For example, this study has shown that parents who will be participating in this component of the project spend a significantly greater amount of time working but also have a lower socio-economic status than parents of students from the ELMI ECCD centres. This may prove to create a greater challenge for garnering commitment from parents to dedicating time to attend parenting sessions. However, these same parents report to spend more time with their child than their counterparts, which creates greater opportunity for applying skills learned in the parenting sessions.

Additionally, the demonstration of high correlation between the home literacy environment and students’ literacy scores can be useful for sensitizing stakeholders on the importance of the ELMI content / techniques the project is advocating. Likewise, the high significance that availability of books at home has on children’s literacy skills is an important finding for promoting availability of books for children in the home.

Finally, the visible differences on school readiness indicators between children who are already attending an established, integrated ECCD centre (despite this being the first year of ECCD for most of them) and those not attending ECCD centres is demonstrative of the impact that exposure to pre-primary has on children’s developmental skills. Likewise, the striking comparison between the supportive home environment factors provided by parents who have already received sensitization by Save the Children staff (parents whose children attended ELMI ECCD centres) and those who have not had this same exposure (parents of children attending other ECCD centres or no ECCD centre) is reflective of the important role parents play in their children’s school readiness preparation. As parents and communities in Rwanda generally lack awareness of the support they can offer to their children in foundational skills development, this kind of evidence will strengthen Save the Children’s advocacy efforts to promote the notion that working with parents to develop the knowledge and skills to support their own children’s school readiness is just as critical as making ECD services accessible to more children.

As outlined in the “Methodology” section at the start of this report, Save the Children will conduct a midline assessment using the same tools with the same children, parents and ECCD centres in July

2014, and an endline assessment will be conducted the following year. Based on the clear, existing gaps demonstrated across all indicators throughout this report, there is a high expectation that significant changes will be reflected following the implementation of this projects' activities.

Appendices can be found in an additional file.