



**Save the Children®**

# Early Literacy & Maths Initiative (ELMI)

Rwanda

## Midline Report

December 2014



## 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 early 2013. In recognition of the increased interest and commitment by the Government of Rwanda to increasing access to ECCD services, the project was designed to focus on the quality of service delivery as this relates to school readiness outcomes for children. 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, given how new ECCD is in the country, 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 midline results of an assessment of five, six and seven years old children's school readiness skills. The midline data collection also sought to better understand change in children's home learning environment as well as the quality of their classroom learning environments compared to baseline levels measured in 2013.

The study tested over 617 young children who were also assessed at baseline, some of which are part of the ELMI Centre-based intervention, some which are part of the ELMI Parenting intervention and two types of control students—those in ECCD centers that do not receive the ELM booster and those not attending any type of ECCD program. Information was also collected on the children's background and learning environment at home and in ECCDs. This information helps us monitor both the intermediate changes in learning environment and support we hope to see from the program and the ultimate goal of better school readiness for children.

First, the report looks at the composition of the midline sample compared to the baseline sample. We find that there has been substantial attrition from baseline to midline in the form of children not being located for the midline assessment, as well as children enrolling in primary school before the intended transition time of January 2015. In response to the attrition, 98 additional children were added to the ELMI sample at midline in order to increase study sample size and were included in midline analyses.

Next, we look at learning gains with a specific focus on children in the center-based and home-based ELMI programs. While both groups of students are growing in their skills in different areas, we find that the ELMI Centre group maintains their developmental advantage seen at baseline. However, we find that children in ELMI Parenting and ECCD control centers make comparable learning gains from baseline to midline. In addition, when changes in parenting behaviors are investigated we find that

caregivers in the Parenting ELMI group increase the types of learning and playing activities they engage in with their children at home compared to caretakers in other groups.

When investigating the drivers of children's learning gains, we find that typical background characteristics like maternal education level and socioeconomic status play a role, but importantly the amount of play activities at home at midline has the most consistent relationship with skill growth across groups. The strong relationship between playful activities between parents and children and learning gains highlights the need for children to engage in developmentally appropriate play at early ages.

Finally, the last section reports on the overall quality of the ECCD centers children in the study are attending using a revised version of the Early Childhood Environmental Rating Scale (ECERS). Items related to space/furnishing, activities, interactions, programme structure, language and literature and mathematics are all included in the ECERS. ELMI centers experienced stronger gains than Control centers in all areas, with the largest gains found in programme structure and language and literacy environment in classrooms. In addition, strong correlations were found between the language and mathematics environments in classrooms and children's literacy and mathematics (respectively) average midline learning outcomes.

The data collected for this midline and reflected in this report provide thought provoking evidence that supports the project's effectiveness in delivering the ELM program overall. Moreover, the results to date demonstrate the value of considering alternative ECD program approaches (aside to the traditional ECD center based provision), such as parent education programs, that seem to be powerful in delivering results for children. The midline analysis also provides important reference point that will inform the project's further implementation and potential scale up.

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## II. Overview

The following report presents the results of a midline school readiness assessment for five, six and seven year olds participating in the Innovation for Education-funded ELMI project and in control groups. This section outlines the main questions investigated during this midline and provides background information about the project intervention. Section III presents information on what kinds of data were collected and information about the sample, including attrition. In Section IV, we compare development skills between the different groups in the study. Section V provides a comparison between home environments, and Section VI outlines the background characteristics that may predict performance on areas of school readiness.

The report looks to answer three main questions:

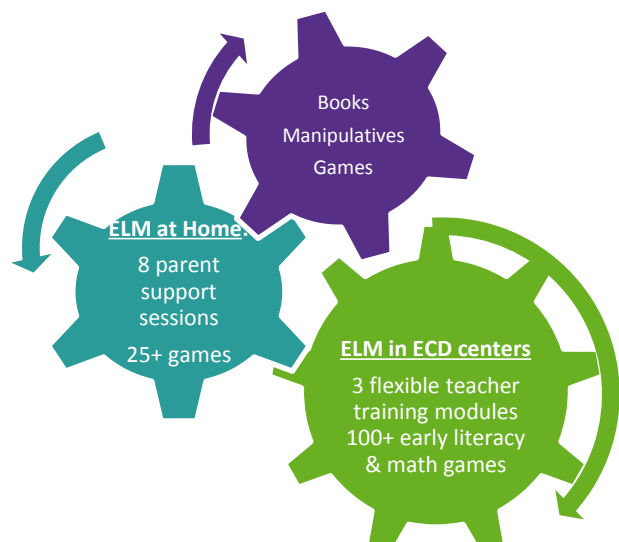
1. What skills have children in each of the groups gained in terms of physical development (gross and fine motor skills), emergent literacy, mathematics, socio-emotional skills, approaches to learning and personal health and hygiene since the ELMI project began, and what is the current level of engagement of parents in the learning and development of children?
2. What factors are correlated with the children's gains in the school readiness assessment at midline?
3. How has the quality of the classroom improved since baseline and how is quality of environments correlated with children's learning gains in school readiness at midline?

## 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 part of emergent math and that pave the way to more complex math 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. Through a rigorous ELM toolkit developed by Save the Children US, the overarching objective of the Early Literacy and Math Initiative is to develop an evidence-based, scalable programme that effectively supports ELM skills of ECCD age children (3-6 years) in Rwanda.

The toolkit has three key components:



- 1) A training package for early childhood teachers/facilitators (*ELM in ECCD Centers*) focused on playful and age-appropriate ways to support ELM skills in the classroom.
- 2) A family outreach package (*ELM at Home*) extending opportunities to develop ELM skills at home, especially for those children with no access to ECCD centers.
- 3) Age-appropriate books available to children both at home and in ECCD centers, as well as hands-on math manipulatives and games.

The project aimed to achieve the following outcomes, measured by the indicators in the table:

<b>Outcome</b>	<b>Indicators</b>
Improved early learning environment and teachers' pedagogical practices supporting ELM skills	ECD children's scores in school readiness assessment (disaggregated by gender and foundational skills domains)
	Non-ECD children's scores in school readiness assessment, whose parents are being trained by the ELM initiative (disaggregated by gender and foundational skills domains).
	ECD teachers' scores in classroom environment assessment (disaggregated by gender).
	G1 children's scores in literacy and math skills <sup>1</sup>
Improved parenting practices in supporting ELM skills	Parents/caregivers' scores in home environment assessment (disaggregated by gender).
ELM approach included in revised GoR's ECD curriculum	Evidence of inclusion of ELM in GoR's revised ECD curriculum <sup>2</sup>

Through the implementation of ELMI project, this was tackled by:

- 1) Training ECCD caregivers in 21 existing ECCD centers to effectively support ELM skills development among children;
- 2) Providing ongoing monitoring and coaching to ECCD caregivers /teachers to improve the way ELM is delivered to children in classrooms;
- 3) Training parents to actively support children's ELM skills development at home;
- 4) Providing ongoing monitoring and coaching to Parents' Facilitators to improve the way they deliver parenting sessions;
- 5) Providing age appropriate books for both centre-based and home-based groups to support early reading skills among children;
- 6) Engaging in advocacy to build leadership and commitment to the ELMI 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 and used for the baseline to set appropriate benchmarks and for the midline assessment to measure the progress. The report highlights the methodology that was applied, the results that were drawn from the data collected on school readiness skills, a result comparison across four different groups, broken down according to background factors, and recommendations for programme adjustments in light of the findings.

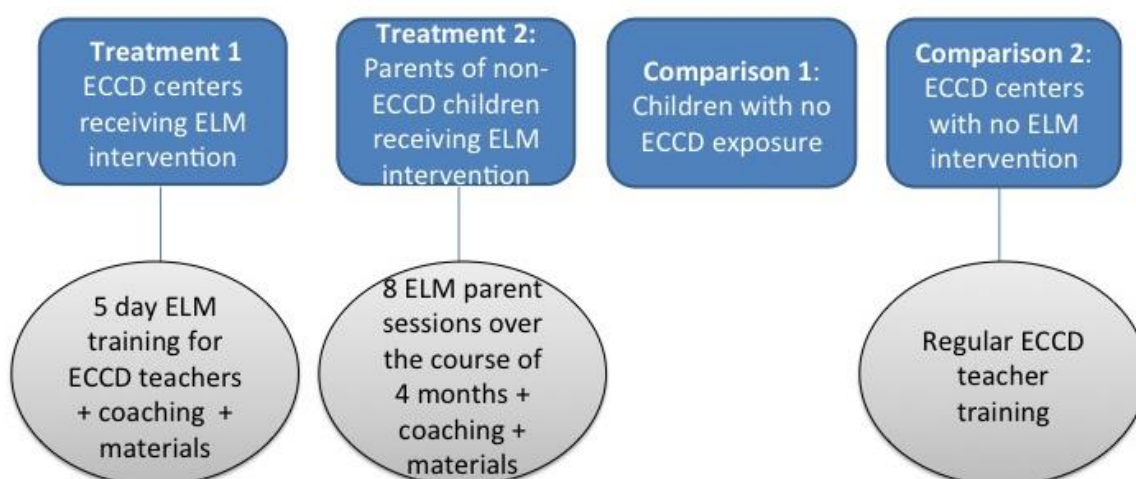
<sup>1</sup> This indicator will be measured at endline

<sup>2</sup> Not measured in this report

### 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 Centre 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 (now known under the name of IDELA – the International Development and Early Learning Assessment) 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 project, as well as an adapted version of the ECERS (Early Childhood Environment Rating Scale) assessment to document the quality of classroom environments. The tools have been used and validated in more than 5 countries by Save the Children, but they were new to Rwanda before the baseline assessment in 2013. In addition, a shortened version of this tool, the International Development and Early Learning Assessment (IDELA), has been validated by Save the Children in 11 countries. At the time of Baseline, substantial effort and time went into adapting, piloting and validating the tools to the Rwandan context to ensure relevance.

Twenty (20) enumerators<sup>3</sup> were hired and trained by Save the Children staff for 8 days from 20<sup>th</sup> to 29<sup>th</sup> August 2014 during which period they also pilot-tested the tools in communities not supported by Save the Children to fully train enumerators on the assessment. 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 September. Data collection was closely supervised by ELMI project staff in each district (under the guidance of the MEAL Specialist) to ensure that data are reliable.

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<sup>3</sup> Although twenty enumerators were trained and began the data collection, one dropped out in the middle of data collection.

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

- A direct assessment of school readiness skills for the child;
- A household and parenting questionnaire for the parent/caregiver.

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. The assessment tracked children that were assessed at baseline in all the 4 groups.

At midline 715 assessments were collected across the project. The children from the baseline were targeted for the 2014 midline study in order to directly measure learning gains and changes in household environments. Not all children surveyed at baseline were able to be found at midline, and some additional children were surveyed at midline. A detailed description of missing and additional children appears in the Sample section below. Data was entered by 4 selected enumerators and cross checked by 2 members of the MEAL team.

In addition, ECERS data was collected by the ELMI Advisors (VSO volunteers seconded to the project) in the 24 ECCD centres across the 4 districts in September-October. The Advisors were trained together on the tool and discussed amongst each other the interpretation of scoring for each indicator. As in the use of any observation tool, however, potential for differences in scoring decisions from one Advisor to the next cannot be underestimated. Future data collection will consider utilizing inter-rater reliability exercises in order to determine the level of agreement between assessors using the ECERS tool. Data was entered by both enumerators and project staff and cross-checked by the MEAL staff.

## Instruments

This School Readiness Assessment (SRA) tool<sup>4</sup> includes items related to five developmental domains of preschool children: Language and Emergent Literacy, Emergent Math, Physical Development (fine and gross motor skills), Socio-Personal Development, and Personal Health & Hygiene<sup>5</sup>. The table below outlines the key constructs assessed under each domain with corresponding number of items. The baseline analysis established the strong internal consistency of this tool, and an updated analysis using midline data confirms this finding. Details about the internal consistency of the school readiness assessment can be found in Appendix A.

**Table 1. Assessment domains and associated indicators**

Domain of assessment	Constructs assessed	# of indicators	# of items
Physical Development	Fine Motor Skills	4	11
	Gross Motor Skills	4	5

<sup>4</sup> Note that the tools, along with commentary on their development and validity, were attached and detailed in the Baseline Report and therefore have not been included in this report. This report can be accessed through the following link: <https://rwanda.savethechildren.net/resources/education/>.

<sup>5</sup> A modified version of the SRA is now known as the International Development and Early Learning Assessment (IDELA).



Emergent Literacy	Print awareness and book knowledge	1	10
	Alphabet Awareness (Expressive & Receptive)	2	2
	Oral language (Expressive, Receptive & Comprehension)	6	28
	Phonological Awareness	2	5
	Writing	3	3
Emergent Math	Number awareness	7	18
	Measurement	3	10
	Geometry	1	7
	Sorting & Classification	2	6
	Patterns	3	3
Socio-emotional Development	Emotional awareness, conflict resolution, preferences, personal information, sharing, friends, strengths	8	19
Approaches to learning	Persistence/motivation	5	5
Personal Health and Hygiene	Hand washing, latrines, bed nets	6	18

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 the child, read stories with the child, etc.), the home literacy environment, the toys and learning materials available for the child at home, as well as the discipline style of the parents – i.e. positive discipline vs. punitive discipline.

Finally, 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 maths focus of the programme. ECCD 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.

### Sample

Although all children surveyed at baseline were sought after in the 2014 midline assessment, not all children were located. Assessment teams made multiple trips to the field to find baseline children, but were still unable to locate all children for a number of reasons. Table 2 outlines the children and who were assessed and missing at baseline and midline.

**Table 2. Children assessed at baseline and midline, by group**

	Present at baseline & midline	Missing at midline	% Missing at midline
<b>ELMI Centre</b>	161	38	19%
<b>ELMI Parenting</b>	207	49	19%
<b>ECCD control</b>	99	23	19%
<b>Non-ECCD control</b>	150	106	41%
<b>Total</b>	617	216	26%

Across all groups, regression analyses found that children with more types of books at home and more home resources (e.g., appliances, rooms in the home) were more likely to be present for the midline assessment. In addition, significantly more boys than girls were missing at midline, and more children from the non-ECCD control group could not be found for the midline assessment compared to other groups in the study. Some possible reasons for the additional attrition in this group (suggested by community members and local leaders) include: that some families shifted from the localities where they were assessed during the baseline, some families/parents gave wrong information during the baseline thinking that they were going to get some benefits/incentives after the assessment, some parents didn't want to turn up to the midline assessment possibly because they had expected some benefits after the baseline and became uninterested, and some families assessed during the baseline had provided wrong names and couldn't be located during the midline. This constitute a lesson learnt that will inspire future assessments to always double-check the accuracy of the profile information provided by people assessed. There were no significant differences found between the other three groups in the study (ELMI Centre, ELMI Parenting, and ECCD control) with respect to attrition.

In addition to attrition, some children were found to have enrolled in primary school before the expected school year commencing in January 2015. Table 3 displays the breakdown of the children present for the baseline and midline assessments who are now enrolled in primary school. Parenting questionnaires and literacy and numeracy assessments were given to these children and families at midline but none of the other subtests were administered. A detailed analysis of which children transitioned to primary school early and reasons why appears in Section V.

**Table 3. Proportion of children enrolled in primary school, by intervention group**

	Not enrolled in primary (as per expectations)	Primary enrolled	% of baseline-midline sample enrolled in primary
ELMI Centre	74	87	54%
ELMI Parenting	167	40	19%
ECCD control	68	31	31%
Non-ECCD control	82	68	45%
Total	391	226	37%

With traditional study attrition and early entry to primary school, the proportion of children from the original sample still in ECCD centers / not in school yet at midline decreased substantially (Table 4).

**Table 4. Midline sample remaining outside of primary school, by group**

	Baseline sample	Present at baseline only	Enrolled in primary school	Midline sample remaining (#/%)	
ELMI	200	38	87	74	37%
Parenting	254	49	40	167	65%
ECCD control	121	23	31	68	56%
Non-ECCD control	258	106	68	82	32%
Total	833	216	226	391	47%

The high and variable attrition rate across groups makes comparisons of change from baseline to midline difficult because we cannot be confident that our midline sample represents the broader population of ECCD-aged children accurately. For this reason subsequent analyses will present details about children’s learning growth for each group but differences between children’s learning growth will not be directly compared.

Finally, in an effort to compensate for missing children at midline, 98 additional children enrolled in ELMI centers who were not assessed at baseline were sampled during the midline assessment. However, these children have fathers with significantly higher education, more home resources and are younger in age than ELMI Centre children sampled at baseline. Looking across original and new ELMI children, the trend seen at baseline of ELMI Centre children coming from relatively wealthier families remains.

Given the larger than normal attrition rate, addition of new children at midline and background differences between intervention groups, details about children’s learning growth for each group will be shown not directly compared in the following section.

## **Analysis**

When comparing more than two groups of students at one time regressions with dummy variables representing each intervention group and ANOVA with Tukey-Kramer post-hoc pairwise comparison tests were used. Regressions analyses with robust standard errors were used to predict learning gains, but scores were not clustered because half of the sample is not enrolled in an ECCD center and many children have transitioned from their original ECCD center into a primary school.

Average scores for each item are created by dividing the points a child receives over the total possible points. (For example, answering 2 out of the 3 one-to-one correspondence questions correctly would result in a score of 67 percent correct.) The average scores for each subdomain are calculated by adding together average scores for each item in the subdomain and dividing by the total number of items in that subdomain. (For example, the Emergent Numeracy subscale is calculated by adding the one-to-one correspondence item average to the other numeracy item averages and dividing by seven.) The overall SRA score is calculated by adding together the percent correct for each subdomain and dividing by four. In this way, all items within each subdomain are weighted equally in the total subdomain score, and all subdomains are weighted equally in the overall SRA score.

The relationship between ECERS and child learning was analyzed by averaging student learning to the classroom level and regressing quality on learning gains.

## IV. Results – School Readiness Skills

The following section describes baseline and midline score for children in multiple areas of development. **Tables will display average skills at baseline and midline for all children surveyed from the ELMI Centre group, including children from the original baseline sample and new midline children.** Tables for children in the ELMI Parenting group and all figures will show growth for only students present at baseline and midline because this group had the lowest level of attrition and new children were not needed to supplement the sample. **Figures show learning gains only for children who were present at baseline and endline for all groups.** No statistical tests were done to compare growth between groups due to the low proportion of children present for both assessments.

### Emergent Numeracy

Overall for ELMI Centre children, there is a large range in children’s ability to successfully complete early numeracy tasks. Strong skill growth was seen in areas like number identification with children identifying on average 1 number at baseline and 6+ numbers at midline, but children still struggled to make progress on skills like shape identification and simple operations. This could be attributed in part to the caregivers’ preference for focusing on the activities that were more obviously relating to ‘numeracy’ as observed by ELMI staff when they visited centres; caregivers were less likely to choose activities that were related to other emergent numeracy skills, such as patterns, geometry, comparison/measurement, and sorting/classification.

On average ELMI Centre children displayed 21 percent growth in their emergent numeracy skills from baseline but were still at an average of 52% correct responses in the numeracy domain, well below what might be considered desirable in terms of early math knowledge at the end of pre – primary school assuming that all foundational competencies assessed under ELMI are critical for successful transition to early primary. While the program showed significant gains, there is still room for improvement in bolstering these foundational skills.

**Table 5. Summary of Emergent Numeracy skills, ELMI Centre**

	Range	Baseline (N=74)	Midline (N=172)
One to one correspondence	0-4	2.88	3.55
Addition	0-3	0.32	0.74
Subtraction	0-3	0.23	0.29
ID different	0-2	1.11	1.69
Copy pattern	0-1	0.16	0.32
Number ID	0-20	1.19	6.54
Length/size	0-3	1.88	2.42
Puzzle	0-5	0.49	1.58
Classification 1	0-2	1.41	1.70
Count backwards	0-2	0.24	0.63
Shape ID	0-7	2.84	2.95
Day/time	0-4	0.46	1.19
Pattern completion	0-3	0.28	0.72
Classification 2	0-2	0.74	1.29
Rote counting	0-20	7.79	14.18
Quantity selection	0-3	0.46	1.78
Spatial knowledge	0-3	1.28	1.75
<b>Total Numeracy</b>	<b>0-17</b>	<b>5.23</b>	<b>8.66</b>

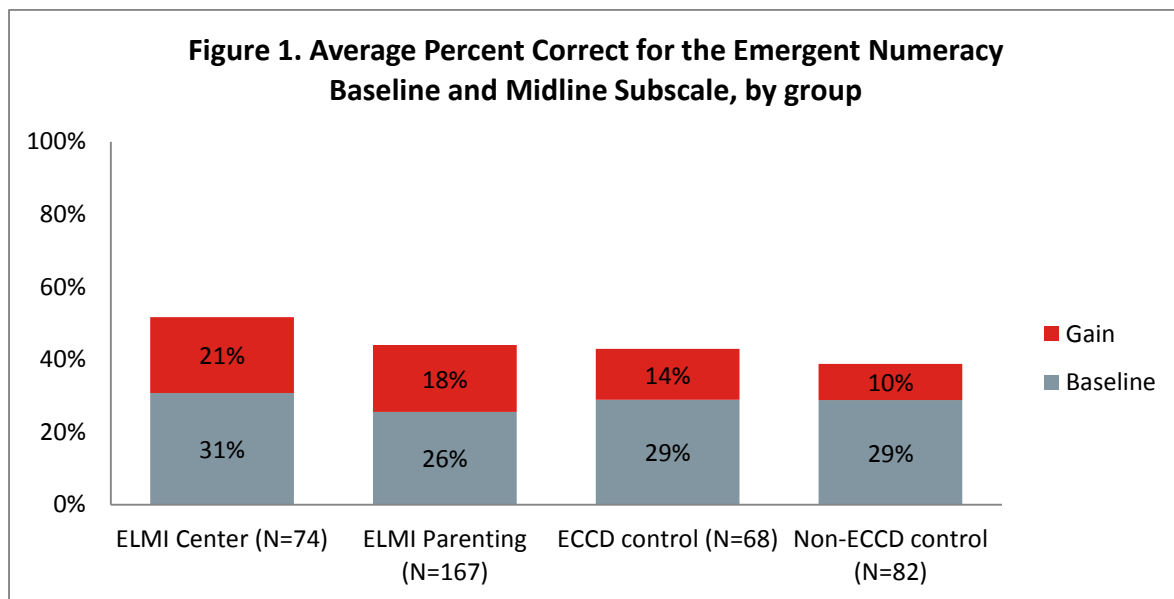
Similarly, children in the ELMI Parenting group display uneven gains across different areas of emergent numeracy but on average showed 18 percent growth from baseline. Interestingly the most notable gains are seen on tasks that are related closely with the content of the parent education ELMI sessions. For example, ELMI parenting had special sessions focused on 1) numbers (ID and one to one correspondence), 2) shapes, and 3) Length/size and we do see substantial gains in these three items on the assessment.

**Table 6. Summary of Emergent Numeracy skills, ELMI Parenting**

	Range	Baseline (N=167)	Midline (N=167)
One to one correspondence	0-4	2.84	3.42
Addition	0-3	0.19	0.64
Subtraction	0-3	0.03	0.28
ID different	0-2	1.04	1.56
Copy pattern	0-1	0.06	0.32
Number ID	0-20	0.62	3.50
Length/size	0-3	1.82	2.32
Puzzle	0-5	0.13	0.79
Classification 1	0-2	1.27	1.45
Count backwards	0-2	0.10	0.37
Shape ID	0-7	1.65	2.20
Day/time	0-4	0.23	0.83
Pattern completion	0-3	0.14	0.53
Classification 2	0-2	0.71	1.15

Rote counting	0-20	6.12	14.09
Quantity selection	0-3	0.43	1.53
Spatial knowledge	0-3	1.44	1.75
<b>Total Numeracy</b>	<b>0-17</b>	<b>4.36</b>	<b>7.48</b>

Figure 1 displays baseline and gain in emergent numeracy for children present for the baseline and midline assessments in each group. There were no significant differences between gains made by boys and girls. Children in the non-ECCD control group gained the least over the course of the program period and the ELMI ECCD center group gained the most. Interestingly, we see the ELMI Parenting group exceeding in gains over the regular ECCD control group and almost catching up with the ELMI Center group.



### Emergent Literacy

As with their numeracy skills, children range quite a bit in their skill gains across individual sub-skill areas. Some items like listening comprehension and copying words became easier with time while others like letter identification remain quite difficult. Children in the ELMI ECCD center group show strong gains in listening comprehension, print awareness, oral vocabulary and writing/copying words. These skills are covered in greater depth through the ELM training and materials so it is encouraging to see that children improved over time in these areas. It is especially positive to see print awareness moving up since a great effort was made to ensure that all preschools have a small book bank and that teachers understand the value and practice of interactive reading with children on a daily basis. On average, children in ELMI Centres show a 22 percent improvement from baseline to midline, but still scoring on average below the 50% mark on the full scale.

**Table 7. Summary of Emergent Literacy Skills, ELMI Centre**

	Range	Baseline (N=74)	Midline (N=172)
Writing level	0-4	1.31	2.34
Copying words	0-4	1.59	3.10

Rhyming	0-2	0.14	0.49
Word sounds	0-3	0.35	0.81
Print awareness	0-9	2.70	4.41
Letter ID	0-20	0.23	1.71
Listening comprehension	0-8	2.08	4.58
Oral vocabulary	0-8	3.42	4.62
Word identification	0-6	1.85	3.37
Story description	0-4	1.55	2.24
<b>Total Emergent Literacy</b>	<b>0-10</b>	<b>2.71</b>	<b>4.81</b>

Children in the ELMI Parenting group also show strong gains in listening comprehension, print awareness, oral language and writing/copying words, as well as modest gains in letter knowledge. Again, it is very encouraging to see print awareness and language improving at comparable rate to the ELMI ECCD center group – given that books and helping parents feel comfortable with reading with their children was a big focus of the ELMI parenting program. In fact, we see that ELMI Parenting children have caught up with the ELMI ECD center children on listening comprehension skills, which are a precursor of reading comprehension later on, and almost caught up on oral vocabulary and print awareness. Overall children in this group moved to an average of almost 5 out of 10 items correct from 2 at baseline (21 percent gain).

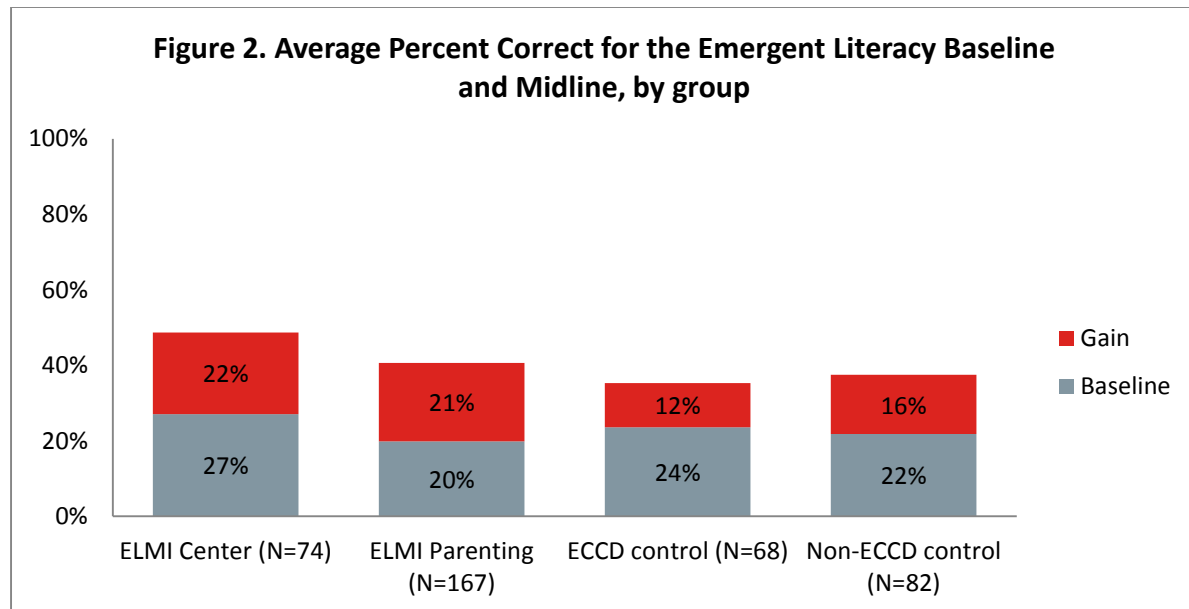
We do see that neither group shows gains in phonological awareness which notes the challenges of teaching this particular skill area at preschool and the lack of focus on this in the ELMI parenting curriculum.

**Table 8. Summary of Emergent Literacy Skills, ELMI Parenting**

	Range	Baseline (N=167)	Midline (N=167)
Writing level	0-4	1.15	1.69
Copying words	0-4	1.13	2.25
Rhyming	0-2	0.16	0.44
Word sounds	0-3	0.14	0.49
Print awareness	0-9	1.95	3.91
Letter ID	0-20	0.08	1.44
Listening comprehension	0-8	1.81	4.42
Oral vocabulary	0-8	3.05	4.47
Word identification	0-6	0.76	2.62
Story description	0-4	0.92	2.07
<b>Total Emergent Literacy</b>	<b>0-10</b>	<b>1.99</b>	<b>4.06</b>

Figure 2 displays baseline and gain in emergent literacy for children present for the baseline and midline assessments in each group. There were no significant differences between gains made by boys and girls. This figure displays strong and similar Emergent Literacy skill growth for both ELMI Centre and ELMI Parenting groups, while ECCD control and non-ECCD control children make weaker gains. The exact averages should be interpreted with caution given the large rate of attrition, especially for the non-ECCD control group as well as the overall small sample size. However, despite

this it is exciting to see a similar magnitude in literacy gains for children in ELMI centers and those in the ELMI Parenting group, especially given the difference in intensity and duration of each program. Overall however, there is quite a bit of room for further improvement of literacy skills among preschoolers. Despite the program’s intensive focus on teacher training and appropriate materials there might be other factors that are slowing down the gains over time - large numbers of children per classroom being among the key ones.



### Socio-emotional development

On average, children also gained socio-emotional skills from baseline to midline, but the magnitude of these gains was relatively smaller than growth seen in emergent numeracy and literacy. Children in both the ELMI Centre and ELMI Parenting groups showed the most growth in their ability to help friends in distress, identify their own emotions and recognize others’ emotions.

**Table 9. Summary of Socio-emotional Development, ELMI Centre**

	Range	Baseline (N=74)	Midline (N=172)
Empathy	0-4	0.92	2.01
Expressing preference	0-16	6.54	7.18
Solving conflict	0-2	0.39	0.87
Friends	0-16	2.81	3.90
Personal emotions	0-3	0.69	1.46
Self-awareness	0-6	3.11	3.60
Sharing	0-2	0.64	0.92
Strengths	0-8	1.64	2.88
<b>Total Socio-emotional</b>	<b>0-8</b>	<b>2.35</b>	<b>3.89</b>

What is particularly interesting is the expansion of friendships and social connections the ELMI Parenting children report at endline compared to baseline. The parenting program required that children come along with the parents to the sessions and they had a chance to interact with peers

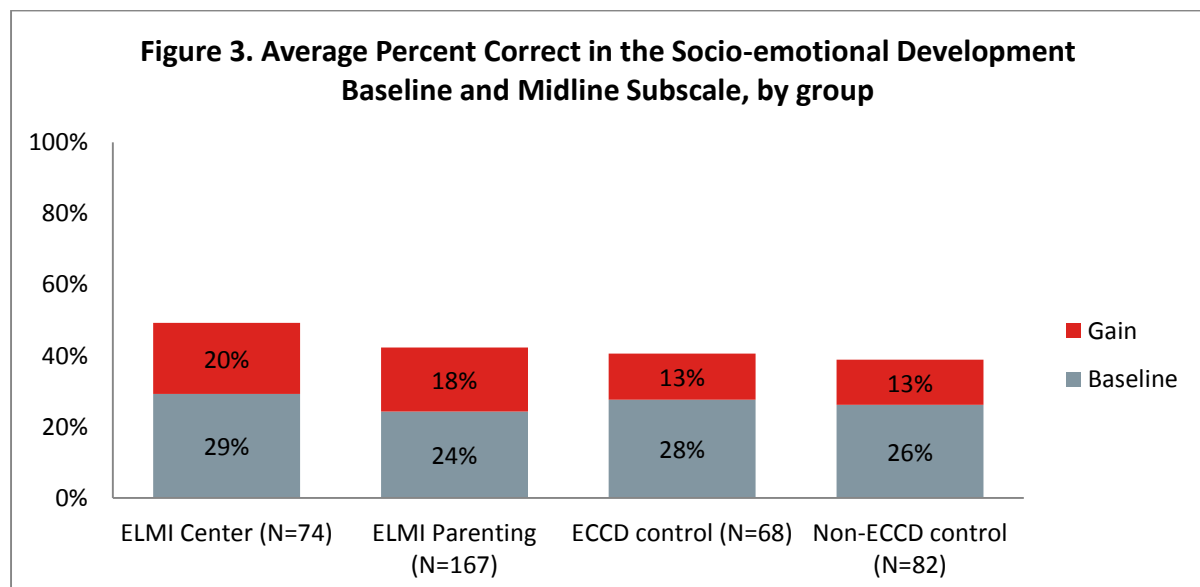


outside of home, play joint games and also participate in some parts of the parent education sessions. These opportunities certainly seem to have extended their social networks and they report almost comparable number of friends at endline to their peers who attend an organized ECCD program that lends itself to plenty of social interactions.

**Table 10. Summary of Socio-emotional Development, ELMI Parenting**

	Range	Baseline (N=167)	Midline (N=167)
Empathy	0-4	0.76	1.79
Expressing preference	0-16	4.05	6.33
Solving conflict	0-2	0.28	0.83
Friends	0-16	1.96	3.51
Personal emotions	0-3	0.60	1.41
Self-awareness	0-6	3.10	3.55
Sharing	0-2	0.40	0.88
Strengths	0-8	1.20	2.48
<b>Total Socio-emotional</b>	<b>0-8</b>	<b>1.94</b>	<b>3.38</b>

Figure 3 displays baseline and gain in socio-emotional development for children present for the baseline and midline assessments in each group. There were no significant differences between gains made by boys and girls. Again we see the ELMI ECCD group making the biggest gains (which is to be expected given the active social environments they were a part of) but very close behind are the ELMI parenting children who have made considerable more gains compared to the other comparison groups. Again however we notice that overall scores in the intervention groups are generally low at midline, indicating that despite the notable gains, more room for improvement is there.



## Physical Development

### Gross Motor Development

We find that on average, children are gaining gross motor skills over time and are nearing the maximum possible points in this domain. Catching a ball was the only area where growth was not observed for children in ELMI ECCD centers. Given the overall trend of increasing skills in this area future assessments may consider dropping this item if it does not fit well in this domain. Overall children in the ELMI Centre group score 4.7 out of 5 points at midline.

**Table 11. Summary of Gross Motor Development, ELMI Centre**

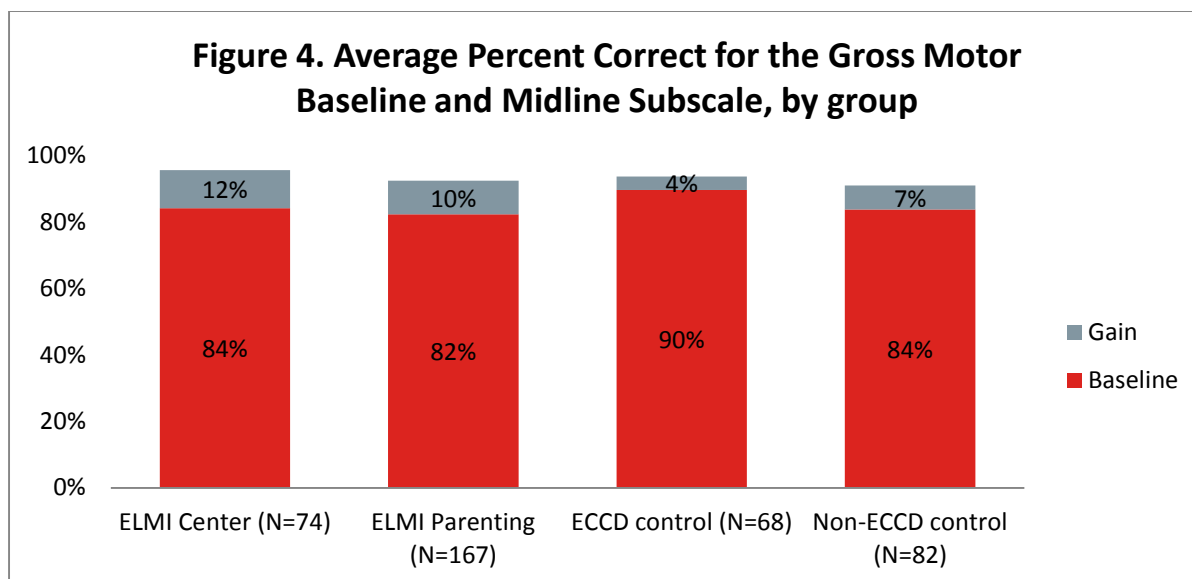
	Range	Baseline (N=74)	Midline (N=172)
Catching a ball	0-3	2.50	2.38
Walking in a line	0-2	1.49	1.51
Hopping	0-10	8.80	9.55
Balancing 1	0-6	5.40	5.83
Balancing 2	0-6	5.07	5.69
<b>Total Gross Motor</b>	<b>0-5</b>	<b>4.21</b>	<b>4.66</b>

Children in the ELMI Parenting group also made the smallest gains in the area of catching a ball, and the most growth walking in a line. Overall children in this group score 4.6 out of 5 points on the gross motor scale at midline.

**Table 12. Summary of Gross Motor Development, ELMI Parenting**

	Range	Baseline (N=167)	Midline (N=167)
Catching a ball	0-3	2.61	2.67
Walking in a line	0-2	1.27	1.64
Hopping	0-10	8.58	9.78
Balancing 1	0-6	5.30	5.84
Balancing 2	0-6	5.10	5.53
<b>Total Gross Motor</b>	<b>0-5</b>	<b>4.12</b>	<b>4.62</b>

Figure 4 displays baseline and gain in gross motor skills for children present for the baseline and midline assessments in each group. There were no significant differences between gains made by boys and girls. Overall the ELMI program was not intended to have a significant impact on gross motor skills. Further, gross motor skills are pretty highly developed across all groups, so the gains we see here are likely reflective of a traditional developmental trajectory. Children began with high baseline scores and we see some of the groups climbing up to 96% at midline. Certainly children attending and ECCD program seem to be scoring slightly higher than peers not in a program, and that could be due to the fact that ECCD attending children have access to well-equipped playgrounds as well as to various outdoor organized games.



### Fine Motor Development

On average, young 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. Children display growth on all items in this developmental area, except stringing a bead. However, almost all children were able to successfully complete this task at baseline so very little growth was possible. Therefore this particular activity may not be relevant for future assessments. On average children in the ELMI Centre group successfully completed 3.6 out of 5 tasks in this area at midline, 19 percent growth from baseline, and maintained their overall advantage over other study groups.

**Table 13. Summary of Fine Motor Development, ELMI Centre**

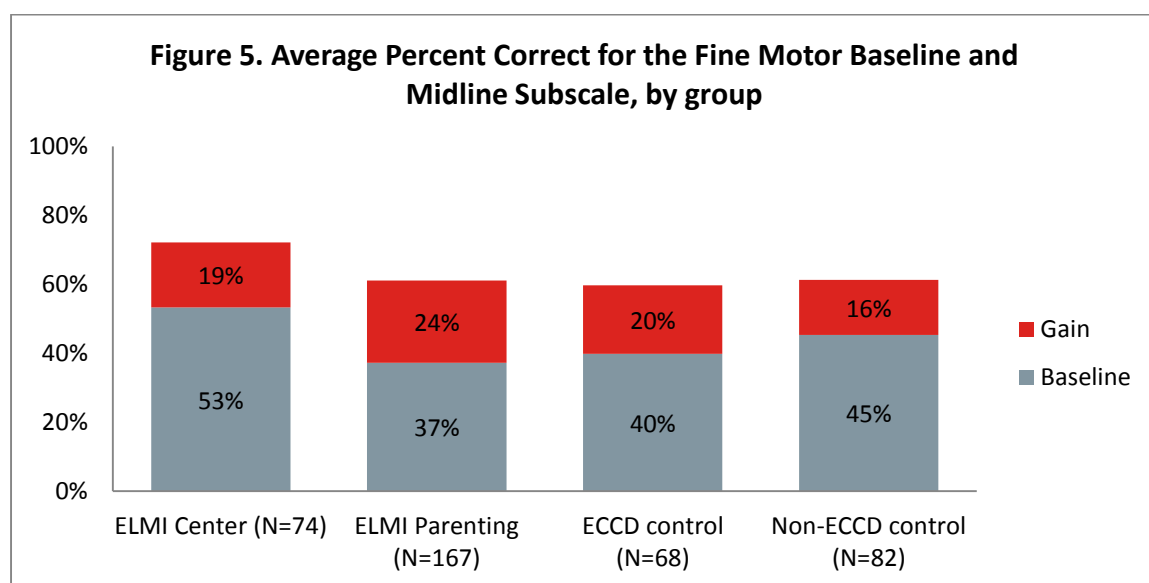
	Range	Baseline (N=74)	Midline (N=172)
Stringing beads	0-1	0.99	0.98
Folding paper	0-7	2.52	3.53
Drawing human	0-7	2.92	4.08
Drawing shapes	0-2	1.18	1.38
Cutting paper	0-2	0.57	1.12
<b>Total Fine Motor</b>	<b>0-5</b>	<b>2.67</b>	<b>3.63</b>

Children in the ELMI Parenting group showed the strongest gains in cutting and folding paper, and were able to successfully complete 3 of the 5 tasks on average at the time of the midline assessment, a 24 percent gain from baseline.

**Table 14. Summary of Fine Motor Development, ELMI Parenting**

	Range	Baseline (N=167)	Midline (N=167)
Stringing beads	0-1	0.97	0.96
Folding paper	0-7	1.14	2.83
Drawing human	0-7	1.61	3.44
Drawing shapes	0-2	0.74	1.15
Cutting paper	0-2	0.22	1.14
<b>Total Fine Motor</b>	<b>0-5</b>	<b>1.86</b>	<b>3.06</b>

Figure 5 displays baseline and gain in fine motor skills for children present for the baseline and midline assessments in each group. There were no significant differences between gains made by boys and girls. Although it was expected to see similar gains for the two groups of ECD attending children (who have access to practicing many of the skills in this developmental area), the larger gains in the ELMI Parenting group were notable to observe. In fact ELMI Parenting children outperformed the standard ECD control group. It is likely that these gains are linked to the various games and activities that were introduced to parents and children in the program involving fine motor skills- such as drawing with sticks, counting little pebbles (which require careful grip), tearing paper and others. In the absence of previous exposure to such skills (parenting group scored the lowest at baseline) even modest attention and practice of fine motor tasks made a big difference for this group.



## Approaches to Learning

In addition to items related to the socio-emotional development listed above, five items asked assessors to evaluate children’s persistence in attempting to tackle novel or complicated tasks on the assessment. These items attempted to measure persistence or non-cognitive skills (very important as we consider holistic development) which fit under the area of “approaches to learning”. On average, students’ persistence on challenging tasks increased from baseline to midline across both the ELMI Parenting and ELMI center groups, and there were no significant differences between gains made by boys and girls.

**Table 15. Summary of persistence, ELMI Centres**

	Range	Baseline (N=74)	Midline (N=172)
Rote counting	0-1	0.70	0.94
One-to-one correspondence	0-1	0.70	0.90
Folding	0-1	0.73	0.89
Writing	0-1	0.85	0.94

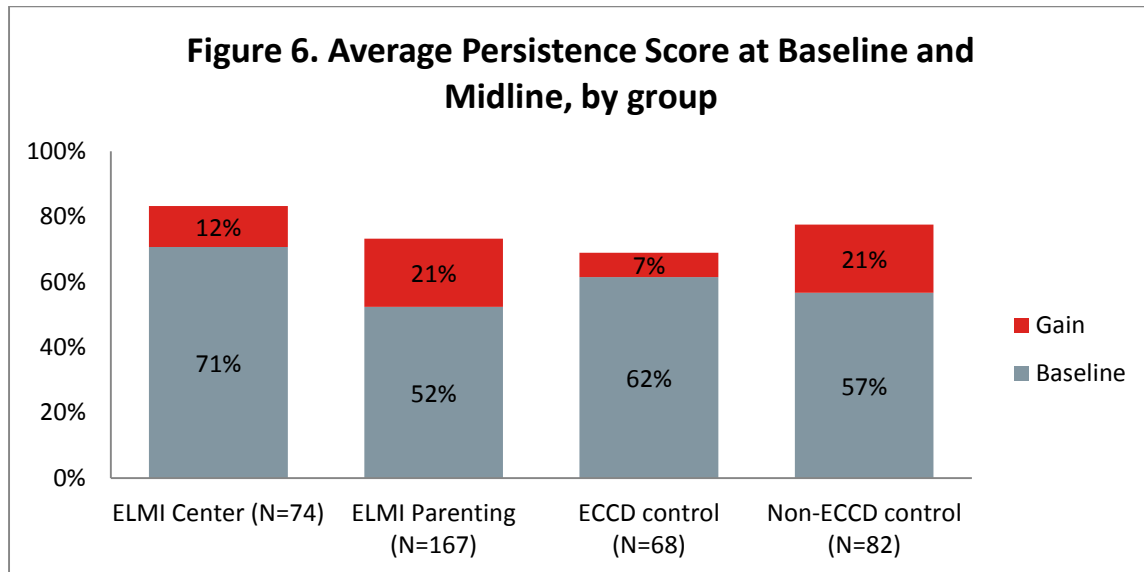
Puzzle	0-1	0.52	0.71
<b>Total persistence</b>	<b>0-5</b>	<b>3.54</b>	<b>4.38</b>

In contrast to children in the ELMI Centre group who exhibited strongest persistence and engagement on rote counting and putting together a puzzle, children in the ELMI Parenting group displayed the largest gains in persistence on the one-to-one correspondence task, which was a task their parents were coached to support at home regularly.

**Table 16. Summary of persistence, ELMI Parenting**

	Range	Baseline (N=167)	Midline (N=167)
Rote counting	0-1	0.67	0.87
One-to-one correspondence	0-1	0.46	0.80
Folding	0-1	0.63	0.74
Writing	0-1	0.52	0.73
Puzzle	0-1	0.32	0.49
<b>Total persistence</b>	<b>0-5</b>	<b>2.62</b>	<b>3.66</b>

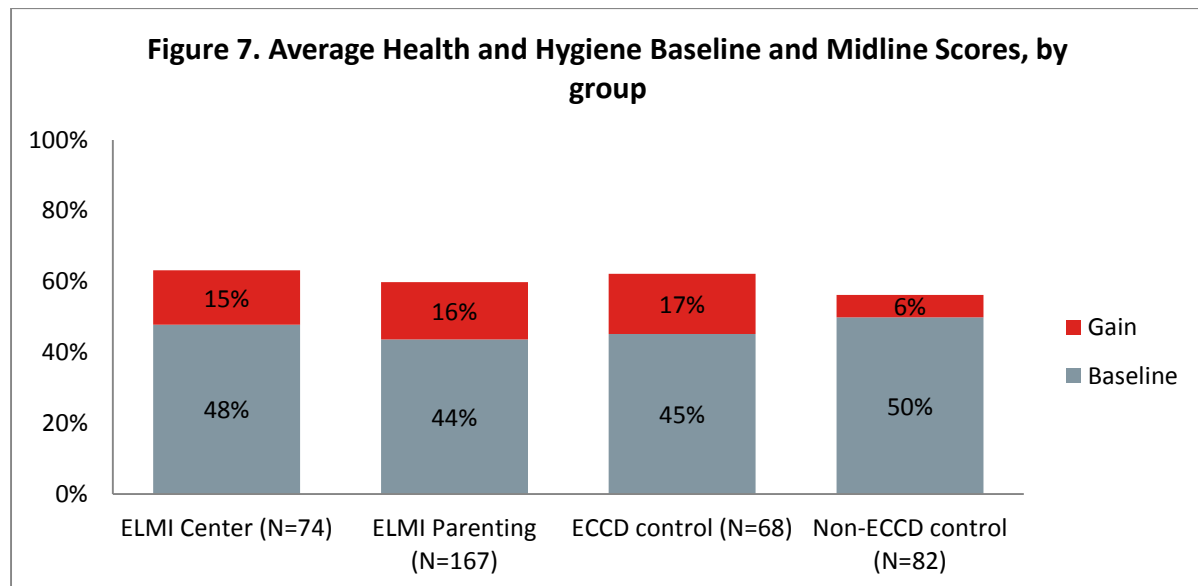
Figure 6 displays baseline and gain in persistence and engagement among children present for the baseline and midline assessments in each group.



## Personal Health and Hygiene

Various health knowledge indicators were also included in the assessment at baseline and midline, however these skill areas were not explicitly addressed by program interventions so were not analyzed in great detail. On average, children across all groups gained knowledge about hand washing but there is still space for improvement. The least knowledge was gained about what constitute healthy and unhealthy foods. Future programs should consider a stronger emphasis on hygiene and nutrition habits in preschools and through parent education.

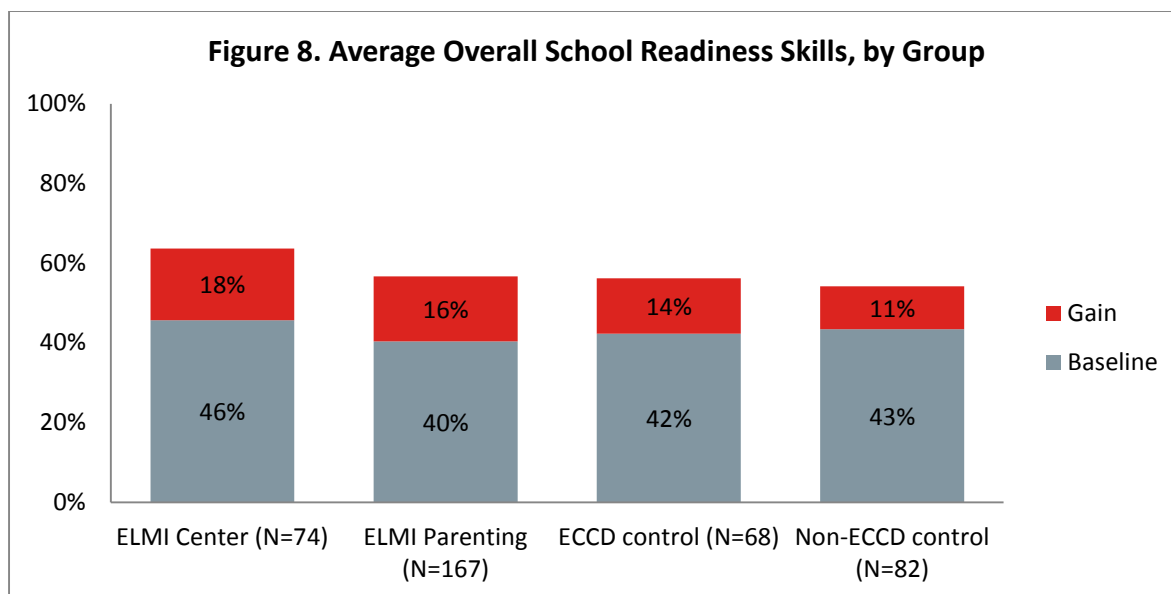
Figure 7 displays baseline and gain in health and hygiene knowledge for children present for the baseline and midline assessments in each group. There were no differences in the gains made by boys and girls. It does appear that children not participating in any ECCD program are gaining the least in this area while the other groups are gaining a similar amount.



## Total School Readiness Skills

As Figure 8 displays, children in all groups made many gains in overall early knowledge and development. It is natural to expect that all children will make some gains in learning and development as they age and this section will investigate differences in the amount of skill gains acquired by children in various groups. ELMI Centre children began at baseline and remain at midline with a developmental advantage over children in all other groups. However, it is interesting to note the children in the ELMI Parenting group and children in the ECCD control group have similar skills at baseline and midline, **suggesting that a high quality parenting intervention can have similar results to a standard center-based ECCD program.** A further investigation of this trend will be reviewed in Section VII. The small sample sizes unfortunately are a significant limitation in this analysis as these findings are likely an underestimation of the effects that might have been seen with larger samples.

What is notable regardless, is that even in groups with highest gains children are only answering correctly on average 64% of the questions, which suggests that there is more work that needs to be done to ensure that programs adequately support children’s learning and development and prepare them for school. Further investigation of this is presented in Section VII, where we see the role that program quality plays in terms of children’s gains.



## V. Results – Primary school

As noted in Section III, 226 of the children originally sampled at baseline (the majority of which were from the ELMI Centre treatment group) were unexpectedly enrolled in Primary school in 2014 and therefore were in their last term of P1 at the time the midline data collection was carried out. Using logistic regression analyses to predict enrollment in primary school, we find that children who enrolled in primary school early tended to be older, were from families with more home resources, and had stronger emergent literacy and overall SRA baseline scores than children not enrolling in primary school. This suggests that perhaps they were enrolled in primary school early in part due to their relatively strong early learning skills. Finally, children in the ELMI Parenting and ECCD control groups were less likely than children in ELMI Centre group to transition to primary school early. Detailed regression results are shown in Appendix A.

In an attempt to further understand the reasons for this early enrollment, interviews were held with key stakeholders. Three categories of stakeholders were interviewed, including government officials, ECCD caregivers and parents whose children graduated early to primary school. Information was collected through individual interviews and the sampling was as follows: 2 government officials (1 Sector Education Officer (SEO) and one Primary Head Teacher) per district X 4= **8 people**; 1 ECCD caregiver/district X4= **4 people**; 3 parents of children who enrolled early to primary X 4= **12 people**. A set of questions as to why children enroll early to P1 was administered. The following table provides a snapshot of their feedback on the reasons behind early enrollment in primary school.

**Table 17. Summary of feedback provided by local stakeholders on reasons behind early enrollment in Grade 1**

Government Officials (SEOs and Primary School Head Teachers)	ECCD caregivers	Parents
<ul style="list-style-type: none"> <li>Children are registered to primary school between 6 and 7 depending on when a child is coming to enroll, if they are 6 but turning 7 in few months,</li> </ul>	<ul style="list-style-type: none"> <li>There is sometimes peer/ neighbor influence that push parent to enroll their children early in P1.</li> <li>Parents don't like paying the</li> </ul>	<ul style="list-style-type: none"> <li>Depending on when the child started ECCD, the child can graduate before 7 years: my son is only 5 years old and has already finished the ECCD</li> </ul>

<p>they have to be accepted.</p> <ul style="list-style-type: none"> <li>• The government children need to be 7 years old to enroll in P1 but 6 years old is allowed for special cases. The government gives that room for special cases (e.g. those who come from the ECCD are qualified to enter the P1 at 6 because they have been exposed to more skills).</li> <li>• Apart from those who come from the ECCD centers, others have to be 7 years to be enrolled in P1.</li> <li>• There is the issue of the total number of students the Primary school should have, so we really don't consider much about the age of children who come to be registered if we have to fill up spots in grade 1</li> <li>• Yes, we consider the age <b>but</b> we end up finding out that many children are under age due to carelessness of the P1 teachers who do the registration thinking that they are doing the children a favor to let them in P1 under the age.</li> <li>• Primary School teachers arrange that with parents and accept to take their children under the age because they are friends.</li> <li>• Some parents make fake ECCD completion certificates to have their children registered before age.</li> <li>• Parents want their children to start going to school only going in the afternoon instead of ECCD where they go mornings. Here they make arrangements with teacher to make sure their children only go there in the afternoon.</li> <li>• Some children follow their elder siblings rather than just remaining at home, and you find they are enrolled at an early age.</li> <li>• Because parents want to avoid the contribution they give in ECCD centers they take their children to Primary school</li> </ul>	<p>contribution in ECCD/Pre-primary schools because primary education is free.</p> <ul style="list-style-type: none"> <li>• Parents don't have enough money to contribute for ECCD for more than one year, and hence make them go to primary earlier than expected.</li> <li>• When we see that the skills the child has are necessary and sufficient for her to really start school we let her/him graduate early to P1.</li> <li>• Primary schools are not strict about accepting underage children, hence parents take them to primary earlier.</li> <li>• Children who graduate are either 6 or 7 years.</li> <li>• Sometimes parents take children out of preschool before they graduate to register them in Primary.</li> <li>• Some children are ready before 7 years depending on the age at which they were registered to ECCD.</li> </ul>	<p>and has his certificate now, but am not sure if he is ready for P1.</p> <ul style="list-style-type: none"> <li>• I think 7 years is more appropriate, the children are more mature and would not be crying every time and wanting to go back home.</li> <li>• 6 years old is more appropriate, because that is when they finish ECCD and have lower chance to quit school because they are too old and are sharing a class with younger children.</li> <li>• Children feel proud to be in school when they are young and love school more.</li> <li>• Some children have the basic skills before the age of 7.</li> <li>• I think one year is enough since I see that they learn a lot in just one year.</li> <li>• 6 years is very ok for a child to start primary. If not 6 then 7. But 4 and 5 years a child is still very small.</li> <li>• My child joined to Primary at 6 years old. She really knew a lot of things like counting, was sharp, and up to now her teachers tell me that she is performing well in primary.</li> <li>• Some parent said the child would stay in the ECCD depending on the age the child joined.</li> <li>• One parent said her daughter joined ECCD at 2 years; she will be there for 3 years; which means she'll graduate at 5 years old.</li> <li>• If the child exhibits that she/he is ready, she/he can even go primary before 7 years.</li> <li>• Some children have the basic skills before the age of 7.</li> </ul>
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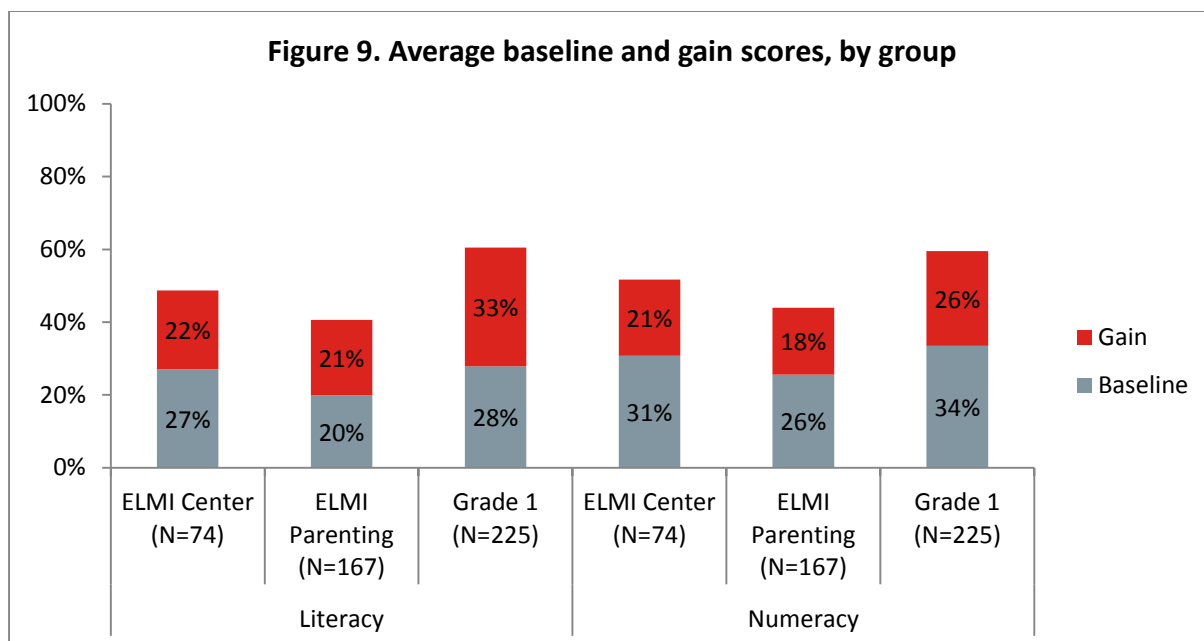


<p>early.</p> <ul style="list-style-type: none"> <li>• Because they want them to be going with their older siblings who go to Primary school.</li> <li>• Some parents can give their children skills at home and they are ready for Grade 1 before 7 years.</li> <li>• Some parents of children who are not in ECCD centres want a place where to leave them so that they can go working.</li> <li>• Educated parents think children are getting late to wait 7 years.</li> </ul>		
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This qualitative feedback helps to provide a bit more background as to why more ELMI Centre children enrolled to grade 1 earlier as opposed to other groups. Parents, government officials and ECD caregivers all state many reasons why the earlier enrolment might be the norm in some communities. Further, the interviews helped underscore the challenges of parental contributions for ECCD services as well as the challenges of grade 1 classrooms where one might find children of varying ages and of different school backgrounds.

Children who enrolled in primary school were only assessed in literacy and numeracy, so those are the only results available to compare. Given the small sample size of this self-selected group and the fact that intervention children would have only received about 3 months or less of whichever program they had access to (given the ELMI implementation timeline vis-à-vis the school year), score differences between groups were not tested for statistical significance. However, tests were run to determine whether scores differed between children who had attended any type of ECCD center compared to those who had never been in an ECCD classroom and found that there were no differences between the literacy or numeracy skills of the two groups of children. It should be noted that the sample here is small and children may have attended various types of ECD programs before attending primary school, which means that this may not be an accurate reflection of the average impact of ECCD attendance on grade 1 outcomes.

Interesting to observe, however, are the types of gains children enrolled in primary grades make over the course of almost a full year of grade 1, compared to gains we see in the ECCD programs. The graph below summarizes literacy and numeracy gains by group.



In terms of language and literacy, the grade 1 students tracked under this study and the ELMI ECCD group started at very similar places at baseline and the grade 1 group gained on average 33% points over their baseline scores, while the ELMI ECCD group gained 22% points. The literacy outcomes for these two groups are actually not that different even though one group received the extra year of pre-primary ELMI intervention while the other group received the grade 1 curriculum, which is much more academic and focused on reading and literacy.

This is quite interesting and suggests that the one year ELMI intervention was quite strong compared to the learning that children gained in almost a year of grade 1 (the difference between the two groups is 10%). This seems like a finding in favor of the ELMI program but disheartening for the teaching and learning of literacy skills in early grades. At the end of grade 1, students in this study (many of whom had been through a kind of an ECCD program) are still scoring at about 61% correct responses on this assessment of *early* literacy, which leaves a lot to be desired from grade 1 competencies.

The biggest gains recorded for those who entered grade 1 early are in the areas of letter ID (on average those students could identify 5 letters at midline vs 2 letters among the intervention groups). However, in terms of skills like phonological awareness, writing level, listening comprehension the differences between the two groups were not many.

**Table 18. Summary of emergent literacy skills for children enrolled in primary school at midline**

	Range	Baseline	Midline
Writing level	0-4	1.35	2.81
Copying words	0-4	1.54	3.66
Rhyming	0-2	0.28	0.79
Word sounds	0-3	0.24	1.24
Print awareness	0-9	2.50	5.57
Letter ID	0-20	0.11	5.07
Listening comprehension	0-8	2.85	5.56

Oral vocabulary	0-8	3.89	5.22
Word identification	0-6	1.56	4.09
Story description	0-4	1.38	2.59
<b>Total Emergent Literacy</b>	<b>0-10</b>	<b>2.78</b>	<b>6.05</b>

In terms of math, the data is even more promising for ELMI center children. Those who moved up to grade 1 faster started with similar baseline scores and gained only slightly more than their peers who stayed in preschool (difference was 5% points). On average, towards the end of the grade 1 year, students in this study were getting just about 60% of math questions right vs 52% among the ELMI ECCD group. While some additional gains were made in grade 1 it is still concerning that what are considered *emergent* math skills are not fully mastered by the end of grade 1.

For math, the biggest gains were also in number ID with grade 1 students identifying on average 12 numbers at midline vs only 3-4 among the ELMI groups. In terms of shapes, measurement and subtraction however, midline outcomes appear quite similar.

While not initially planned, this comparison of students who had moved to grade 1 faster presents an interesting point for reflection and will help us in interpreting future endline results which will follow the ELMI students from midline into grade 1 next year. Overall, the results emphasize the strong literacy foundations ELMI groups will bring to grade 1 as well as the challenges with learning further skills in the context of traditional grade 1 classrooms that children are likely to face.

**Table 19. Summary of emergent numeracy skills for children enrolled in primary school at midline**

	Range	Baseline	Endline
One to one correspondence	0-4	3.16	3.65
Addition	0-3	0.27	1.09
Subtraction	0-3	0.12	0.59
ID different	0-2	1.26	1.66
Copy pattern	0-1	0.16	0.44
Number ID	0-20	1.41	11.62
Length/size	0-3	2.18	2.65
Classification 1	0-5	1.54	1.70
Count backwards	0-2	0.21	0.84
Shape ID	0-2	2.31	2.62
Day/time	0-7	0.50	1.81
Pattern completion	0-4	0.34	0.84
Classification 2	0-3	0.88	1.42
Quantity selection	0-2	0.74	2.32
Rote counting	0-20	8.60	17.15
Puzzle	0-5	.30	NA
Spatial knowledge	0-3	1.66	NA
<b>Total Emergent Numeracy*</b>	<b>0-17</b>	<b>5.70</b>	<b>8.92</b>

\*Note: Baseline Emergent Numeracy totals are scored out of 17 points, whereas endline scores for children enrolled in primary school are scored out of 15 points due to two questions not being asked to these children at endline.

## VI. Parenting Practices

In addition to comparing children’s early skills, caregivers were also surveyed about their activities at home with children. All parents, regardless of whether their child was enrolled in primary school, were surveyed again at midline so caregivers of all children assessed at baseline and midline will be included in this section. The increased sample size does allow for direct comparison of changes between groups.

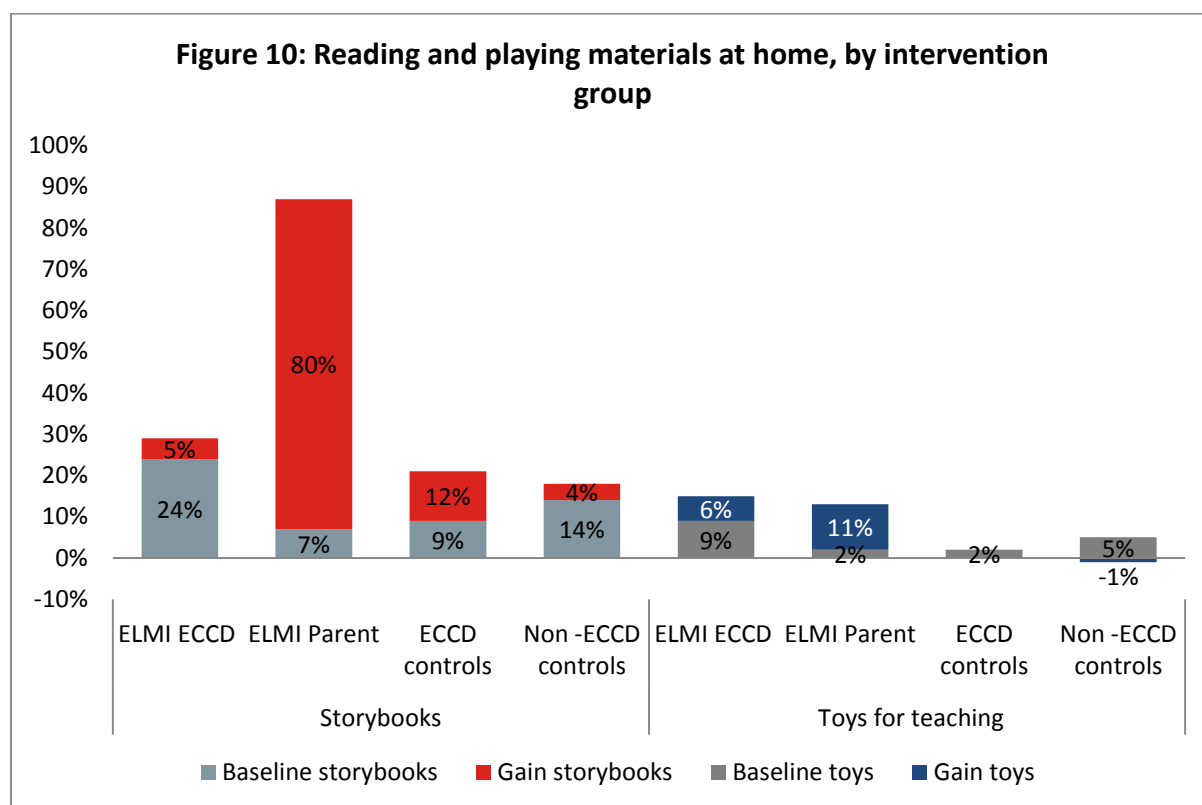
### Materials at home

One key element of engaging children in learning and developmentally appropriate play at home is access to and knowledge about materials to help them do so. Often parents have multiple resources at home that can be used to help children learn, but they are not aware of these. Table 20 displays the reported prevalence of toys and reading materials in homes at baseline and midline. Overall, all parents report some gains in the amount of reading materials or toys at home. However, parents in the ELMI Parenting group report gaining more storybooks compared to parents in other groups, which is to be expected as each parent ‘graduating’ from the parenting sessions received 2 books and have access to community book banks provided by the project.

**Table 20. Learning and playing materials at home, by intervention group**

	ELMI (N=74)		Parenting (N=167)		ECCD control (N=68)		Non-ECCD control (N=82)	
	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Storybook	24%	29%	7%	87%	9%	23%	14%	18%
Textbooks	21%	46%	6%	33%	6%	23%	6%	41%
Magazine	0%	15%	2%	6%	2%	11%	1%	11%
Newspaper	4%	5%	4%	18%	5%	5%	2%	5%
Religious book	61%	51%	43%	49%	47%	43%	35%	50%
Coloring book	11%	9%	3%	14%	5%	5%	2%	6%
Comics	5%	4%	2%	5%	5%	3%	2%	4%
Homemade toys	64%	88%	69%	95%	66%	88%	68%	94%
Manufactured toys	26%	28%	15%	19%	2%	30%	18%	13%
Household objects	55%	72%	80%	78%	34%	52%	45%	83%
Outdoor objects	84%	77%	91%	90%	73%	76%	86%	87%
Writing materials	37%	50%	14%	13%	13%	18%	11%	17%
Puzzle	23%	13%	17%	6%	2%	2%	15%	2%
Toys for teaching	9%	15%	2%	13%	2%	2%	5%	4%
<b># types of reading materials</b>	<b>1.0</b>	<b>1.3</b>	<b>0.6</b>	<b>1.2</b>	<b>0.7</b>	<b>0.9</b>	<b>0.5</b>	<b>1.1</b>
<b># types of toys</b>	<b>3.0</b>	<b>3.4</b>	<b>2.8</b>	<b>3.1</b>	<b>1.9</b>	<b>2.6</b>	<b>2.5</b>	<b>3.0</b>

The Figure 10 below clearly demonstrates the very high gains in children’s books for the ELMI parenting group going from the lowest % at baseline (7%) to the highest % at midline- at 80% of households reporting having storybooks for children, well above the rest of the groups. We also see the notable gains in the parenting group around toys available at the home for teaching children new things – again the parenting group starts at 2% at baseline and gained the most in terms of availability of toys, while the control groups didn’t demonstrate any gains.



### Activities at home

In conjunction with reporting on learning materials, parents also reported on activities occurring at home with their children. On average, parents who received the parenting intervention reported significantly increasing engagement in learning activities (i.e., reading books, naming objects, and teaching new things, letters, numbers, shapes and writing)<sup>6</sup> with their children at home than parents in other groups. In addition, parents in the ELMI Parenting group also reported increasing engagement in more play activities (i.e., telling stories, singing, taking outside, playing, and hugging) than parents in the ELMI and non-ECCD control groups.

<sup>6</sup> Activities were grouped into the categories of learning or playing using principle component analysis.

**Table 21. Learning and playing materials at home, by intervention group**

	ELMI (N=74)		Parenting (N=167)		ECCD control (N=68)		Non-ECCD control (N=82)	
	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Read books	23%	37%	8%	56%	12%	19%	17%	25%
Tell stories	35%	36%	22%	40%	10%	43%	29%	31%
Sing	55%	35%	33%	46%	27%	31%	54%	35%
Take outside	68%	51%	40%	50%	45%	67%	51%	61%
Play	46%	40%	20%	46%	19%	42%	42%	36%
Name objects	27%	28%	5%	39%	3%	10%	10%	20%
Teach new things	43%	31%	10%	43%	5%	18%	18%	32%
Teach alphabet	40%	42%	9%	47%	9%	28%	14%	24%
Teach numbers	52%	45%	18%	62%	18%	30%	30%	39%
Teach shapes	8%	15%	1%	15%	3%	5%	6%	7%
Teach writing	47%	46%	8%	38%	16%	21%	22%	21%
Hug	83%	75%	64%	66%	70%	54%	89%	55%
Spank	70%	45%	38%	65%	37%	65%	57%	51%
Hit	35%	31%	36%	53%	12%	29%	51%	46%
Yell	73%	45%	52%	65%	66%	53%	69%	52%
<b>School activities</b>	<b>2.5</b>	<b>2.5</b>	<b>0.6</b>	<b>3.0</b>	<b>0.7</b>	<b>1.3</b>	<b>1.2</b>	<b>1.6</b>
<b>Play activities</b>	<b>2.9</b>	<b>2.4</b>	<b>1.8</b>	<b>2.5</b>	<b>1.7</b>	<b>2.4</b>	<b>2.6</b>	<b>2.2</b>
<b>Aggressive activities</b>	<b>1.8</b>	<b>1.2</b>	<b>1.3</b>	<b>1.8</b>	<b>1.1</b>	<b>1.5</b>	<b>1.8</b>	<b>1.5</b>

Figure 11 below demonstrates that ELMI parenting group started with lowest rates of engagement at baseline but improved the most in terms of learning and play activities at home, outscoring all other groups at midline, which in some instances actually showed a downward trajectory of family engagement - as in the case of ELMI center group and the non ECCD controls in terms of play activities. It seems that ELMI parenting families embraced the idea of play and learning at home and took their role seriously.

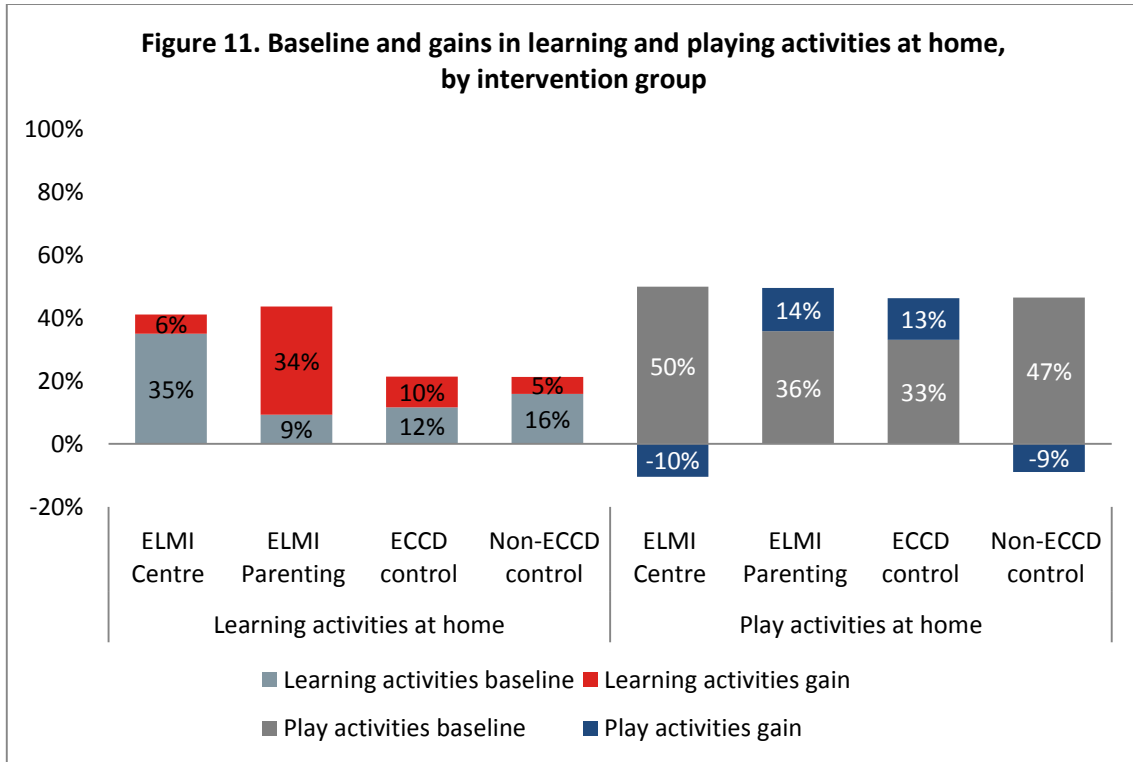
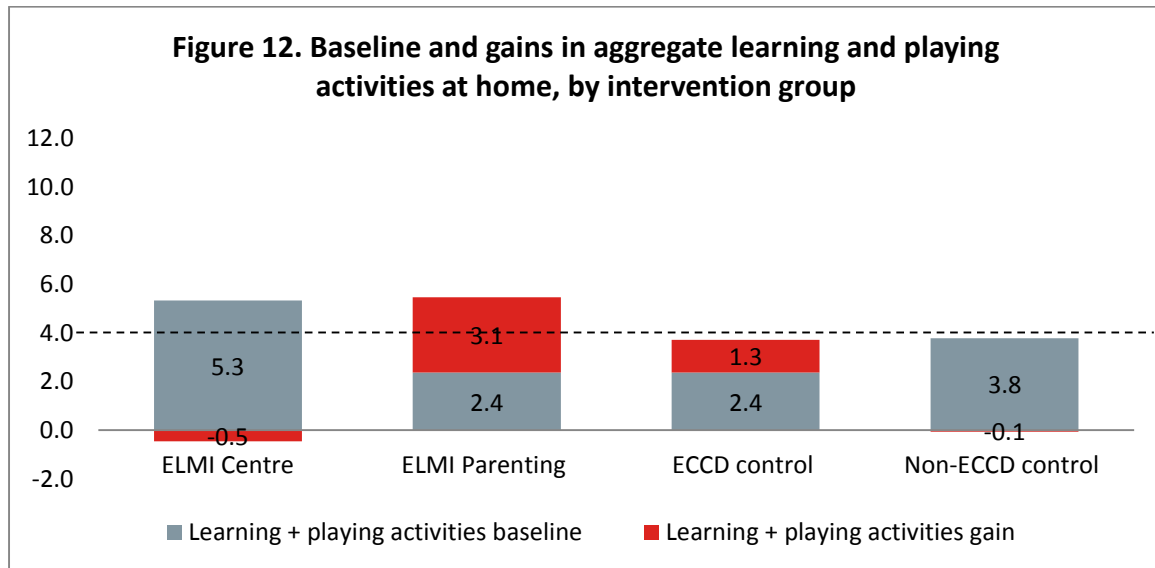
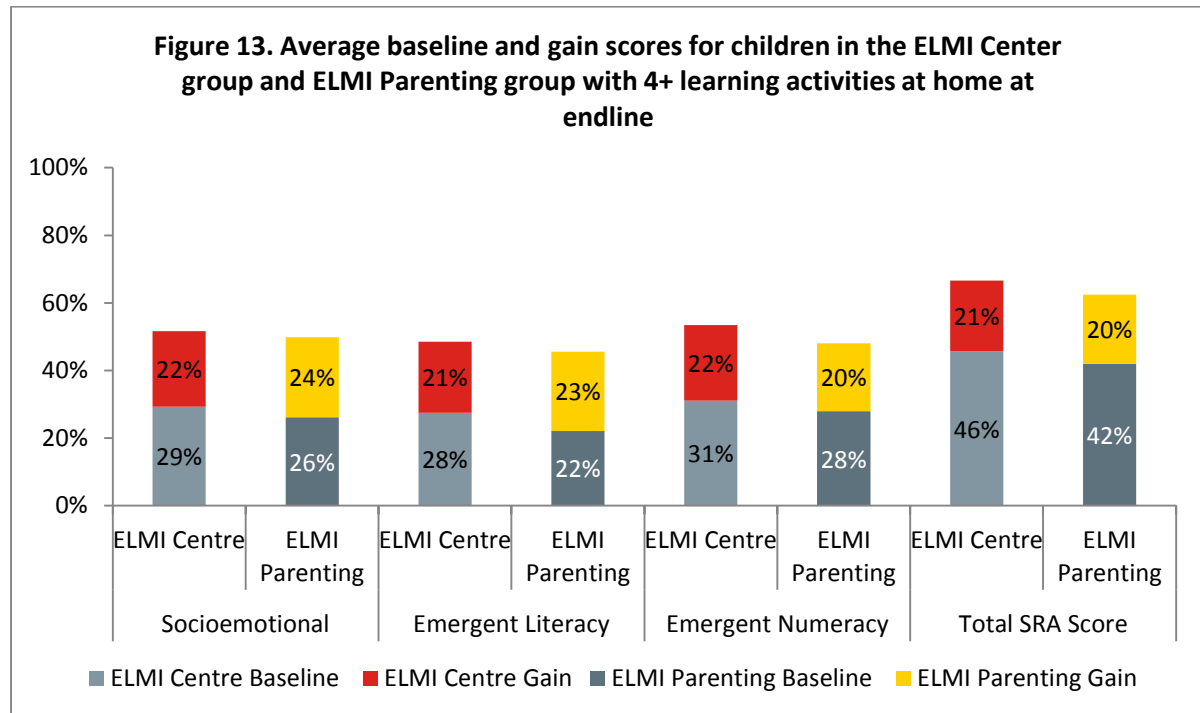


Figure 12 presents the aggregate gains across groups in home environment and activities. We see the same trends observed in the previous graph, with ELMI parenting group leading the way in providing stimulating activities at home.



Interestingly, when looking at gains made by children in the ELMI Centre group compared to children in the ELMI Parenting group whose parents’ reported engaging in four or more positive activities with the child (a benchmark used by UNICEF’s MICS survey to distinguish between a stimulating and non-stimulating home environment), results show that ELMI Centre children have only a small advantage over ELMI Parenting children at baseline compared to the larger differences seen with the whole group (Figure 13). Further, results demonstrate that these two groups of

children make comparable gains over the course of the year. **This suggests that strong parenting can have comparable impact to that of a high quality ECCD centre program.**



## VI. Predicting School Readiness Skills

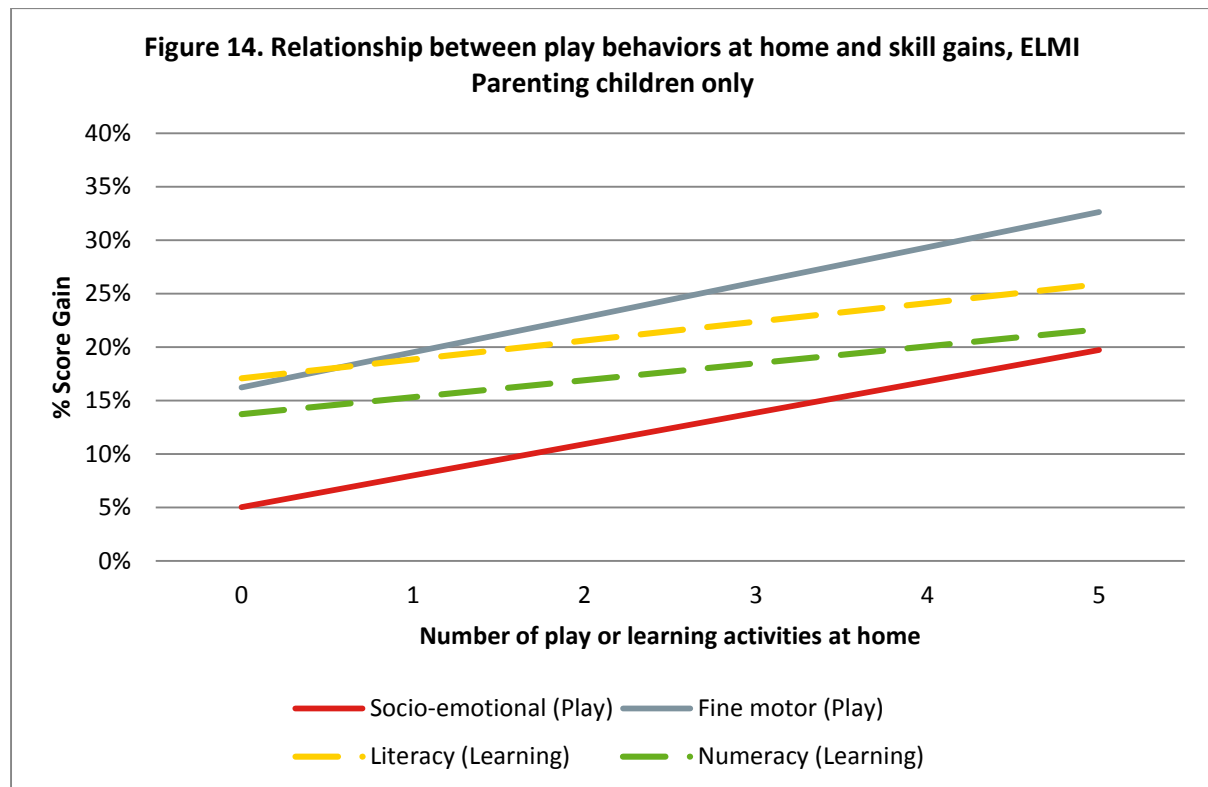
Multivariate regression analyses were used to investigate relationships between background characteristics as well as learning materials and activities at home with learning gains between baseline and midline in each area of school readiness: physical development (gross motor and fine motor skills), literacy, numeracy, socio-emotional development, approaches to learning, and health and hygiene knowledge.

Overall, several variables were found to be significantly related to gains in multiple school readiness domains for all children assessed at baseline and midline. These included a child’s age, and mother’s education. **Focusing on the two groups of interest, ELMI Center and ELMI Parenting, analyses find that age and variety of toys at home significantly and positively predict learning gains for 3 of the 6 learning outcomes in the ELMI Center group. Interestingly, the same pattern is not seen in the ELMI Parenting group for whom toys at home are not found to be significantly related to learning gains but for whom the family’s socio-economic status is positively related to learning gains for children across 3 of the 6 outcomes. In addition, multivariate analyses controlling for these background characteristics and baseline scores find that frequency of parents’ play behaviors with children at midline is positively related to gains in all areas of learning and development, except for gross motor skills, for children in the ELMI Parenting group but not for children in the ELMI Center group.**

That is, data show no significant relationship between parenting behaviors and learning gains for children in the ELMI Center group, but learning and playing behaviors are found to be significantly



related to learning gains in all areas other than gross motor skills for children in the ELMI Parenting group. Figure 14 displays the relationship between play and learning behaviors, respectively, and school readiness scores for the ELMI Parenting group only. Complete regression results for both groups are shown in Appendix A. The more activities parents engaged in at home, the higher their children’s school readiness skills across key developmental domains.



Note: Figure controls for baseline scores as well as relevant background characteristics.

One possible reason for the difference in trends between ELMI Center and ELMI Parenting children’s learning is that the number of students in the ELMI Center group at baseline and midline was quite small, which limits the statistical power and possibility of finding significant relationships between variables. In addition, the ELMI center group did not focus on changing parenting practices and thus fewer changes in parenting behaviors were seen for the ELMI Center group, which makes it less likely that they will appear as drivers of change in child learning. Finally, because the ELMI Parenting children are not receiving stimuli in ECCD centers, parent behaviors have more impact on their skill development. **Despite the sample issues for the ELMI Center group, the strong relationship between parenting behaviors and improved learning gains highlights the important role parents can take in their children’s preparation for school if they have adequate training and support.**

Finally, multivariate regressions controlling for baseline scores and background characteristics find that ELMI Centre children gained significantly more in gross motor, literacy and numeracy skills compared to children in ECCD control centers. Further, as suggested by the descriptive results displayed earlier there were no significant differences in the learning gains made by children in the ELMI Parenting and ECCD control group, except that children in the ELMI Parenting group made significantly stronger literacy gains than children in the ECCD control group. No trends of significant gender differences in learning gains were found for any group. Future programming and studies

should investigate whether the parenting program messages and activities are being adopted equally by all caregivers, regardless of socio-economic status.

## VII. Early Childhood Environment Rating Scale (ECERS)

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 maths focus of the programme. ECCD 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 considered by the team to be non-applicable to Rwanda and omitted.

Data was collected via centre observation and short interviews with ECCD caregivers from twenty<sup>7</sup> ELMI centres and four control ECCD centres. The data collection was carried out by ELMI advisors (VSO volunteers) in collaboration with ELMI officers.

Centres were assessed along 27 different indicators covering such areas as adequate lighting, availability of materials, daily schedule and access to a variety of activities. The 27 indicators are categorized into six domains in the table below, which presents both an overall mean score for all centres, and one for ELMI centres only.

**Table 22. Baseline and Midline ECERS scores, by sub-area**

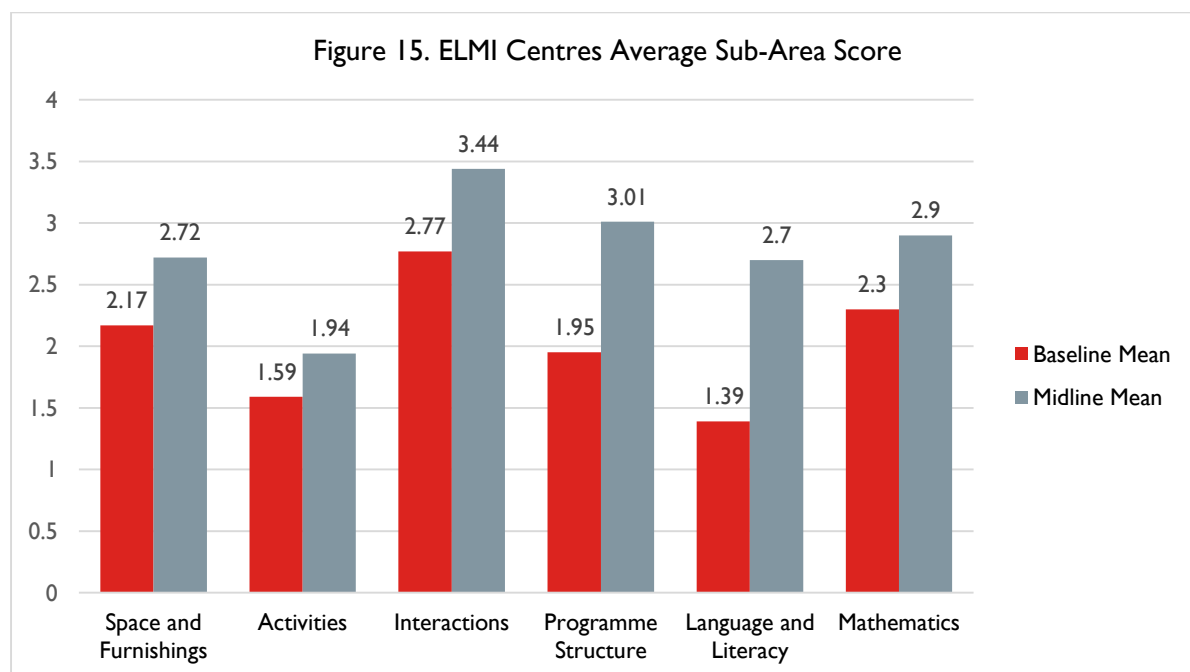
Sub-Area	Indicator	All Centres Baseline Mean	All Centres Midline Mean	ELMI Midline Mean
Space and Furnishings	Indoor space	1	2.2	2.4
	Furniture for routine, play and learning	<b>3.4</b>	2.8	<b>3.1</b>
	Room arrangement for play	1	2.7	<b>3.1</b>
Activities	Gross motor equipment	2.4	2.2	2.4
	Fine motor equipment	1.7	2.1	2.3
	Art materials	1.3	1	1
	Music and movement	2.2	2.5	2.7
	Blocks	1.4	2.8	<b>3.1</b>
	Sand/water	1	1.1	1.1
Interactions	Nature/Science/Health materials	1.7	1.5	1.6
	Discipline	2.1	<b>3.3</b>	<b>3.3</b>
	Caregiver-Child Interactions	<b>3.8</b>	<b>3.9</b>	<b>4.1</b>
Programme Structure	Interactions among Children	2.4	<b>3</b>	<b>3</b>
	Free Play	2.1	2.9	<b>3.3</b>
	Group Time	1.4	2.9	3
	Schedule	2	2.5	2.8

<sup>7</sup> Note that at baseline, twenty-one ELMI Centres were rated; one Centre was removed from the ELMI intervention following the 'take over' of the Centre by a church that did not want to take up ELMI methodologies.

Language and Literacy	Print Environment	1.6	2.3	2.6
	Book and Literacy Area	1	2.8	<b>3.2</b>
	Adult Reading with Children	1.2	2.6	2.9
	Sounds	1.2	2.8	2.8
	Emergent Writing/Mark Making	1	1.5	1.7
	Talking and Listening	2.6	<b>3</b>	<b>3</b>
Mathematics	Books and Pictures	1.1	2.8	<b>3</b>
	Math and Numbers	2	3.1	<b>3.5</b>
	Counting and Application of Counting	2.4	2.5	2.7
	Representing Simple Numbers	2.2	<b>3</b>	<b>3.3</b>
	Sorting, Matching and Comparing	2.3	2.4	2.9
<b>TOTAL ECERS</b>		<b>1.8</b>	<b>2.6</b>	<b>2.8</b>

Overall the 27 indicators had good internal reliability with an alpha of 0.94. Since the scale ranges from 1 (inadequate) to 5 (good), all domains still have potential for significant improvement. However, more scores (those in **bold red**), especially those in ELMI centres at midline, have reached a score of 3 or higher, which is considered minimal in terms of quality.

The mean midline rating of all 24 ECCD Centres on the ECERS was 2.6 (SD = 0.64) with a range of 1.6 to 3.8. The average is up .7 points from baseline, a gain of 14 percent. At baseline, the Program Interactions and Math Subscales received the highest ratings, and Program Interactions continues to rank highest, but Programme Structure has joined Math approaching 3 on average at midline, which is close to what is considered adequate in terms of quality. Language & Literacy and Activities subscales were lowest at baseline; while Language and Literacy has showed great improvement – the average jumping nearly a full point – the items in the Activities subscales remain a challenge and are considered of inadequate quality. The figure below provides the overall means for each sub scale in ELMI centres observed.



In Appendix B we also show the baseline and midline means for each item in the assessment. For some items related to materials, equipment and furniture, the midline average is lower than the

baseline. This is because the furniture and equipment was provided in 2012 through a previous project, and therefore was relatively new when the first ECERS was completed, while already worn out by midline (with no provision in the scope of this project to provide/augment furniture / equipment). Likewise, average scores for gross motor equipment decreased, which is not surprising since this was not a focus of the ELMI initiative and on these items, all ECCD centres are performing well below expected. Similarly, the decrease in average score on the Activities subscale is primarily due to items related to art as well as nature and science materials – items that the ELMI program did not purposefully address and, while important to ECD, were not as relevant to this particular intervention.

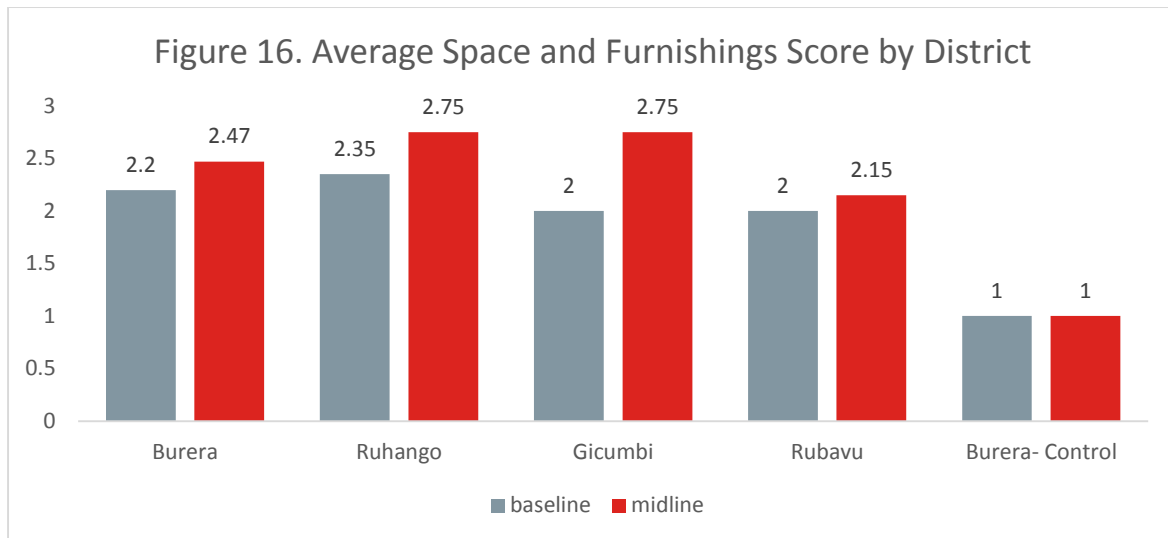
Great improvements are seen in the averages for all the language and literacy program elements, where ELMI clearly focused. Impressive strides in book and literacy areas, adults reading, books, pictures and resources, but there is still work to be done in emergent writing. While writing activities did take place in the program and caregivers were trained on including these in the daily schedule, caregivers did not annotate and write down children’s thoughts, which is an important aspect of that sub-scale. Interactions between students and teachers across most ECCD centres continue to be good and improve, as has discipline as teachers care about the children in their classrooms, treat them with respect and very rarely use harsh discipline. Program structure has seen important improvements as well in many centres, in fact it has made the greatest average gains in the table below.

**Table 23. ECERS gains from Baseline to Midline, by group**

Area	ELMI Mean Gain	Control Mean Gain
Space and furniture	.55	.13
Activities	.35	0
Interactions	.67	.33
Programme Structure	1.07	.25
Language and literacy	1.31	.19
Math	.57	.15
ECERS Total	.89	.23

### Space & Furnishings

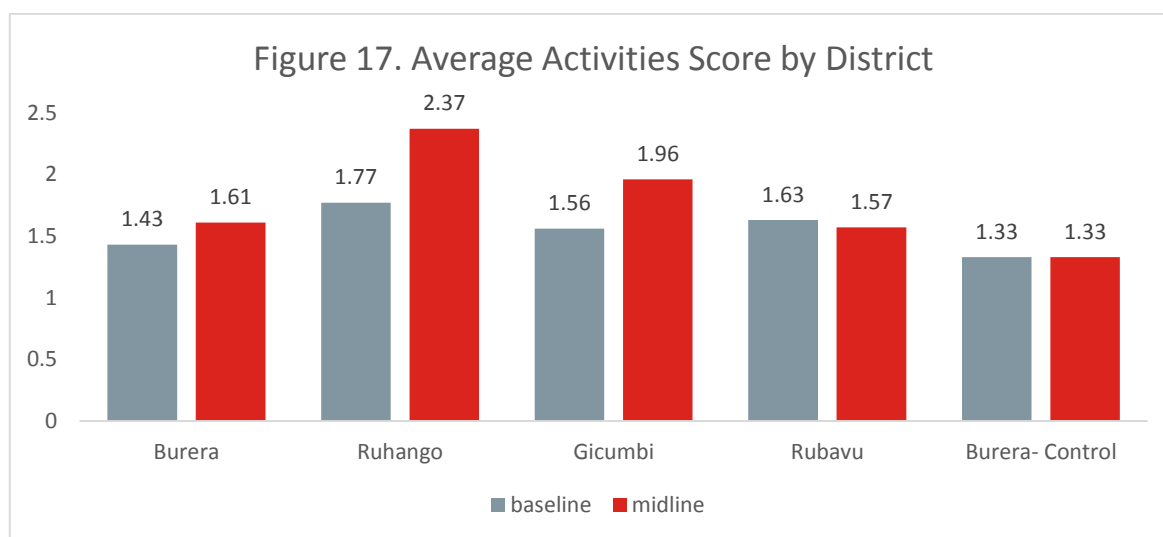
Within the space and furnishings sub-domain, ECCD Centres continued to do fairly well in providing children with furniture for play and learning; all four districts with ELMI ECCD Centres showing movement towards a score of 3 in the figure below.



However, control ECCD schools in Burera ranked significantly lower in this area with all indicators scoring one (inadequate) in this sub domain.

### Activities

All schools ranked very low in being able to provide students with materials for a variety of play and activities at baseline. No schools provided students with water/sand for play and few had art materials, blocks or instruments. By midline in the figure below, several districts have improved on average in this area, especially Ruhango.

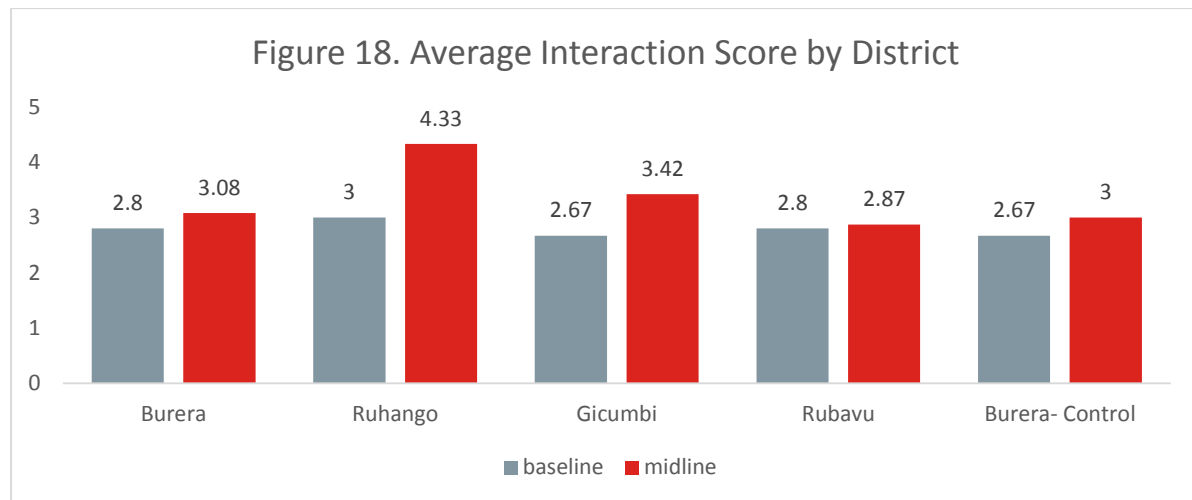


Again, the control ECCD centers scored the lowest of the districts and made no improvements to midline. Overall performance remains low on this sub-scale across all districts, warranting further attention. However, as far as this related to ELMI, the project did not focus on this area and impact was not anticipated in this sub-domain of quality.

### Interactions

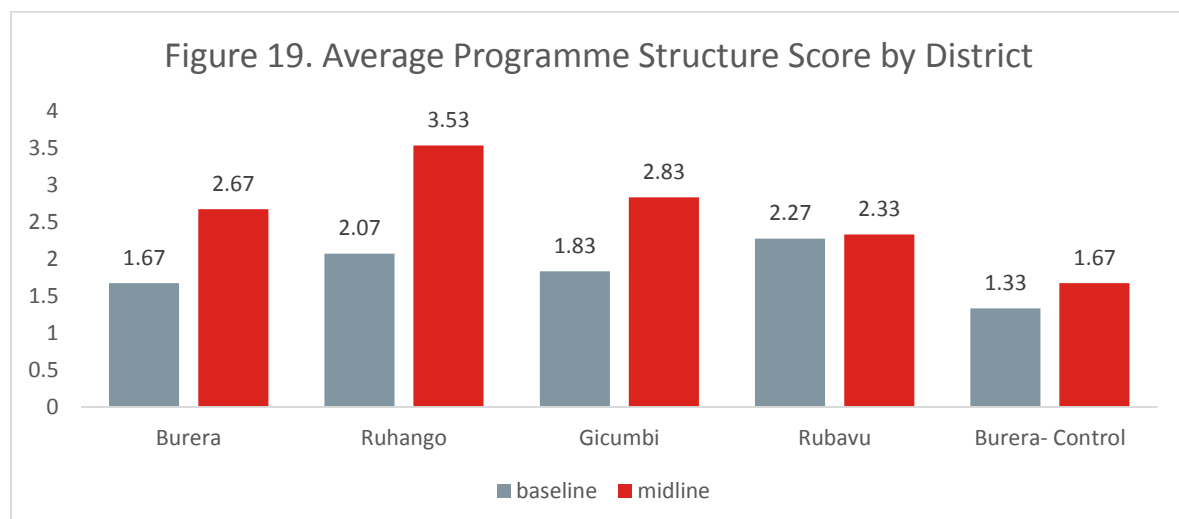
The Interactions sub-domain was the highest scoring overall at baseline. Students frequently had opportunities to interact positively with caregivers and other students at most schools with all centres receiving over a score of 2.5. Despite starting at a point of adequate quality, midline average

scores in all districts are even higher than baseline. The positive discipline item that had the lowest score (2.1) at baseline improved to 3.3 on average.



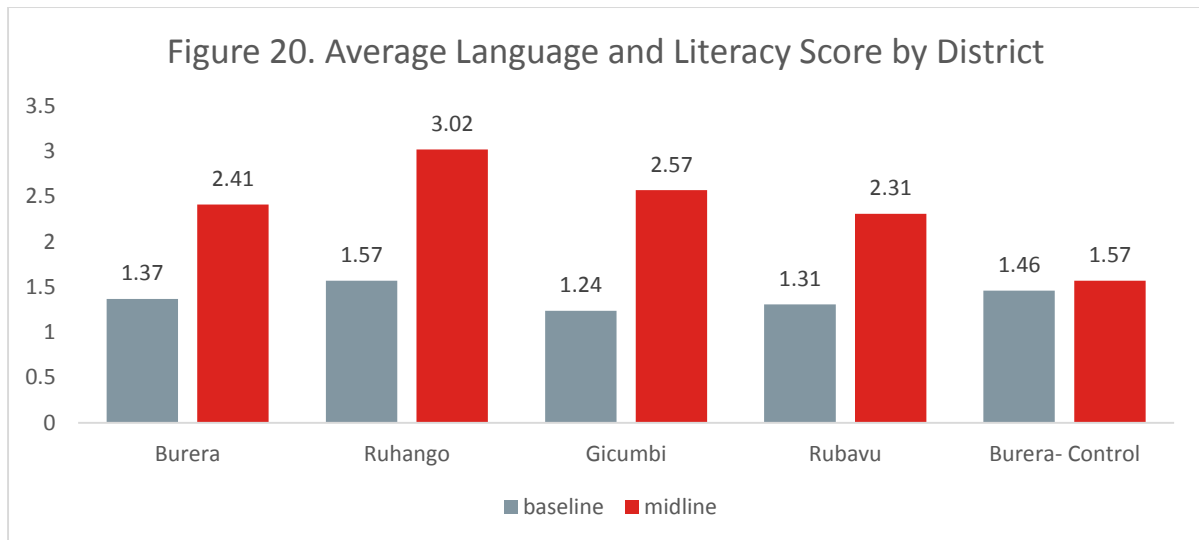
### Programme Structure

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. At baseline, 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 – by midline, the average score on this item is 2.9 – nearly adequate quality on this developmentally appropriate practice. Control schools continue to perform particularly low in this area.



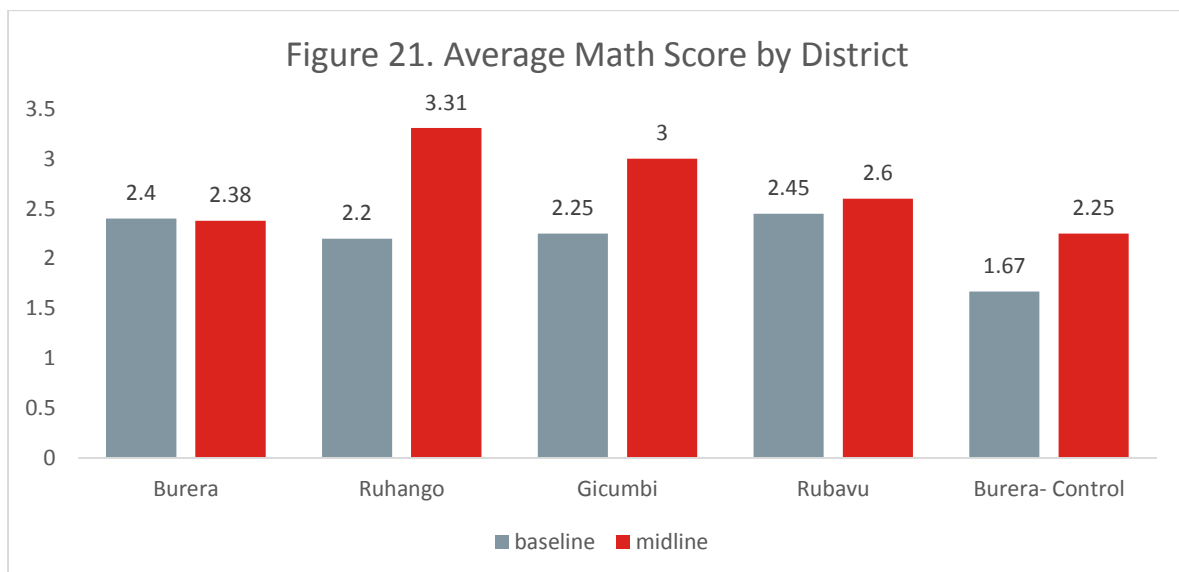
### Language & Literacy

Language and literacy scores were very low across all districts at baseline, but by midline students are getting more exposure to concepts of print, reading, letters, sounds, and books in ELMI centres. In Ruhango, adequate quality has been achieved on average and all other treatment district scores are up as expected given that ELMI is heavily focused on this area.



### Mathematics

At baseline, schools in each district did a fair job of providing students with objects for counting, sorting and learning numbers, and midline shows that two of four districts – Ruhango and Gicumbi – have achieved adequate quality on this sub-scale, while Burera ELMI centres have slightly regressed. As with the other areas, control ECCD centres performed worse on this measure at baseline, but achieved some improvement by midline as well.



Overall the ECERS midline assessment shows that in every district there have been improvements, and that there is still room to grow towards ensuring that all students have a safe, positive environment for learning and growth. Some districts, like Ruhango demonstrated higher gains across the board while other districts like Rubavu demonstrated relatively lower gains in relation to other districts. This isn't a surprising results due to the lack of continuous support provided (both in terms of no ELMI Advisor based there as well as a large gap in ELMI Officer support) vis-à-vis the other 3 districts. This is important to underscore in terms of sustainability since the coaching aspect, particularly that of the ELMI Advisors, is something much harder to sustain in the longer term.

We look now at how these ECERS scores relate to skills.



## Early Childhood Environment Rating Scale and Children’s Development

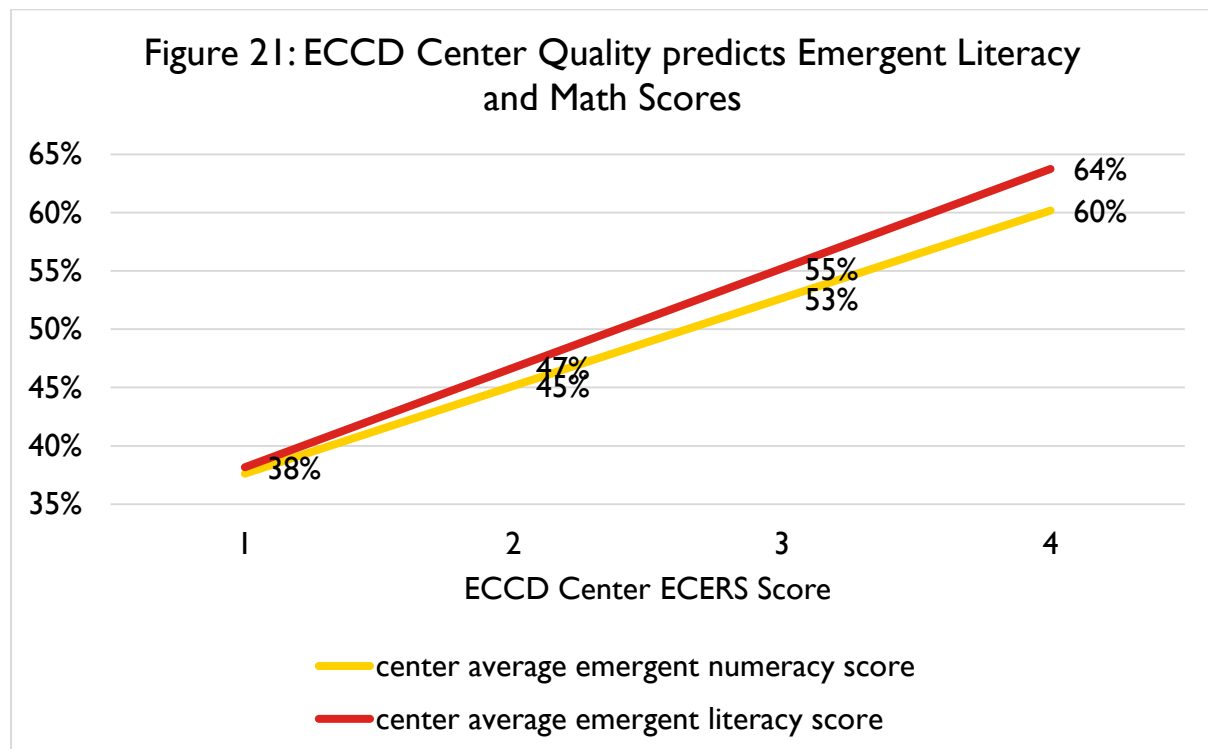
To investigate the relationship between quality and learning, we first correlate and then run regression models using the ECERS total to predict each midline domain score as well as the gain score in each domain. We find that centre quality, as measured using the ECERS, is significantly correlated with the average centre score of all assessed children on emergent numeracy, emergent literacy, as well as persistence. It is less consistently related to socio emotional skills scores and unrelated to motor scores and health knowledge.

**Table 24. Correlations between ECERS and Average Midline centre scores**

	Socio-emotional	Emergent Numeracy	Emergent Literacy	Persistence
Space and Furnishings		.43*		.50*
Activities		.45*	.61**	.60**
Interactions		.77***	.52*	
Programme Structure		.53*	.54**	.72***
Language and Literacy		.50*	.52*	.68**
Mathematics	.52*	.67**	.53*	.75***
ECERS Total		.68**	.55**	.69**

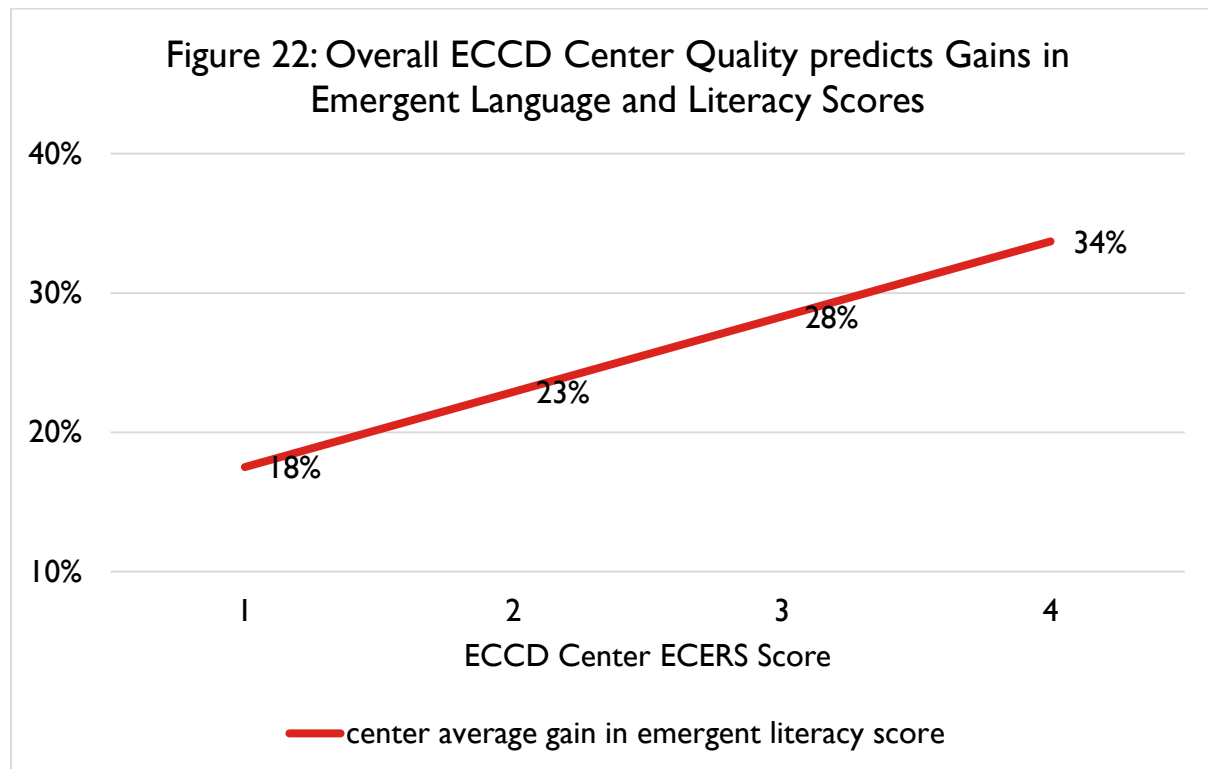
Note: \*p < .05, \*\*p < .01, \*\*\*p < .001

Modelling this relationship for numeracy and literacy (Figure 21), we see in the figure below that center ECERS scores significantly and positively predicts children’s midline average skills scores for emergent numeracy and literacy.



Higher average quality is significantly associated with higher centre averages in these skills. The same is true of the relationship between skill gains in literacy, numeracy and persistence as well, reinforcing the importance of attention to these six areas of ECCD centre quality for learning.

In addition to midline scores, we looked at the relationship between quality (ECERS scores) and children’s **gains** in literacy. In Figure 22 we see that the gains of ELMI children attending a lower quality ECD center over the course of the project are about 18%, but the gains of children attending a high quality ECD center are at 34%.



To put this in the context of children’s average gains reported in the first part of the report, we saw on **average** a 22% improvement of literacy scores for the ELMI center group but when we look closely at the gains of children as they relate to quality of the centers, we see that in high quality ELMI centers the gains are almost double (34% gains) and are much stronger than the 22% reported, on average. On the other hand low quality centers produced much more modest results for children. This finding has critical implications for scale up ECD nationally and for scale up of ELMI as it powerfully reinforces the link between quality and child outcomes.

## VIII. Conclusions

Reflecting on our proposed targets, midline results display that substantial progress has been made on all indicators for ELMI groups. Goals set at baseline were already realized for children in the ELMI Parenting groups for Emergent Literacy skills, as well as increases in learning-focused behaviors by parents.

Children in intervention groups display mastery of gross motor skills, and are approaching mastery of fine motor items. While strong progress is made in Emergent Literacy and Numeracy, average scores still hover around 50 percent correct at midline, shortly before children are expected to transition to primary school. These scores are lower than anticipated, on average, especially for the more intensive ELMI center intervention group, however clearly moderated by quality of the ECCD centers and children attending high quality ECD centers were on par with the projected gains. There are a number of reasons why that is the case that are worth noting here.

On one hand, what the findings suggest is that more work is needed to improve overall quality of ECCD centers and ensure conditions are in place for children to benefit from the stronger focus on ELM. This is especially true in the context of classrooms with over 50 children per teacher, which was the case for most of the ECD centers under ELMI. It is very hard to achieve desired results even with the most effective teacher training methodology if teacher to student ratio is as high. As such, at the start of the project teachers were struggling to employ ELM practices and reverted to whole class instruction only, which limited the impact of the ELM toolkit use during that first phase. These issues were partially overcome by ELMI staff working with parent committees to try and limit class sizes, which included a decision by the project to pay caregiver incentives to enable parent committees to rely less on having larger numbers of parent contributing to support running costs. Additionally, ELMI staff provided significant mentorship support to caregivers to help them learn how to manage large class sizes through the establishment of learning corners and modeling other interactive techniques.

Secondly, ELMI activities were slightly behind schedule and the training, supplementary materials and mentoring support only took full effect in the second year of ELMI<sup>8</sup>. Impact could be stronger in the future if children benefit from more than a year of ELM experiences, which is something worth considering in future programming. In addition to the late start up, the program faced challenges with ensuring consistent quality across the four districts. Rubavu specifically struggled because of a significant gap in technical oversight there for much of the first year; this is reflected in the ECERS scores in this particular district.

Finally, daily attendance of children in the program was not consistent over the course of the year, which also curtails the impact observed on children. While we did not analyze attendance rates as they relate to outcomes in this study, in other studies globally the trend is quite strong and exposure/attendance has a direct effect on children's learning.

Despite these challenges during the implementation of the ELMI, it is encouraging that we see some of the largest gains in the areas of literacy and math among the ELMI children, and especially high gains among the children who attended high quality ECCD centers. Challenging skills such as phonological awareness and problem solving require further attention and support for teachers, but many of the foundational skills addressed by the ELMI toolkit are progressing well, as demonstrated in the following table showing progress against the project indicators:

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<sup>8</sup> This is particularly the case considering that the first training of Caregivers took place in August 2013, following the lengthy baseline and subsequent staff training process, and the school year finished in October.

Indicators	Baseline Scores (% Correct)	Targets	Midline Scores <sup>9</sup> (% Correct)
ECD children's scores in school readiness assessment (disaggregated by gender and foundational skills domains).	<ul style="list-style-type: none"> <li>Gross motor: 86%</li> <li>Fine motor: 53%</li> <li>Literacy: 28%</li> <li>Numeracy: 33%</li> <li>Socio-emotional: 37%</li> <li>Health: 50%</li> <li>Overall SRA: 48%</li> </ul>	35% increase on baseline. <sup>10</sup>	<ul style="list-style-type: none"> <li>Gross motor: 96%</li> <li>Fine motor: 71%</li> <li>Literacy: 56%</li> <li>Numeracy: 51%</li> <li>Socio-emotional: 50%</li> <li>Health: 63%</li> <li>Overall SRA: 64%</li> </ul>
Non-ECD children's scores in school readiness assessment, whose parents are being trained by the ELM initiative (disaggregated by gender and foundational skills domains).	<ul style="list-style-type: none"> <li>Gross motor: 84%</li> <li>Fine motor: 40%</li> <li>Literacy: 22%</li> <li>Numeracy: 27%</li> <li>Socio-emotional: 32%</li> <li>Health: 46%</li> <li>Overall SRA: 42%</li> </ul>	20% increase on baseline.	<ul style="list-style-type: none"> <li>Gross motor: 93%</li> <li>Fine motor: 61%</li> <li>Literacy: 44%</li> <li>Numeracy: 44%</li> <li>Socio-emotional: 42%</li> <li>Health: 59%</li> <li>Overall SRA: 57%</li> </ul>
Parents/caregivers' scores in home environment assessment (disaggregated by gender).	<ul style="list-style-type: none"> <li>Learning activities: 9%</li> <li>Play-based activities: 36%</li> </ul>	20% increase on baseline.	<ul style="list-style-type: none"> <li>Learning activities: 34%</li> <li>Play-based activities: 50%</li> </ul>
ECD teachers' scores in classroom environment assessment (disaggregated by gender).	<ul style="list-style-type: none"> <li>Literacy environment (ECERS): 28%</li> <li>Math environment (ECERS): 46%</li> </ul>	25% increase on baseline.	<ul style="list-style-type: none"> <li>Literacy environment (ECERS): 54%</li> <li>Math environment (ECERS): 59%</li> </ul>
Evidence of inclusion of ELM in GoR's revised ECD curriculum	To be reviewed upon release of revised pre-primary curriculum (expected in 2015).	ECD curriculum includes ELM.	N/A

In addition to highlighting the progress of ELMI against targets, the midline results also revealed the following salient findings:

**The scores of children in ELMI Parenting and ECCD Control centres are comparable from baseline to midline.** On average the gains made by children in the parenting group were notable and on par with the gains of the children in the non-ELMI ECCD centers, and in some instances comparable to

<sup>9</sup> Note that no significant differences based on gender were found for any group and foundational skill domain; as such, these have not been specifically indicated as disaggregated figures.

<sup>10</sup> It should be noted that the general target of 35% growth from baseline to endline for children's school readiness scores is not applicable for gross motor skills as on average children scored 86% correct on these items at baseline.

the gains of the ELMI ECCD group. When looking at the sub set of ELMI Parenting group participants who reported engaging in four or more positive activities with the child, results demonstrate that the ELMI ECCD group and this subset of ELMI parenting children make comparable gains over the course of the year. Taking into consideration the low cost and lower intensity of the ELMI parenting program, this is a very exciting finding as the program can be scaled up much more easily. **This emphasized that a high quality parenting education programme can serve as an effective alternative to more costly centre-based approaches to ECCD.**

**Additionally, the amount of play activities at home at midline has the most consistent relationship with skill growth across groups.** The study demonstrated that while the ELMI parenting group started with lowest rates of parent engagement at baseline, they improved the most in terms of learning and play activities at home, outscoring all other groups at midline. It seems that ELMI parenting families embraced the idea of play and learning at home and took their role seriously, which in turn paid off when we look at the child outcomes in this intervention group. **This demonstrates the importance of home environments and family engagement as a powerful driver of child achievement.**

**Similarly, children's gains in literacy and math skills are directly correlated to the quality of teaching and learning environments in Centres and homes.** Improvements in children's learning environments are apparent in homes for the ELMI Parenting group and also ECCD classrooms for the ELMI Centre group. For children in the ELMI Parenting group, gains in parent-child interactions at home are notable between baseline and midline. In addition, the quality of ELMI ECCD Centres is also found to be improving over time. **Importantly, this study finds that parents' interactions with their children at home and quality of children's classroom environments are both positively related with children's early learning gains, further highlighting the need to support quality learning environments wherever they are.**

What is also interesting is the comparison between the grade 1 sample in this study (who had very limited ELM exposure but substantial grade 1 instruction) and the ELMI center group. This study showed that **ELMI ECCD children come quite close in knowledge and skills on math and literacy vis-a-vis their grade 1 counterparts.** With some exceptions, such as in the areas of letter and number knowledge, grade one students still scored quite low on the school readiness math and literacy domains of the assessment, posing some critical questions about the quality of learning that has been taking place in first grade. At the end of grade 1, students knew on average 5 letters, compared to 2 letters in the ELMI ECCD group. In terms of math, the ELMI scores were even closer to the scores of their grade 1 counterparts. It will be very interesting at endline to compare grade 1 competencies of ELMI graduates with the findings of this grade 1 cohort at midline.

**Another notable result of this study is the lessons learned about children transitioning to primary school earlier than intended.** Interestingly, children in ELMI ECCD Centres were the most likely to transition to primary school early and children in the ELMI Parenting group were the least likely. Future studies could investigate retention in ECCD and whether different types of programs can help reduce the rate of children's early enrollment into primary school. In addition, further research could also investigate the longer-term impact of ECCD participation on primary school learning, as well as the costs associated with different types of programs and the relationship with learning gains.

In conclusion, children in three different types of early childhood care and development programs are found to be gaining more skills in a variety of learning and development areas than children who are not attending any type of early learning program. In general, children in the ELMI Centre group tend to come from relatively more advantaged families and maintain stronger early learning skills than children in other groups from baseline to midline. The differences in baseline skills and family backgrounds make it difficult to directly compare the ELMI Centre group with the ELMI Parenting and ECCD control groups. However, **children in the ELMI Parenting and ECCD control groups have more similar profiles and also make comparable learning gains from baseline to midline. This suggests that high quality parenting programs can be used effectively by relatively lower income families, and can help children who do not have access to ECCD centers become as prepared for entry to primary school as children who do have access to an ECCD center. Finally, this study clearly demonstrates that quality of preschool classrooms is tightly linked to the gains children make in learning and development. Future expansion of preschool initiatives in Rwanda should pay close attention to issues of quality and invest in high quality environments to ensure the best results for children.**

## Appendix A.

Table A1. Internal consistency of school readiness assessment at midline

	Internal consistency	Rating*
Motor Development	0.79	Acceptable
Emergent Literacy	0.90	Good
Emergent Numeracy	0.88	Good
Socio-emotional development	0.80	Good
Overall SRA	0.95	Excellent

\*Ratings are based on George and Mallery (2003), stating that internal consistency > .9 is Excellent, > .8 is Good, > .7 is Acceptable, > .6 is Questionable, > .5 is Poor, and < .5 is Unacceptable (p. 231).

Table A2. Predicting early enrollment in primary school

VARIABLES	(1) Primary enrollment	(2) Primary enrollment	(3) Primary enrollment	(4) Primary enrollment	(5) Primary enrollment	(6) Primary enrollment	(7) Primary enrollment
Age	0.858*** (0.192)	0.846*** (0.199)	0.895*** (0.193)	0.868*** (0.200)	0.894*** (0.195)	0.830*** (0.201)	0.821*** (0.209)
Sex	-0.0961 (0.183)	-0.121 (0.188)	-0.105 (0.186)	-0.128 (0.189)	-0.0984 (0.185)	-0.179 (0.191)	-0.112 (0.195)
SES home	0.185*** (0.0497)	0.214*** (0.0508)	0.218*** (0.0499)	0.238*** (0.0509)	0.199*** (0.0486)	0.170*** (0.0497)	0.168** (0.0510)
1.ELMI	Reference	Reference	Reference	Reference	Reference	Reference	Reference
2. Parenting	-1.491*** (0.252)	-1.470*** (0.261)	-1.694*** (0.272)	-1.632*** (0.268)	-1.588*** (0.255)	-1.381*** (0.260)	-1.410*** (0.264)
3. ECCD control	-1.001*** (0.290)	-1.141*** (0.305)	-1.228*** (0.308)	-1.221*** (0.304)	-1.121*** (0.295)	-0.918** (0.301)	-0.941** (0.311)
4. Non-ECCD control	-0.376 (0.252)	-0.314 (0.255)	-0.524* (0.261)	-0.373 (0.257)	-0.447 (0.252)	-0.368 (0.259)	-0.378 (0.264)
# types of reading materials	0.00832 (0.0761)						
# types of toys		-0.0894 (0.0710)					
Learning activities			-0.130* (0.0633)				
Play activities				-0.241*** (0.0693)			
Aggressive activities					-0.0754 (0.0817)		
Emergent literacy						2.642** (0.856)	
Total school readiness							2.203* (0.879)
Constant	-4.699*** (0.979)	-4.549*** (1.068)	-4.713*** (0.991)	-4.428*** (1.046)	-4.742*** (1.006)	-5.165*** (1.011)	-5.439*** (1.054)
Observations	596	571	584	582	593	577	540
r <sup>2</sup> _a	.	.	.	.	.	.	.

Robust standard errors in parentheses

\*\*\* p&lt;0.001, \*\* p&lt;0.01, \* p&lt;0.05



Table A3: Prediction of School Readiness Skill Gains by midline characteristics, ELMI Center only

VARIABLES	(1) Socio-emotional Change	(2) Gross Motor Change	(3) Fine Motor Change	(4) Emergent Literacy Change	(5) Emergent Numeracy Change	(6) Health & Hygiene Change	(7) Total School Readiness Change
Learning activities	0.0132 (0.00986)	0.00778 (0.00548)	0.00154 (0.0105)	0.00433 (0.00593)	-0.00317 (0.0138)	-0.0165 (0.0153)	0.00485 (0.00761)
Play activities	-0.0173 (0.0194)	-0.00543 (0.0116)	-0.00437 (0.0184)	0.00882 (0.00803)	-0.00749 (0.0176)	0.0311 (0.0271)	-0.00963 (0.0152)
Age (years)	0.150*** (0.0378)	0.000815 (0.0143)	0.199*** (0.0409)	0.0508* (0.0227)	0.0459 (0.0421)	0.0636 (0.0729)	0.0886*** (0.0239)
# types of reading materials	-0.0260 (0.0140)	0.00663 (0.00518)	0.00796 (0.0173)	-0.00121 (0.00877)	0.00311 (0.0216)	-0.00353 (0.0208)	-0.00663 (0.00902)
# types of toys	0.0535** (0.0184)	-0.0163 (0.00831)	0.0574** (0.0195)	0.0171 (0.0112)	0.0240 (0.0181)	0.0364 (0.0251)	0.0422** (0.0138)
Sex (Female=1)	0.00337 (0.0370)	0.0116 (0.0181)	-0.00892 (0.0433)	-0.0178 (0.0241)	0.0409 (0.0525)	-0.00169 (0.0576)	-0.0185 (0.0305)
Mother education	-0.0407 (0.0232)	-0.0117 (0.00822)	-0.0409 (0.0276)	0.0412*** (0.0107)	-0.00238 (0.0235)	0.0254 (0.0314)	-0.0172 (0.0132)
SES Home	-0.00528 (0.0126)	0.00767 (0.00691)	0.0101 (0.0127)	-0.00441 (0.00761)	-0.000441 (0.0120)	0.00777 (0.0150)	0.00323 (0.0102)
Socio-emotional Baseline (%)	-0.688*** (0.134)						
Gross Motor Baseline (%)		-1.003*** (0.0520)					
Fine Motor Baseline (%)			-0.680*** (0.103)				
Emergent Literacy Baseline (%)				-0.330** (0.105)			
Emergent Numeracy Baseline (%)					-0.440 (0.264)		
Health & Hygiene Baseline (%)						-0.517** (0.176)	
School Readiness Baseline (%)							-0.482*** (0.117)
Constant	-0.514* (0.228)	0.975*** (0.0957)	-0.741** (0.225)	-0.0654 (0.145)	0.0318 (0.242)	-0.157 (0.435)	-0.196 (0.138)
Observations	41	42	42	137	42	43	37
R-squared	0.698	0.914	0.671	0.202	0.154	0.402	0.552
Adjusted R-squared	0.610	0.890	0.579	0.145	-0.0838	0.239	0.403

Robust standard errors in parentheses

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

Table A4: Prediction of School Readiness Skill Gains by midline characteristics, ELMI Parenting only

VARIABLES	(1) Socio- emotional Change	(2) Gross Motor Change	(3) Fine Motor Change	(4) Emergent Literacy Change	(5) Emergent Numeracy Change	(6) Health & Hygiene Change	(7) Total School Readiness Change
Learning activities	0.00982 (0.00725)	0.00783 (0.00494)	0.00652 (0.00953)	0.0176* (0.00686)	0.0159** (0.00573)	0.0113 (0.00760)	0.0116* (0.00550)
Play activities	0.0294** (0.00970)	-0.00881 (0.00668)	0.0328* (0.0134)	0.0147 (0.00821)	0.0135 (0.00816)	0.0452*** (0.0112)	0.0199* (0.00813)
Age (years)	-0.00452 (0.0261)	0.0168 (0.0136)	-0.000126 (0.0256)	0.0231 (0.0196)	0.0101 (0.0177)	-0.0212 (0.0265)	0.000685 (0.0182)
# types of reading materials	0.00544 (0.0128)	-0.0107 (0.00666)	0.00418 (0.0140)	-0.0102 (0.00799)	-0.00794 (0.00793)	-0.00492 (0.0129)	-0.00164 (0.00807)
# types of toys	-0.00369 (0.0137)	0.000413 (0.00741)	-0.0102 (0.0182)	-0.00756 (0.0108)	-0.0148 (0.0106)	-0.00284 (0.0152)	-0.00386 (0.0104)
Sex (Female=1)	-0.00777 (0.0265)	0.0217 (0.0167)	-0.0454 (0.0347)	-0.0201 (0.0222)	-0.0288 (0.0206)	0.0184 (0.0292)	-0.0108 (0.0189)
Mother education	0.0309* (0.0149)	0.00395 (0.00831)	0.0107 (0.0194)	0.0194 (0.0120)	0.0299** (0.0109)	0.0380* (0.0161)	0.0226* (0.0105)
SES Home	0.00451 (0.00803)	0.000601 (0.00462)	0.0234* (0.0101)	0.0162* (0.00639)	0.0121* (0.00566)	0.00815 (0.00810)	0.00759 (0.00590)
Socio-emotional Baseline (%)	-0.530*** (0.0812)						
Gross Motor Baseline (%)		-0.905*** (0.0417)					
Fine Motor Baseline (%)			-0.436*** (0.113)				
Emergent Literacy Baseline (%)				-0.204 (0.119)			
Emergent Numeracy Baseline (%)					-0.413*** (0.115)		
Health & Hygiene Baseline (%)						-0.721*** (0.0681)	
School Readiness Baseline (%)							-0.450*** (0.0874)
Constant	0.163 (0.166)	0.749*** (0.0907)	0.249 (0.165)	0.00113 (0.124)	0.144 (0.115)	0.391* (0.155)	0.228* (0.112)
Observations	146	153	148	188	148	153	131
R-squared	0.291	0.800	0.219	0.176	0.256	0.482	0.309
Adjusted R-squared	0.244	0.787	0.168	0.134	0.207	0.450	0.258

Robust standard errors in parentheses

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

Appendix B. Average ECERS Score for Each Indicator, ELMI only  
(baseline in light, midline in darker shade of same colour)

