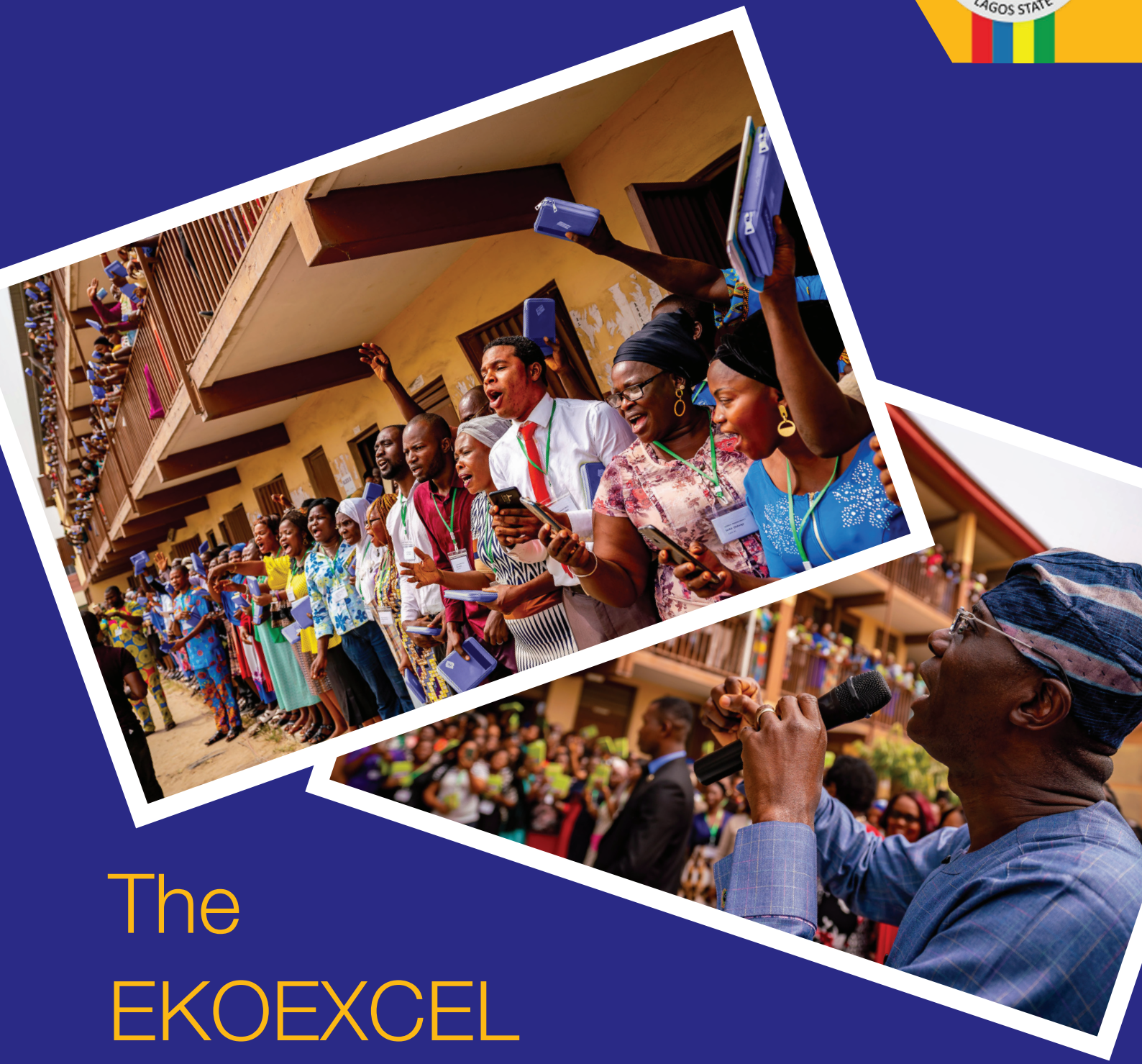
EKO EXCEL
EXCELLENCE IN CHILD EDUCATION AND LEARNING

UNIVERSAL BASIC EDUCATION BOARD
LAGOS STATE



The EKOEXCEL Effect

Improving Learning Outcomes in Lagos State

Midline Results from Controlled Study of Learning Outcomes

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Executive Summary

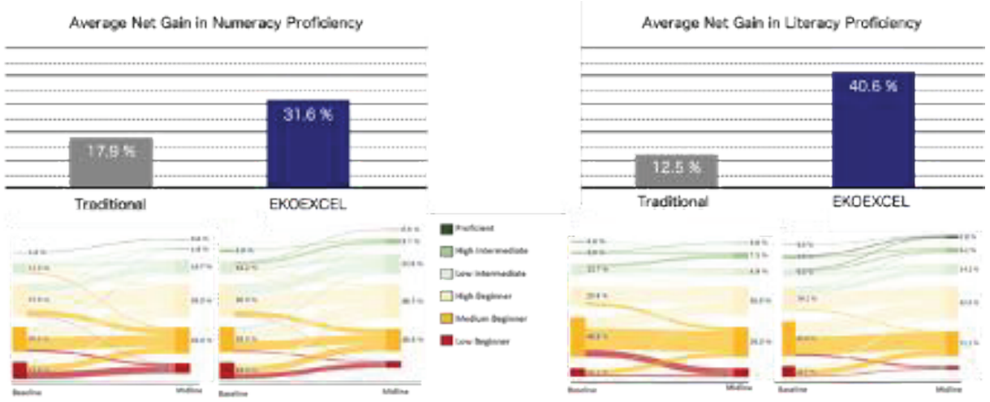
The first 7 weeks of EKOEXCEL has shown accelerated student achievement gains, better classroom culture, and stronger curriculum management. The evidence comes from the mid-line report for a controlled study of learning outcomes in EKOEXCEL. The study's baseline report established equivalence between 30 EKOEXCEL schools and a matched set of 30 comparison schools for several characteristics associated with academic performance.

Student Achievement Gains

EKOEXCEL has dramatically accelerated student literacy and numeracy performance in its first seven weeks. Test data in a controlled study, collected by invigilators from The Education Partnership in partnership with LASG SUBEB, show statistically significant differences between student performance in EKOEXCEL schools versus their peers in traditional schools.

In just 7 weeks, the average student in EKOEXCEL advanced in numeracy twice as fast as students in traditional schools. In Literacy, the contrast was even greater, with EKOEXCEL students progressing 3x as fast as their peers in comparable schools.

Figure 1. Progression in Literacy and Numeracy Proficiency from end of Term 2 to midline of Term 3



Classroom Culture

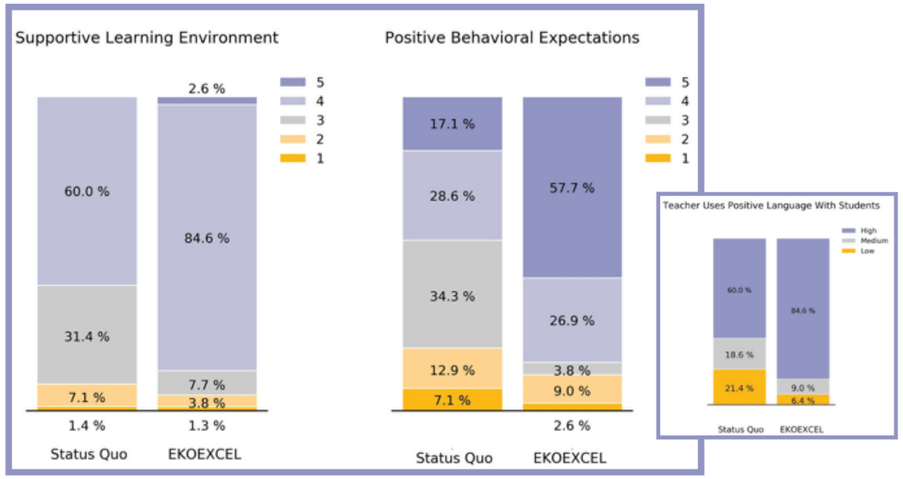
Invigilators from The Education Partnership (TEP) observed more supportive learning environments and more positive behavioral expectations in EKOEXCEL schools compared to typical schools after just seven weeks of the SUBEB-sponsored program.

EKOEXCEL classrooms were 85% more likely to set positive behaviour expectations (a score of 4 or 5 on the rubric) and 45% more likely to have a supportive learning environment (a socre of 4 or 5 on the rubric).

In addition, EKOEXCEL girls were 8% more likely to attend school than girls in status quo classrooms. Attendance for boys across program and status quo schools was similarly strong at 92% and 93%, respectively.

The vast majority of EKOEXCEL classrooms were rated high or very high on two critical determinants of classroom culture: Supportive Learning Environment and Positive Behavioral Expectations. When compared to EKOEXCEL classrooms, observers rated three times as many status quo classrooms to be neutral or worse on these key drivers of student learning. Researchers examined several related behaviors to explain these differences. For example, observers noted more instances of positive language use with students among EKOEXCEL teachers.

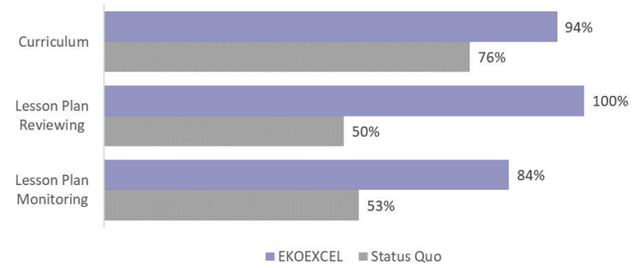
Figure 2. EKOEXCEL and Status Quo Schools Differ on Two Dimensions of Classroom Culture



Curriculum Management by Head Teachers

TEP invigilators interviewed head teachers to understand their expectations for curriculum and teacher lesson plans, and to inquire about the review and monitoring processes put in place to ensure lesson quality. For these dimensions, we do find a clear difference between EKOEXCEL and comparison schools. EKOEXCEL head teachers were confident about EKOEXCEL's lesson plans maintaining curriculum adherence and quality. Similarly, EKOEXCEL head teachers accessed lesson plans through their tablet to ensure that the lessons are delivered according to plan.

Figure 3. Improved Review & Monitoring Processes Around Curriculum



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I. Introduction

Embarking on EKOEXCEL

The Lagos State Universal Basic Education Board (or SUBEB) formally launched the Excellence in Child Education and Learning (EKOEXCEL) initiative on January 25th, 2020. EKOEXCEL aims to develop a highly skilled, supported, and motivated teacher workforce that succeeds in their classrooms using modern technology. The urgent need to build capacity for Kindergarten through Primary 6 teachers at 1,000+ schools prompted the launch of EKOEXCEL. The program launch took place during Term 2 (January – April) of the 2019-2020 school year for ECCDE to Primary 5 pupils. The programme will increase to all Lagos State government schools primary schools in September, and extend to include Primary 6.

Learning Quickly to Understand What is Working

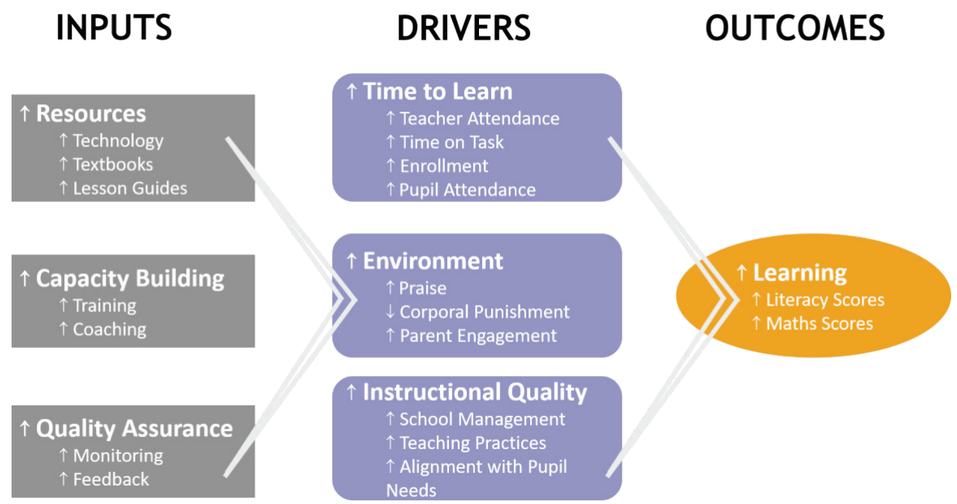
The EKOEXCEL year 1 efficacy study aims to examine the early impact of the program on both learning outcomes and the drivers of pupil learning. During the program's launch, we measured student performance at the beginning of Term 2 (the baseline), at the end of Term 2 (the midline), and have plans to measure again for an endline. We are conducting measurements at a representative sample of EKOEXCEL classrooms, and also a sample of classrooms that have not yet adopted EKOEXCEL; this approach allows us to estimate the benefit of the EKOEXCEL program. This report summarizes findings as of the end of Term 2.

As the baseline report revealed near equivalency between the treatment and the control group, the midline report provides an early signal for learning gains attributable to the EKOEXCEL program. Particularly, we examine differences in classroom behavior and performance on a wide range of foundational skills in math and English.

The EKOEXCEL initiative is a whole-system reform with many integrated components. Implementing large-scale system changes within a few short months calls for a comprehensive understanding of which components are working, to what extent, and how. Furthermore, it is critical for learnings from the pilot to occur quickly to inform implementation of future phases.

The theory of change underlying EKOEXCEL is summarized in Figure 4 below. EKOEXCEL directly provides resources, capacity building, and quality assurance processes. Combined with existing talent at schools, these inputs will increase learning time, improve the learning environment, and raise instructional quality - all drivers of pupil learning. Together, these drivers expand pupils' opportunity to learn, and through consistent and persistent efforts, will result in learning gains and ultimately achievement of global grade-level standards.

Figure 4. Inputs, Drivers, and Outcomes of the EKOEXCEL Program



This theory is testable through two broad research questions:

1. *Drivers*: Did EKOEXCEL increase the amount of time for pupils to learn, create a more positive and safe learning environment, and raise instructional quality?
2. *Outcomes*: Did EKOEXCEL's improvement across drivers translate into learning gains in English literacy and maths?

To test the research question on drivers, we use multiple survey tools that capture school management and teacher practices, awareness of school operations, and behaviors in the classroom. To measure how much these drivers are actually playing out in the classroom, we use the World Bank's classroom observation instrument, *Teach*, which has a specific rubric to rate observed classroom experiences on many criteria, including three categories of criteria that line up closely with the classroom components within each of the three EKOEXCEL drivers.

For data on the broader operations and management of the school, we use a 20-question in-person school management survey, adapted from the Development - World Mangement Survey, conducted with the head teacher at each school. Question responses are noted and coded on a rubric to capture the head teacher's descriptions of various school operations. Although these results rely on self report, they give insights into the extent to which important school inputs are available to the head teachers, and the extent to which they are using the inputs to facilitate the drivers of student learning. It is important to note that neither the school management survey nor the *Teach* instrument matches perfectly with all the driver components in the EKOEXCEL theory of change, but they align closely in many aspects and provide important measurable signals.

To address the second research question on student learning gain outcomes, we use the Early Grade Reading Assessment (EGRA) and Early Grade Maths Assessment (EGMA) to measure performance across literacy and math.

We conduct these measures of the drivers and student outcomes in order to test the EKOEXCEL theory of change, track progress, and make evidence-based adjustments to the EKOEXCEL program. Measuring both drivers and outcomes is important. Typically, studies are powered to detect a minimum 0.2 standard deviation difference[1] for an intervention lasting at least one year;, and the period between baseline and midline lasted only seven weeks. We knew, given such a brief period, it would be difficult to detect learning impacts. However, we thought it valuable to assess to what extent the program was implemented with fidelity and whether the strength of the implementation created the conditions that EKOEXCEL believes will lead to better pupil learning. Additionally, by testing English literacy and math skills now, we establish a baseline to benchmark future learning gains.

II. Sample

Identifying the Best Sample Amidst Assessment Disruption

Our intended sample included nearly 2900 pupils roughly split between 30 schools participating in EKOEXCEL (treatment) and 30 schools not yet participating in EKOEXCEL (control). In the midst of our midline data collection, all Lagos schools were shut down due to the COVID-19 pandemic. At the time of the school closures, we had collected about 40% of the data for our midline report. For one group, Primary 2 girls, we were fortunate to have collected data from roughly 80% of the pupils at nearly all schools. This allowed us to estimate the EKOEXCEL effects for this group with reasonable precision. Thus, we present results from Primary 2 girls first.

Our initial design assessed 20 pupils from Kindergarten, Primary 2, and Primary 5 at 60 schools (30 treatment and 30 control matched pairs) across 20 Local Government Education Authorities (LGEAs) in Lagos.[2] Due to pupil enrollment numbers, some schools had less than 20 pupils assessed in certain grades; in total, we assessed 1,497 and 1,382 pupils at treatment and control schools respectively. The baseline report found no systematic differences in pupil performance at the baseline.

During the midline report, we attempted to reassess all pupils measured at baseline; a team of independent enumerators (The Education Partnership) completed assessments for 13 matched school pairs assessed at the baseline (571 pupils in treatment and 527 in control) and assessed Primary 2 girl pupils at 26 matched pairs (212 and 168 pupils in treatment and control schools respectively) before the study was interrupted by school closures due to the COVID-19 pandemic.[3] The Primary 2 girl sample provides the widest coverage of performance and is therefore the most statistically powered to measure impact. Hence, we present results for Primary 2 girls first. We also show full results from the 13 matched pairs where we completed assessments for both genders across all grades. Due to the smaller sample size and thus low likelihood of statistical significance for

[1] This is equivalent to roughly an additional four words per minute on a passage fluency task for a Primary 2 pupil.

[2] Matched pairs were identified as schools that looked similar to EKOEXCEL schools across a set of key characteristics including pupil enrollment, staff size, infrastructure, and location. Please see the baseline report found at https://tinyurl.com/y7fxz2e8 for more details on the sample and sample balance at the baseline.

[3] The midline report attempted to measure the performance of the same pupils using a one-on-one pupil assessment during the 9th and 10th week of EKOEXCEL's inception (March 16th through 27th). Due to school closure disruptions resulting from the COVID-19 global pandemic, school visits were only conducted during the 9th week. All Lagos public schools were closed by order of the Lagos state government beginning March 23rd. With the news of the closure occurring two days before the end of the 9th week, we had time to adjust the last day of data collection to maximize the total number of schools visited, with a focus on Primary 2 (the middle grade in our sample). Due to a sorting issue, our largest sample of 26 matched pairs solely has data for girls in Primary 2.

these results, we focus less on inference and more on the direction and magnitude of effects. Assessed pupil counts by grade for both the Primary 2 girls sample and the smaller fully-assessed sample can be seen in Table 1 in the Appendix.

Similar to the one-on-one assessment, disruptions to the schedule resulted in a reduction in classrooms observed. We were able to assess a total of 36 schools. Of these, we assessed 16 matched pairs (see Table 2 in the Appendix). Our analysis will focus on the restricted sample of 32 schools.

III. Drivers of Learning

First, we look at the three drivers of learning in the EKOEXCEL theory of change - time spent learning, the classroom environment, and instructional quality. Did the EKOEXCEL program inputs actually improve these drivers? To observe and measure these drivers, we use the World Bank *Teach* instrument and our adapted 20-question school management survey administered to head teachers.

Teach is an instrument designed by the World Bank to capture both (a) the time teachers spend on learning and how many pupils are on task, and (b) the quality of teaching practices that develop students' cognitive skills. The three sections of *Teach* that align with the EKOEXCEL drivers are *Time on Task*, *Quality of Teaching Practices: Classroom Culture*, and *Quality of Teaching Practices: Instruction. Time on Task* requires classroom observers to record three segments during the lesson to assess whether the teacher is providing a learning task and whether pupils are engaged. *Quality of Teaching Practices* focuses on two primary areas: Classroom Culture and Instruction.[4] Observers track 19 related behaviors. Observers rate each behavior as low, medium, or high. Observers use this evidence to derive a summative score for each element. For each lesson, observers captured two 15-minute observations. For lessons shorter than 40 minutes, just one observation was captured. The full rubric used can be found in the Appendix.

The school management survey responses are coded in an effort to pinpoint the presence of key elements of successful school management, ranging from a clearly understood and embraced school goal to regular engagement and support from the school system central office. Most items are scored based on whether or not a specific school feature is mentioned, and the level of detail used to describe the item. For example, one item scores daily pupil attendance taking. If the head teacher simply mentions that they do take pupil attendance daily, this item would receive ½ point, but if they also include details about the recording method, the item would receive a full point. These items are grouped into five categories: (1) school goal / vision, (2) curriculum / materials, (3) instruction, (4) parent engagement, and (5) central office support. Category scores are aggregated into a total score.[5]

These category scores and their component item scores provide measures for some of the EKOEXCEL driver elements that do not manifest solely in the classroom. In particular, measures for the school goal / vision and parent engagement categories relate to the School Environment driver, while the curriculum / materials and instruction categories and their components relate to Instructional Quality. The teacher attendance and pupil attendance items within the instruction category also attest to the Time to Learn driver.

Overall, findings from *Teach* indicate that EKOEXCEL is already increasing the active learning time for pupils and improving the classroom environment. Positive changes in the classroom environment are particularly striking, showing that EKOEXCEL teachers are embracing important teaching values

[4] The original Teach instrument includes a Socio-emotional Skills component. Due to limitations on training time and alignment with the tool to the EKOEXCEL theory of change, solely the Classroom Culture and Instruction areas were included in the Teach tool used in this study.

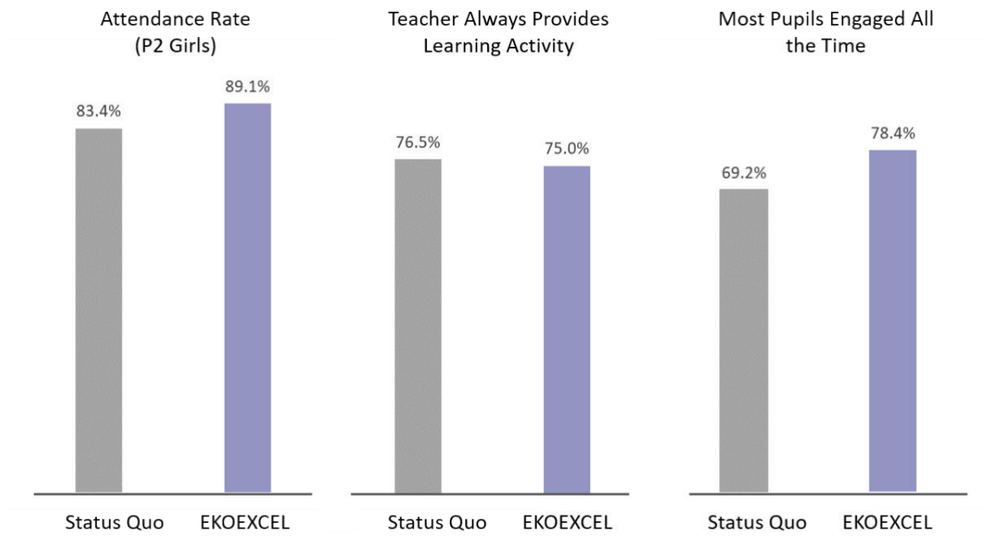
[5] See Appendix section School Management Survey Rubric for the full marking rubric.

and behaviors emphasized in the EKOEXCEL training. Regarding instructional quality, important procedures for lesson plan and lesson delivery quality assurance are demonstrably more present in the head teacher responses at EKOEXCEL schools.

Time on Task Results: More Time to Learn & Higher Engagement

EKOEXCEL pupils have more time to learn. We examined pupil attendance records and the *Time on Task* component of Teach. EKOEXCEL Primary 2 girls are 6.7% more likely to be at school than their counterparts (statistically significant at a 90% confidence level). In EKOEXCEL classrooms, it is 9.1% more likely that either all or the majority of pupils are engaged, and when controls are included to account for differences in grades, LGEAs, subjects, time in lesson, and length of lesson, EKOEXCEL results in a 14.9% increase in pupil engagement, which is statistically significant at the 95% confidence level. Regression results for changes in attendance rates and the *Time on Task* component of Teach can be found in the Appendix (Table 3 and Table 4).

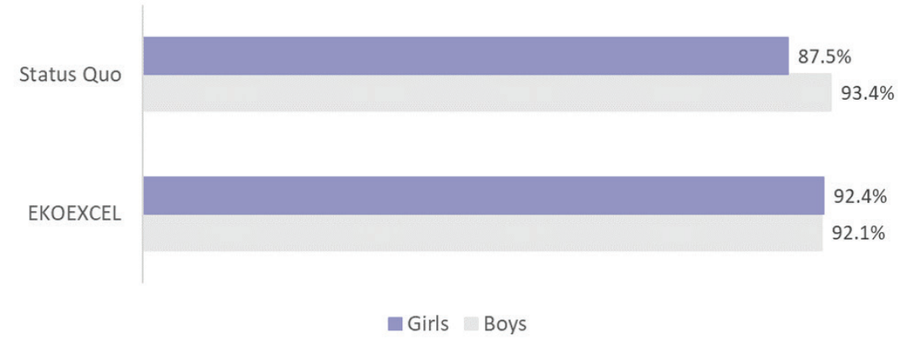
Figure 5. Teach Time on Task



At the school management level, head teachers at EKOEXCEL and control schools report similarly on the presence and details of daily pupil and teacher attendance procedures. Results are statistically indistinguishable. The average item scores (scaled on 0, ½, or 1 point) for daily teacher attendance and daily pupil attendance at EKOEXCEL schools are .97 and 0.8 respectively. At comparison schools, these averages are 0.87 and 0.7.

Finally, there is early evidence that EKOEXCEL may have a differential impact on girls' attendance. At EKOEXCEL schools, girl pupils attended school at a slightly higher rate than boy pupils; more than 92% of the girls were present. At our comparison schools, girl pupils were 6% less likely to attend school than boy pupils.

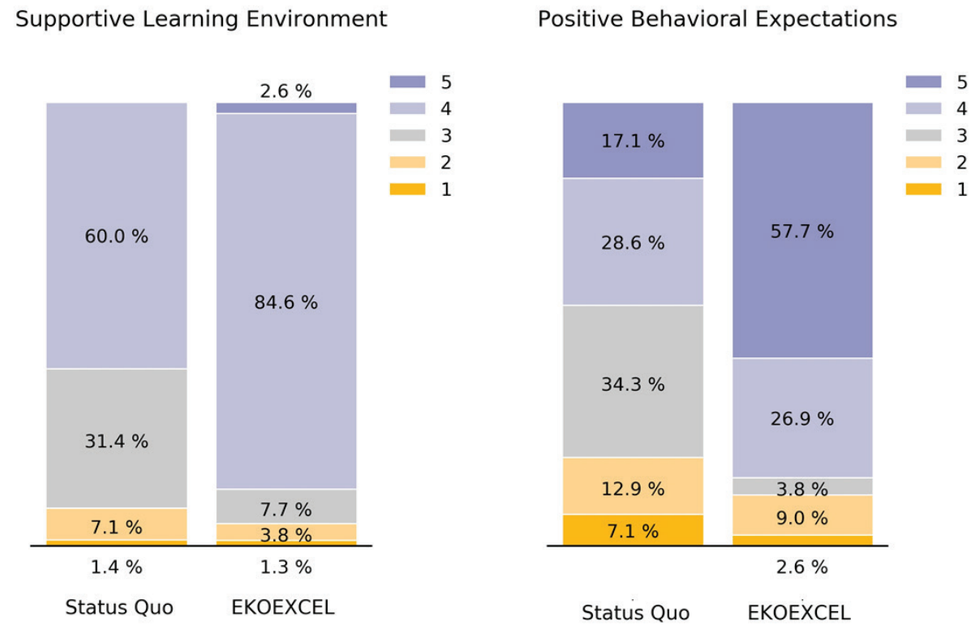
Figure 6. Attendance Rates Boys and Girls - 13v13 Sample



Learning Environment Results: A Better Classroom Culture

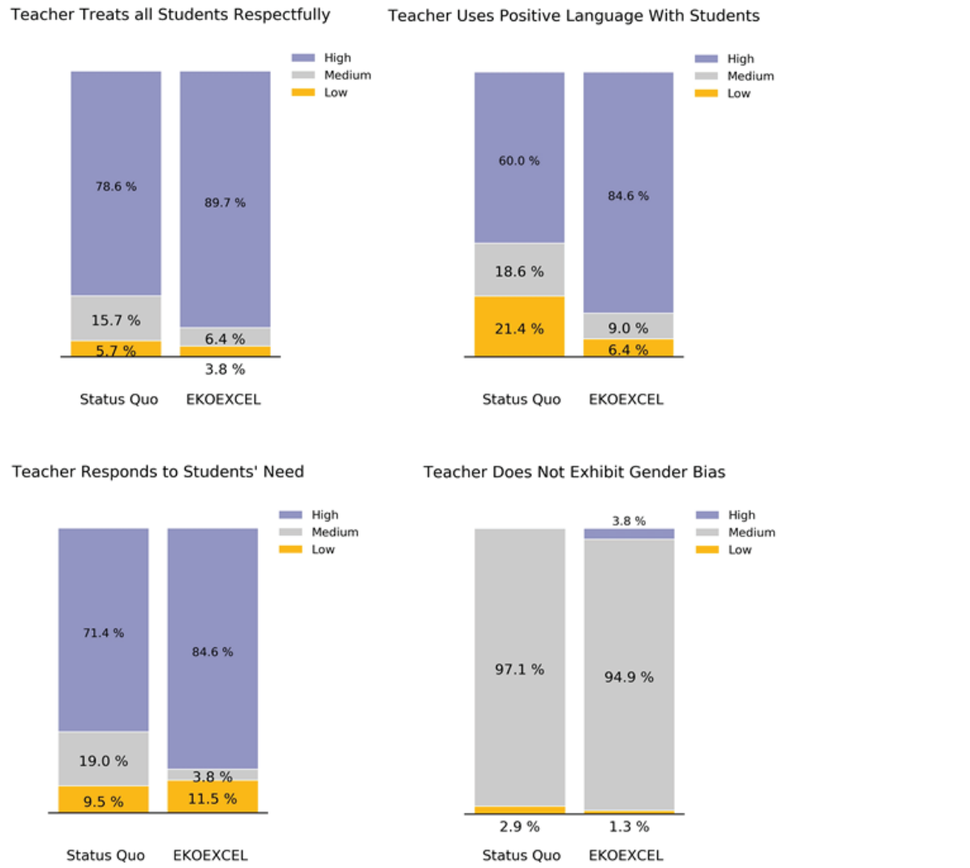
Observers noted significant differences in EKOEXCEL and control school classrooms as measured by the two classroom culture elements in Teach. 87% of EKOEXCEL classrooms receive the two highest ratings for Supportive Learning Environment, compared to 60% of control classrooms. Similarly, Positive Behavioral Expectations in the top two highest ratings are evident in nearly 85% of EKOEXCEL classrooms, compared to just 46% of control classrooms (see Figure 7).

Figure 7. EKOEXCEL Results in Improved Classroom Cultures



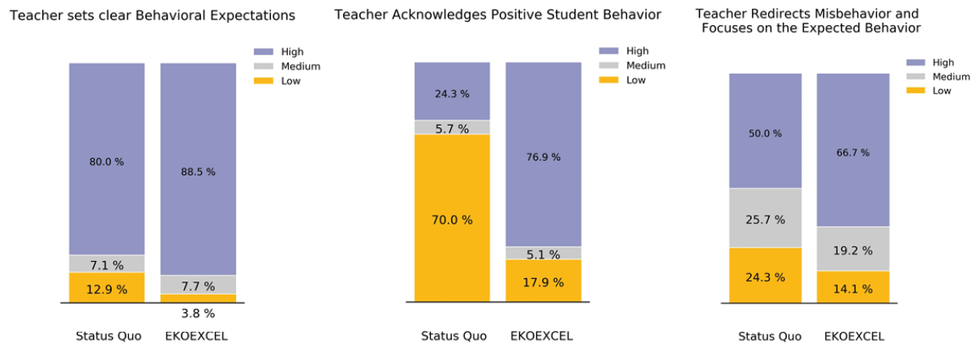
The differences in classroom culture are driven by changes across a number of measured behaviors. In forming a supportive learning environment, EKOEXCEL classrooms are more likely to score in the high category on treating all students respectfully (11.1%), using positive language with students (24.6%), responding to pupil needs (13.2%), and challenging gender stereotypes in the classroom (3.8%).

Figure 8. EKOEXCEL Drives Changes in Each Supportive Learning Environment Behavior



In establishing positive behavioral expectations, EKOEXCEL teachers are more likely to score high on setting clear expectations (8.5%), acknowledging positive student behavior (52.6%) and redirecting misbehavior (16.7%).

Figure 9. EKOEXCEL Drives Changes in Each Positive Behavioral Expectation Behavior



Technical note: These differences in classroom culture are statistically significant. We examine the difference between EKOEXCEL classrooms and control classrooms by treating the element score (from 1 to 5) as a continuous variable. Our first model uses linear regression to estimate the impact of EKOEXCEL by solely looking at the average element score difference between the treatment and control schools.[6] We find on average that EKOEXCEL classrooms score 0.33 and 0.93 points higher (statistically significant at the 95% level) on both the Supportive Learning Environment and Positive Behavioral Expectations respectively. Because the size of the classroom, length of the class, grade, subject of the lesson, segment (first 15 minutes versus last 15 minutes) and LGEA relate to overall scores, our second model controls these aspects. Our estimates of the impact change only slightly, but as these added controls increase the precision of our estimates, our model with controls is our preferred estimate of the EKOEXCEL impact on classroom culture. These estimates can be seen in Table 5 in the Appendix.

With respect to the environment of the overall school community, the school management survey results indicate similar levels of parental engagement at EKOEXCEL and control schools. The average score from 0 to 3 on the three-question parent engagement category is 2.0 for EKOEXCEL and 2.2 at control schools, with no statistical difference. Most head teachers from both school types report that PTA meetings and open days are lines of communication between parents and the school, and that the schools do encourage and guide parents to be active in their child's schooling, although the explanations provide varying levels of detail.

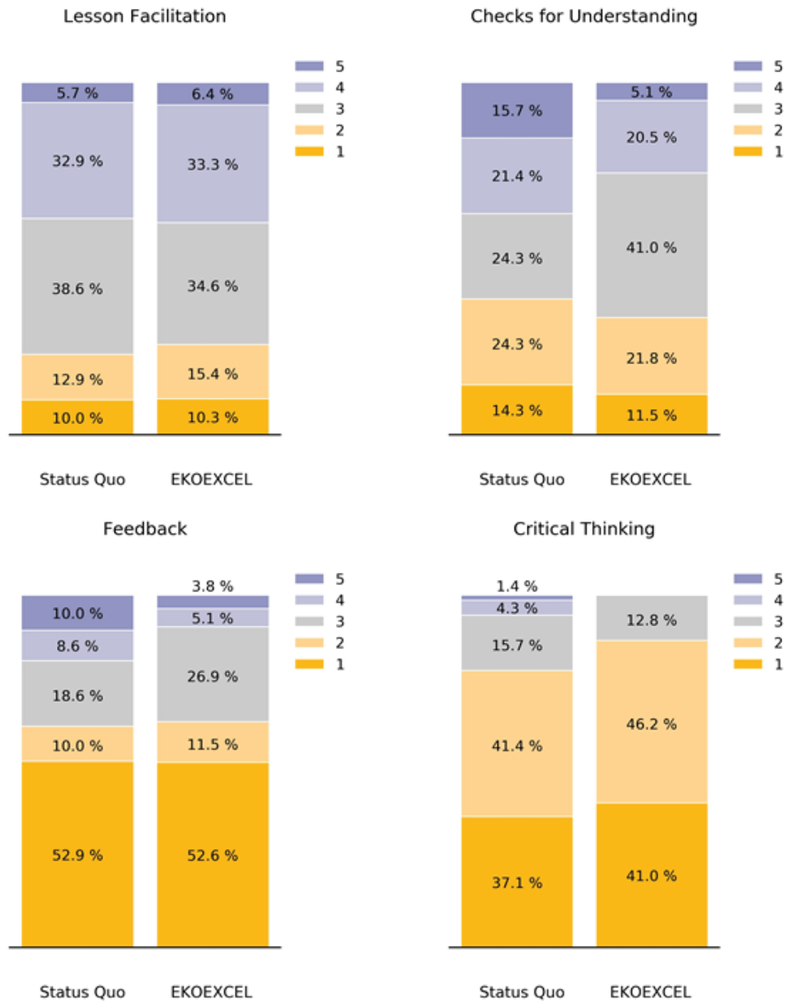
The school management survey also captures an element of the overall school environment through questions about the goals of the school and the extent to which teachers, the community, and school system leadership actively support these goals. Again, results show no statistical difference. When queried on goal specificity for student learning and improvement, and details about active support for the goal, responses by head teachers at EKOEXCEL schools averaged 6.4 of 10 compared to 5. 9 of 10 at control schools.

[6] Due to time constraints, Teach was *not* conducted at the baseline. Because student levels looked similar at the baseline (see https://docs.google.com/document/d/1KoLbc2jbWOVqyhkTb404OXoUA0jonYlXetBVQyE6_Qg/edit) our assumption is teaching practices would be the same at EKOEXCEL schools and control schools in the absence of the treatment.

Instructional Quality Results: No Clear Differences in the Classroom

Differences in Instructional Quality do not yet appear to have manifested, at least through the lens of the Teach tool. The EKOEXCEL theory of change argues that improvements in school management, teaching practices, and better alignment with pupil academic needs are the key drivers in improving overall instructional quality. The Teach instrument measures lesson facilitation, checks for understanding, feedback, and critical thinking. Across these elements, we do not see any statistically significant differences.

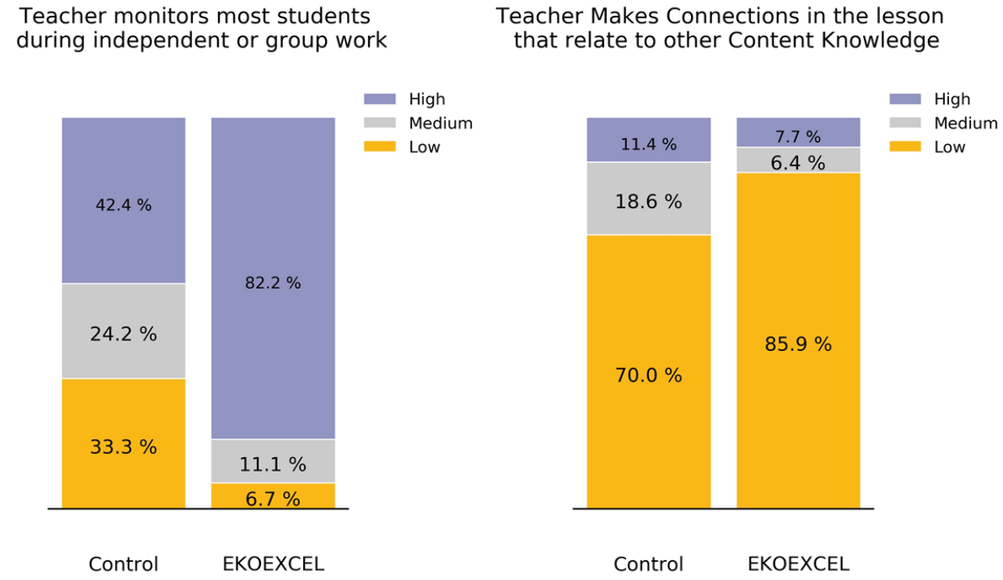
Figure 10. Instructional Quality Estimates Similar Treatment and Control



However, there are specific behaviors where we see differences between EKOEXCEL and comparison schools. During independent work, EKOEXCEL teachers were much more likely to monitor student work, as 93.4% of teachers at EKOEXCEL schools scored high or medium on this behavior relative to 66.6% at control schools. Separately, teachers at control schools were more likely to make connections in the lesson that relate to other content knowledge, with 30.0% scoring high on

this behavior relative to 14.1% at EKOEXCEL. Given the EKOEXCEL theory of change, these findings are unsurprising. Teachers are trained on using the Check-Respond-Leave method to monitor all pupils during their independent work. Similarly, EKOEXCEL's instructional approach makes it unlikely that teachers will reference content knowledge beyond the scope of the lesson. Lesson guides are modular and scripted with focused content that introduces, demonstrates, facilitates practice, and reviews each new concept in the skills progression.

Figure 11. Significant Differences in Teacher Behaviors Related to Instructional Quality

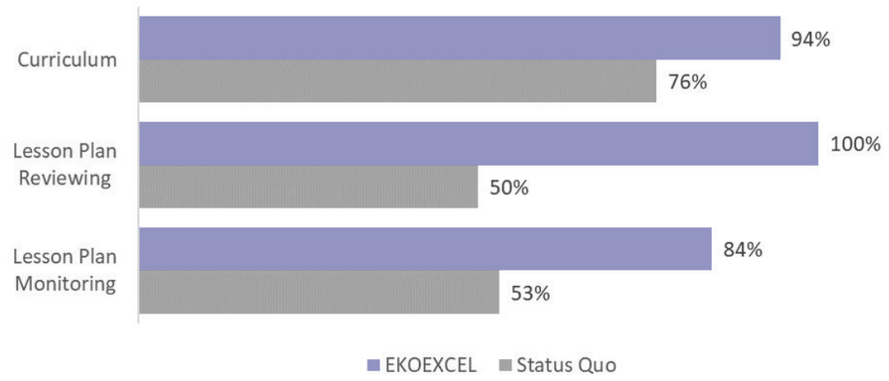


Stepping outside of the classroom, the school management survey measures head teacher explanations of expectations for curriculum and teacher lesson plans, and the review and monitoring processes put in place to ensure lesson quality. For these dimensions, we do find a clear difference between EKOEXCEL and comparison schools. EKOEXCEL lesson plans are developed, levelled and reviewed by the EKOEXCEL Instructional Design Team in alignment with the Lagos curriculum and in collaboration with Lagos SUBEB. These detailed lesson plans are provided electronically every day to the appropriate teachers and head teachers. Consequently, EKOEXCEL head teachers do not have to take it on themselves to review lesson plans for curriculum adherence and quality. Similarly, EKOEXCEL head teachers have easy access to all lesson plans through their smartphone, so they are empowered to regularly monitor teachers in the classroom to ensure that the lessons are delivered according to plan.

It is therefore not surprising that EKOEXCEL schools average a perfect 1 out of 1 on the lesson plan review details, and a high 0.8 out of 1 on the explanation of the lesson plan monitoring process, while comparison schools score lower at 0.5 out of 1 on both measures. Both differences, shown in Figure 12 below[7], are statistically significant at 99% on simple t-tests. On other curriculum components discussed in the survey - instructional resource availability and expectations of a set curriculum and lesson plan - average scores are basically the same for both school types.

[7] Results are shown as the percentage of total possible points for the category or item.

Figure 12. Improved Review & Monitoring Processes Around Curriculum



IV. Literacy and Numeracy Outcomes

EGRA and EGMA results provide an early strong signal that changes in classroom behaviors and the adoption of EKOEXCEL lessons are helping pupils learn faster, across the entire range of pupil skill levels. EKOEXCEL schools have shown more progress in reducing the portion of pupils unable to answer any items correctly on subtasks, and across all pupils, average subtask improvement is higher at EKOEXCEL schools. These results come through strongly in the Primary 2 girls sample. When we combine the Primary 2 girl results from all subtasks into a single literacy score and a single numeracy score, we find that the EKOEXCEL average growth rates are 2.5 and 2.1 times faster than the status quo in literacy and numeracy respectively. At this rate, 71% of P2 pupils will reach literacy proficiency by the end of P4, compared to 23% at status quo schools. Through improved quality assurance and continued performance management, the majority of pupils could reach proficiency by the end of Primary 3.

The EGRA/EGMA Instrument

The Early Grade Reading Assessment (EGRA) and the Early Grade Mathematics Assessment (EGMA) contain a wide range of one-on-one, orally administered subtasks that evaluate pupils' skill levels in English literacy and numeracy. EGRA subtasks start with the most basic skills of listening comprehension and the reading building blocks for reading: letter sound and word sound knowledge. The assessment for Primary 2 and 5 pupils culminates in oral reading fluency and comprehension on a grade-level story. On EGMA, subasks range from basic counting and number identification for kindergarteners to timed basic division exercises for Primary 5 pupils. Full subtask descriptions can be found in Figures A1 - A3 in the Appendix.

We assessed each grade on subtasks that cover the skill range likely to be taught within that grade, with a few exceptions that allow us to capture growth beyond expectations.[8] Administered subtasks by grade are shown in Figure 13 below. The midline report will focus on subtasks given to the Primary 2 girls.

[8] For example, Subtraction Level 1 contains basic subtraction problems that pupils are expected to learn by the end of Primary 1. Given prior research on learning levels in mathematics for pupils in Lagos, we anticipated it was unlikely that many Primary 5 pupils were five grade levels behind on this skill.

Figure 13. Subtasks by Grade

EGRA Subtask	KG	P2	P5	EGMA Subtask	KG	P2	P5
Listening Comprehension	X			One-to-one Correspondence	X		
Letter Sound Knowledge	X	X		Number Identification	X		
Identify Onset Sounds	X	X		Quantity Discrimination	X	X	
Non-word Reading	X	X		Addition Level I	X	X	
Familiar Word Reading	X	X		Addition Level II		X	X
Passage Fluency I		X	X	Subtraction Level I		X	
Reading Comprehension I		X	X	Subtraction Level II		X	X
Passage Fluency II			X	Word Problems		X	X
Reading Comprehension II			X	Multiplication			X
				Division			X

Reducing the Number of Pupils Scoring Zero

During baseline assessments, we found that on most subtasks, a significant portion of pupils could not answer a single item correctly, a result we refer to as a "zero score." Due to this prevalence of zero scores, , we check the midline results to see if the EKOEXCEL program had a differential impact on moving pupils from scoring a zero on a subtask to scoring at least one. In other words, is EKOEXCEL helping to put non-readers on the path to literacy, or to effectively introduce new math skills that learners did not previously understand? Descriptively, we see that EKOEXCEL schools have made more progress reducing zero scores within the Primary 2 girls sample. The percentage point reduction since baseline in the portion of pupils scoring zero is larger for EKOEXCEL schools on almost all subtasks across EGRA and EGMA, as is shown in Figures 14 and 15. When controlling for baseline scores and pupil characteristics, we find that pupils in EKOEXCEL schools are more likely to score at least one point during the midline on Addition Level 2 (95%), Subtraction Level 2 (95%), and Word Problems (90%), which is remarkable given the short duration of the intervention.[9]

[9] Statistical significance is calculated by estimating the probability of a student scoring zero as a function of baseline scores (including squared and cubed terms to account for non-linear growth), age, home language, whether the child had lunch, dinner, and/or breakfast, and (for EGMA) whether the subtasks were conducted in English. Note that the model is *not* sensitive to controls - in other words, adding more controls increases precision of our estimate but does not change the magnitude of our results. For these full regression output tables, see Table 7. Zero Score Reduction EGRA and Table 8. Zero Score Reduction EGMA in the Appendix.

Figure 14: EGRA Zero Score Reduction

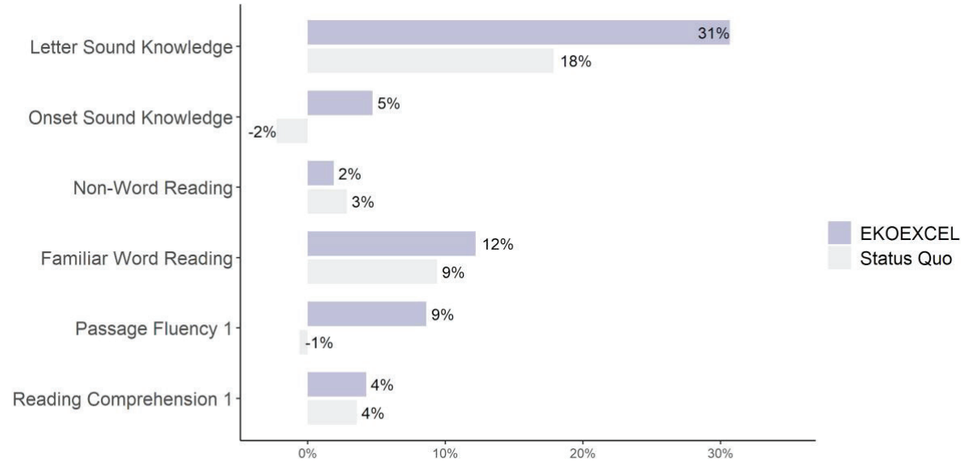
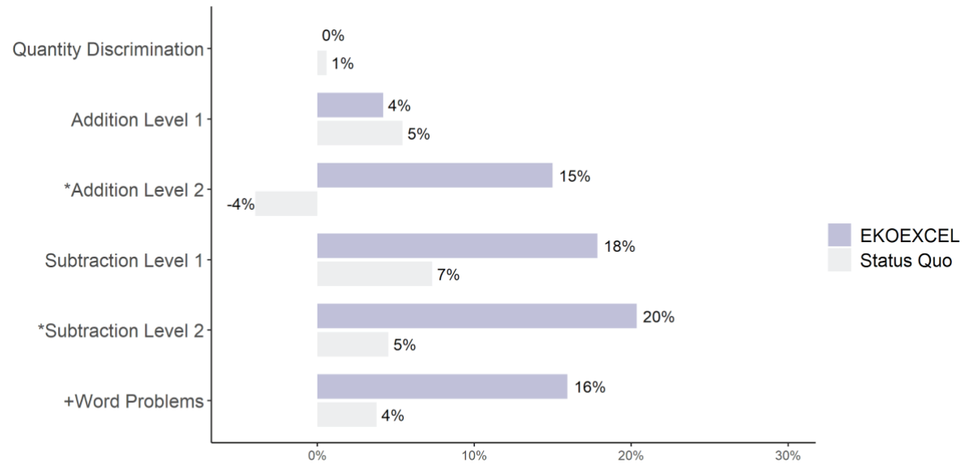


Figure 15: EGMA Zero Score Reduction



Higher Growth Across Subtasks

Across subtasks, we find that EKOEXCEL students learned more than their counterparts in control schools (see Figure 16. EGRA Differential Growth by Subtask). While both sets of students started at similar levels at the beginning of Term 2, by the end of Term 2, EKOEXCEL pupils were outperforming their counterparts on all six subtasks. Differences for Primary 2 girls in letter sounds, non-word reading, familiar word reading and passage fluency are statistically significant at a 95% confidence level (see Table 12. EGRA Results for Primary 2 Girls in the Appendix). These differences are also large in magnitude; EKOEXCEL pupils learned an additional 5 letter sounds, read an additional 1.2 non-words, 2.1 familiar words, and 1.8 words in the passage.

On EGMA subtasks, we find a similar pattern of higher differential growth for EKOEXCEL. For four of the six subtasks, differences were statistically significant; P2 girls in EKOEXCEL earned an additional 9% between the baseline and midline on Addition Level 2, answered an additional 1.2 questions per minute on Subtraction Level 1, and grew an extra 7% on Subtraction Level 2 (differences on Subtraction Level 2 are significant at a 90% confidence level). The other three subtasks (Quantity Discrimination, Addition Level 1, and Word Problems) show a positive growth differential, though these differences are not statistically significant.

Technical note: We measure pupil growth by estimating the difference between average performance at baseline and average performance at midline. This estimate is restricted to pupils who were available both at the baseline and the midline. We find no pattern of differential attrition between the treatment and control group as seen in Table 9 in the Appendix. In other words, regardless of baseline ability, pupils were equally as likely to be measured at EKOEXCEL and non-EKOEXCEL schools. Figures 16 and 17 below provide raw estimates to better contextualize levels and growths of pupils across subtasks. Statistical significance is calculated by fitting a regression to estimate midline performance as a function of baseline scores (including squared and cubed terms to account for non-linear growth), age, English as a home language, whether the child had lunch, dinner, and/or breakfast, and (for EGMA) whether the subtasks were conducted in English. Note that the model is *not* sensitive to controls - in other words, adding more controls increases precision of our estimate but does not change the magnitude of our results. Also note that regression coefficients differ slightly from the simple average differences shown in Figures 16 and 17. The full regression model is as follows:[10]

$$midline_{i,j} = \beta_0 + \beta_1 * treatment_{i,j} + \beta_2 * baseline_{i,j} + \beta_3 * baseline^2_{i,j} + \beta_4 * baseline^3_{i,j} + \beta_5 * child\_age_{i,j} + \beta_6 * home\_language\_english_{i,j} + \beta_7 * lunch_{i,j} + \beta_8 * dinner_{i,j} + \beta_9 * breakfast_{i,j} + \epsilon_{i,j}$$

[10] For the full regression results, see Table 12. EGRA Results for Primary 2 Girls and Table 13. EGMA Results for Primary 2 Girls in Appendix Section EGRA/EGMA Regression Results - Primary 2 Girls.

Figure 16. EGRA Differential Growth by Subtask

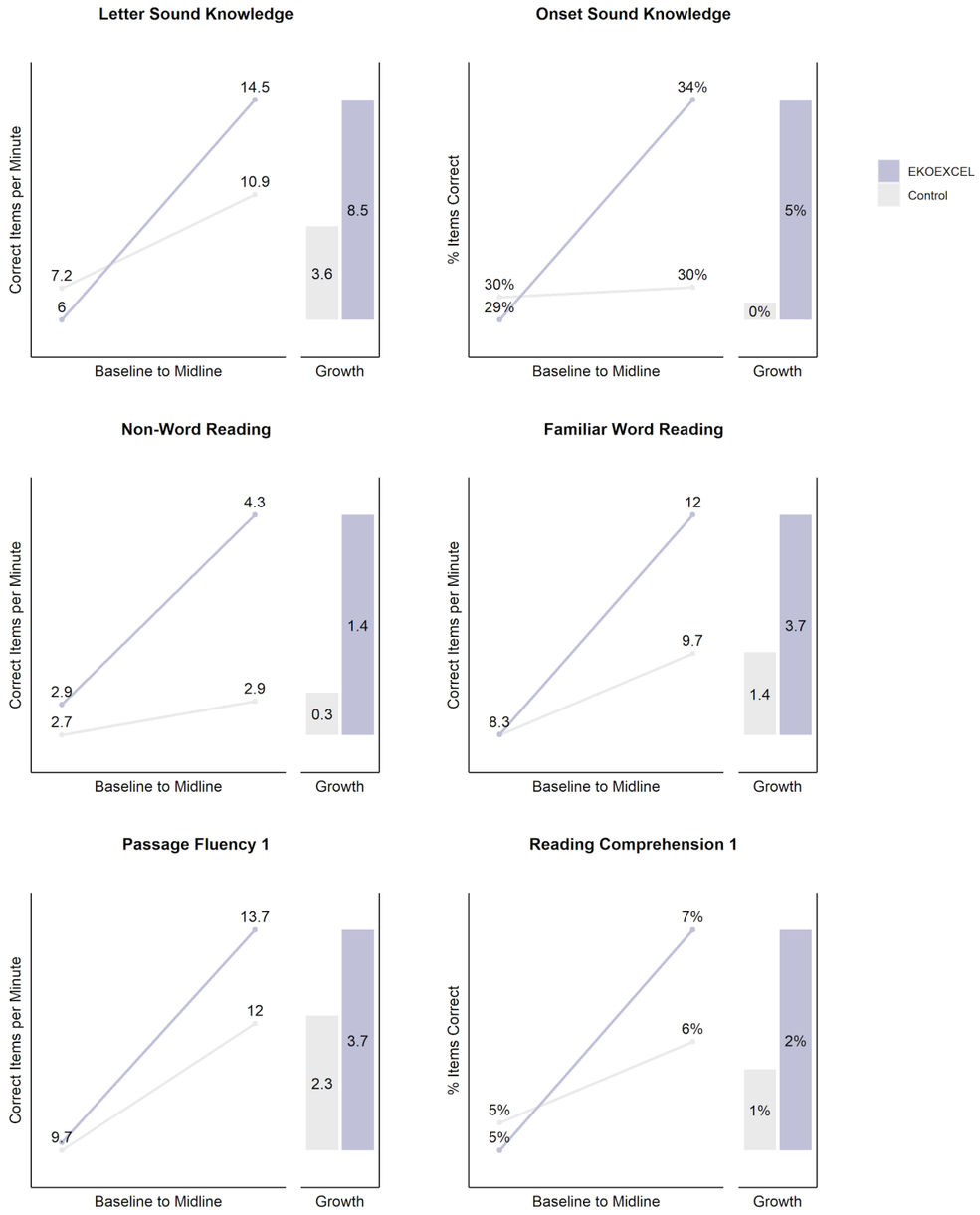
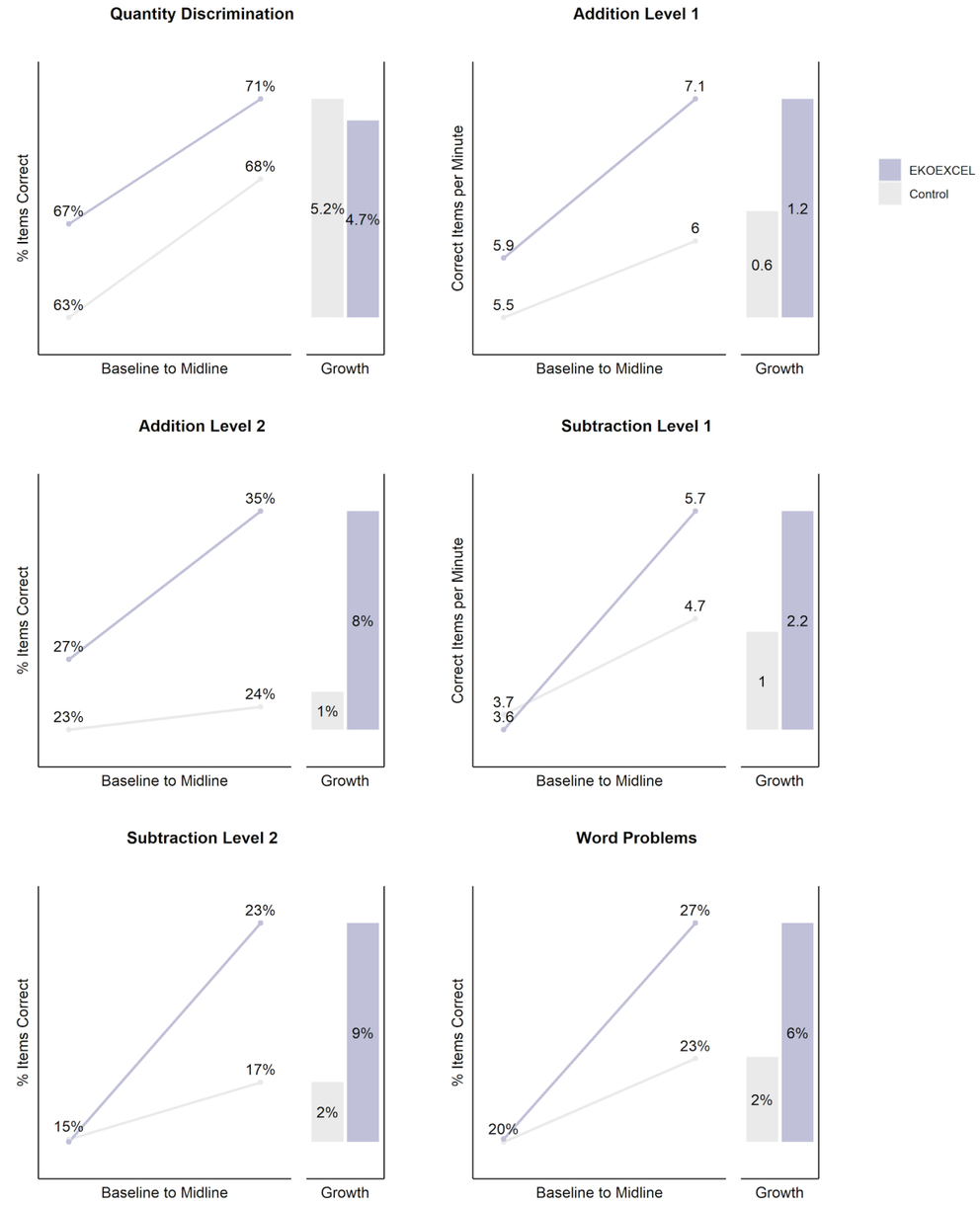


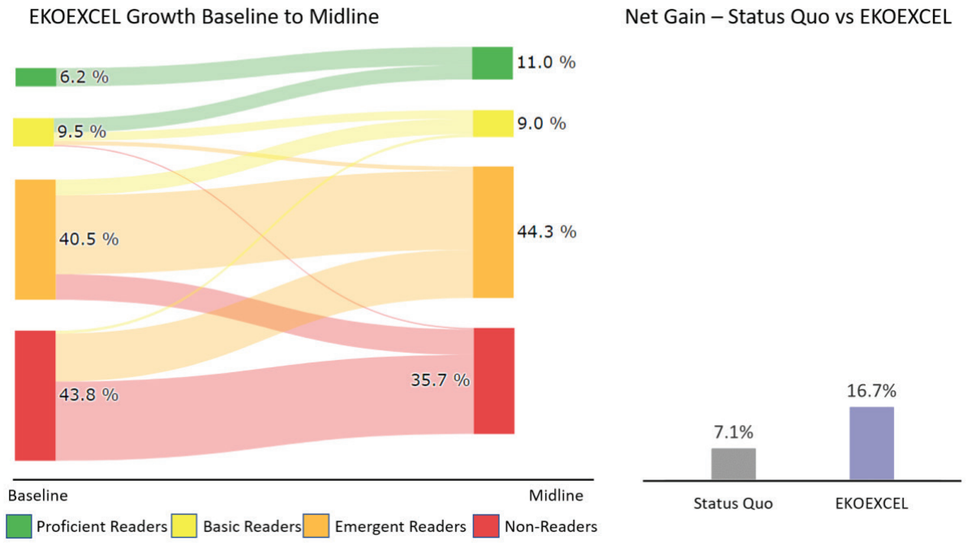
Figure 17. EGMA Differential Growth by Subtask



Further Progress Toward Literacy

We zoom in on the intervention's impact on one key subtask: passage fluency. Pupil growth has accelerated quickly under the EKOEXCEL program; excluding the zero scores, we find that EKOEXCEL pupils grew by 4.7 words per minute, while control schools grew by 2.8 words per minute. This higher growth is reflected in more progress along the reading ability continuum from illiteracy to reading proficiency, which educators often define with categories based on reading speed. Using the four categories Non-Reader (0 wpm), Emergent Reader (1-19 wpm), Basic Reader (20 - 44 wpm), and Proficient Reader (45+ wpm), we find that EKOEXCEL pupils have made more progress into the higher categories.[11] While the majority of these pupils continue to be either emergent readers (44%) or non-readers (36%), 27% of P2 EKOEXCEL girls have progressed to higher categories, as compared to 23% at control groups. We also observed pupils whose performance dropped a category between baseline and midline. By subtracting the percentage of pupils who drop from the percentage who move up, we calculate the net gain achieved by the cohort of pupils. In EKOEXCEL schools, the net gain is 16.7%, over twice as much as the 7.1% net gain in control schools, as is shown in Figure 18.

Figure 18. Literacy Category Growth Baseline to Midline & Net Gain



More Than Two Times Higher Growth in Literacy and Numeracy

We confirm overall improvement on underlying literacy and numeracy by using Item Response Theory (IRT) to estimate that literacy grew 2.5 times faster at EKOEXCEL schools and numeracy grew 2.1 times faster.

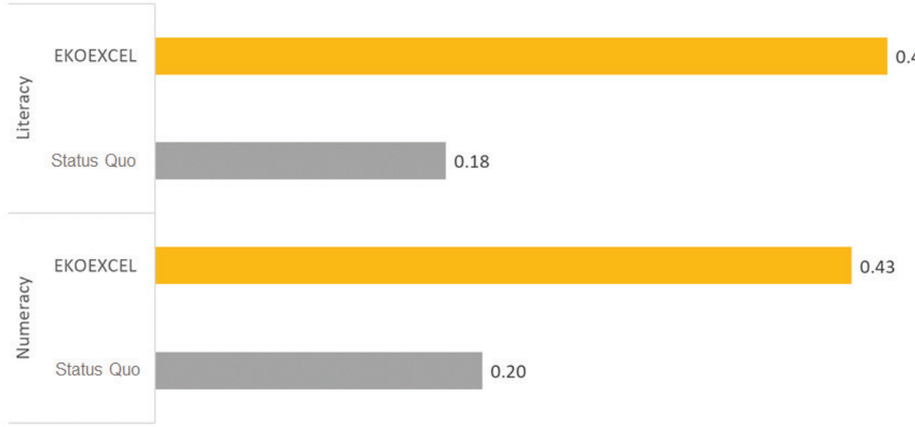
Technical note: the IRT method capitalizes on the fact that we have item-level data for each subtask to estimate overall literacy and numeracy ability. When we look at literacy, we know that identifying letter sounds, being able to read familiar and unfamiliar words, reading passages fluently, and understanding reading comprehension are all aspects of overall literacy. On some items, we would

[11] These literacy correct words per minute cutoffs are based on general early grade reading categories referenced in a benchmark setting workshop with USAID in 2015. See USAID (2015).

expect the majority of pupils to provide the correct answer (74% of P2 girls identified the familiar word *up* at the midline). Other items that are much more difficult (only 23% of pupils could answer the first reading comprehension question). IRT creates a performance estimate by determining relative difficulty of items and providing an overall literacy score based on performance on all of these items.

Using these literacy and numeracy measurements, we calculate differential growth by looking at the difference in performance between the baseline and the midline for the treatment group relative to the difference between the baseline and the midline for the control group[12]. For literacy, we find that control school pupils grew on average 0.18 standard deviations during this period. By contrast, EKOEXCEL schools grew *0.45* standard deviations. Growth was 0.27 standard deviations higher in EKOEXCEL schools. For numeracy, pupils grew 0.20 standard deviations in control schools and 0.43 standard deviations at EKOEXCEL schools, meaning EKOEXCEL resulted in an additional 0.23 standard deviation growth over their counterparts. In other words, EKOEXCEL students grew 2.5 times faster than the control in EGRA and 2.1 times faster in EGMA. These results are large in magnitude and statistically significant (see Table 14. IRT Regression Results Literacy and Numeracy in the Appendix).

Figure 19. Growth is 2.5X higher in literacy and 2.1X higher in numeracy for EKOEXCEL



But what exactly do these scores mean and how do they reflect the types of pupils we see in the classroom? While IRT results in a continuous, standardized score range, we create score range categories[13] to better illustrate differences in performances for literacy and numeracy; pupil profiles for bands of scores can be seen in Table 20 below.

[12] This is also calculated in a regression framework estimating the midline performance as a function of the baseline performance and EKOEXCEL. We find similar treatment effect estimates as seen in Tables 12 & 13. in the Appendix.

[13] Score types were binned based on cuts within the data: students scoring below -1.5 standard deviations were scored a 1, between -1.5 and -0.5 a 2, between -0.5 and 0.5 a 3, between 0.5 and 1.5 a 4, between 1.5 and 2.5 a 5 and above 2.5 a six.

Table 20. Pupil Profiles - Literacy and Numeracy

Score	Type	Pupil Profile - Literacy	Pupil Profile - Numeracy
6	Proficient	Aishat is able to identify all letter sounds, can quickly read most familiar words, can sound out more than 41 non-words in a minute, can finish a short passage and read about 97 words per minute, and can answer the majority of the reading comprehension questions.	Amdalat can always identify the bigger number and can do about 25 simple addition problems in a minute and 19 simple subtraction problems. She can solve two-digit addition and subtraction problems with high accuracy and can solve addition/subtraction word problems and most word problems that require multiplication or division.
5	High Intermediate	Victoria is able to identify all letter sounds, can quickly read most familiar words, can sound out about 25 non-words in a minute, and can finish a short passage, reading about 67 words per minute. However, Victoria can only answer a little under half of the reading comprehension questions.	Baraka can always identify the bigger number and solves about 16 addition problems and 13 subtraction problems per minute. She can solve most two-digit addition and subtraction problems, and can solve simple addition and subtraction word problems.
4	Low Intermediate	Ijeoma is able to identify most letter sounds, can read around 25 familiar words in a minute, can sound out about eight non words, and can read about 32 words per minute in a passage, but is still not able to answer any reading comprehension questions.	Esther can almost always identify the bigger number and can solve about ten addition problems and ten subtraction problems in a minute. She can solve two or three two-digit problems in both addition and subtraction but has difficulty once the numbers are above 20. Esther generally can solve word problems that are addition or subtraction problems.
3	High Beginner	Mariam can identify about half of the letter sounds, can identify around eight familiar words, but can only sound one non words. Mariam can read about seven words in a passage, but due to the time taken on reading a passage and cannot answer any reading comprehension questions.	Destiny can usually identify the bigger number and can solve seven simple addition problems in a minute and solves six subtraction problems in the same amount of time. She can solve one simple two-digit problem in addition and can usually do the same in subtraction. She gets one word problem correct.
2	Medium Beginner	Rashida is able to identify one or two sounds, can identify one or two familiar words, but cannot sound out a non-word. Rashida can maybe read one word in a passage and therefore cannot answer reading comprehension questions	Kadija can sometimes identify the bigger number but has difficulty with bigger numbers. She can only do around four simple addition problems in a minute and solve two simple subtraction problems in a minute. She cannot solve one two digit problems in addition, but struggles when the numbers are large. She cannot solve any two digit subtraction problems but may solve one word problem.
1	Low Beginner	Ruth cannot identify any letter sounds, cannot read any non-words or familiar words, cannot read any words in a passage and (therefore) cannot answer and reading comprehension questions.	Zainab cannot identify which number is bigger and can do only one simple addition problem, but no subtraction or word problems.

EKOEXCEL was more successful in moving pupils into higher literacy and numeracy categories.. If these gains are maintained, we would expect EKOEXCEL pupils to take just over two terms to advance a category. By contrast, it would take control pupils almost two years to move up a category.

Using the cohort net gain definition introduced in the previous section, we find that the EKOEXCEL schools had a net gain of 40.6% in literacy over the first seven weeks of the program, compared to 12.5% at control schools. On numeracy, the net gain at EKOEXCEL schools was 31.6%, compared to 17.9% at control schools. Figure 21 and Figure 22 below show differences in growth between the treatment and control schools between baseline and midline for literacy and numeracy respectively.

Figure 21. Movement on Literacy Between Baseline and Midline

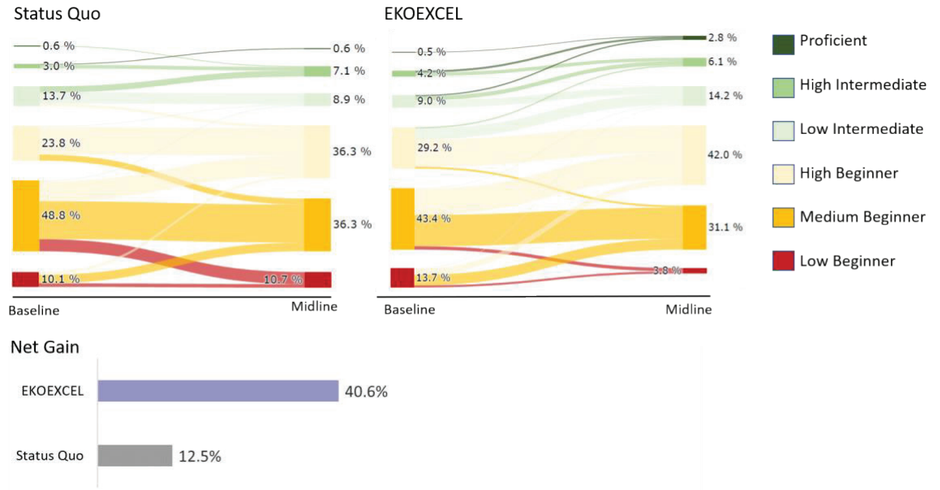
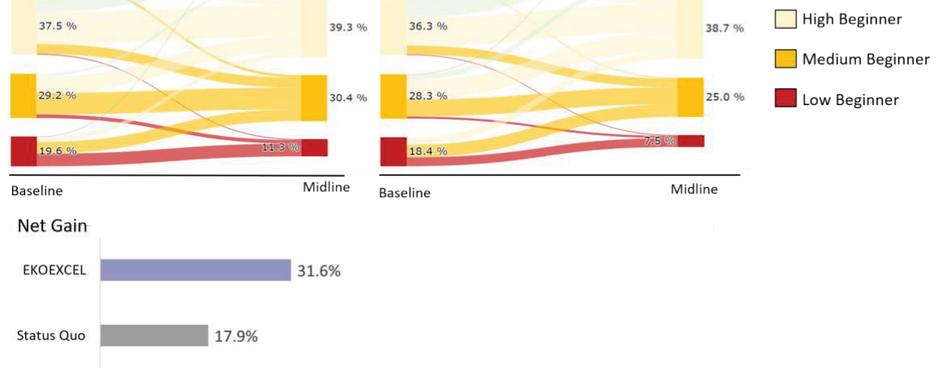


Figure 22. Movement on Numeracy Between Baseline and Midline



We are excited that these results are appearing after only seven weeks of the intervention. Furthermore, while these differences may appear slight at this juncture, they have additive effects that will fundamentally impact pupil performance in the years to come. These additive effects are further explored in Section V.

Pupil Growth for Other Samples

Patterns of differential growth are not just restricted to Primary 2 girls. When we look at our sample of Primary 2 girls and Primary 2 boys at the 26 schools that had assessments for all grades, we see that the results are similar across both samples. Out of the 6 EGRA subtasks, all but Reading Comprehension are the same in direction with only slight differences in magnitude. For EGMA, 4 out of 6 subtasks are the same directionally, with larger differences in Addition Level 1 and Addition Level 2. Differential performance by subtask can be seen in the Appendix in Table 10 and Table 11, which provide EGRA/EGMA differential growth by grade and subtask.

Kindergarten and Primary 5 results from the 26-school sample are less definitive. Unsurprisingly, given the small sample size, we only find three subtasks that are statistically significant. For these three subtasks, we do see positive differential growth for EKOEXCEL schools of substantial magnitude, suggesting EKOEXCEL is having an impact on these grades. On other subtasks, these results are trending in the same direction as our main results but with less significance due to sample size. We believe that our results for Primary 2 can be generalized across all grades.

V. Predicting the Long-term Impact of EKOEXCEL

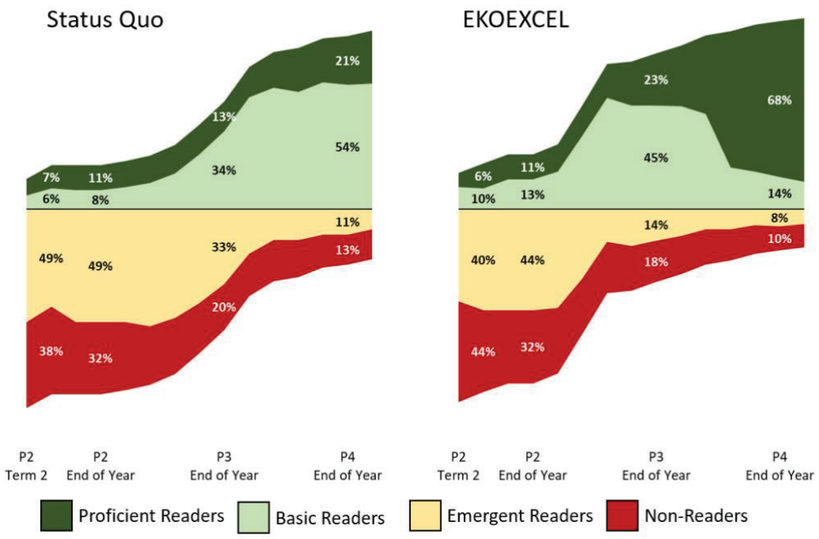
The shifts in performance we see after only seven weeks in the EKOEXCEL program could have major impacts over the course of the next few academic years. Below, we describe how (under certain assumptions) 68% of EKOEXCEL pupils could become proficient readers by the end of Primary 4 compared to 21% at control schools, and as a cohort achieve stronger fluency than their peers on overall numeracy and literacy skills. *Note that all predictions assume continued learning and do not factor in likely learning loss due to COVID-19.*

A Cohort Reaching Proficiency on Passage Fluency a Year Earlier

First, we use estimates of growth for non-zero scores (2.8 and 4.7 more words every seven weeks for status quo and EKOEXCEL schools respectively) and model pupil-level growth and the probability of moving from a non-reader to an emergent reader (10% for both groups). We then estimate pupil-level growth over the next two years for each group assuming five 7-week periods per term.[14]

[14] When we extend estimates for status quo schools through term 2 in Primary 5, our estimates roughly align with Primary 5 performance on EGRA measured in January.

Figure 23. Predicted Literacy Categories from Primary 2 Term 2 to End of Primary

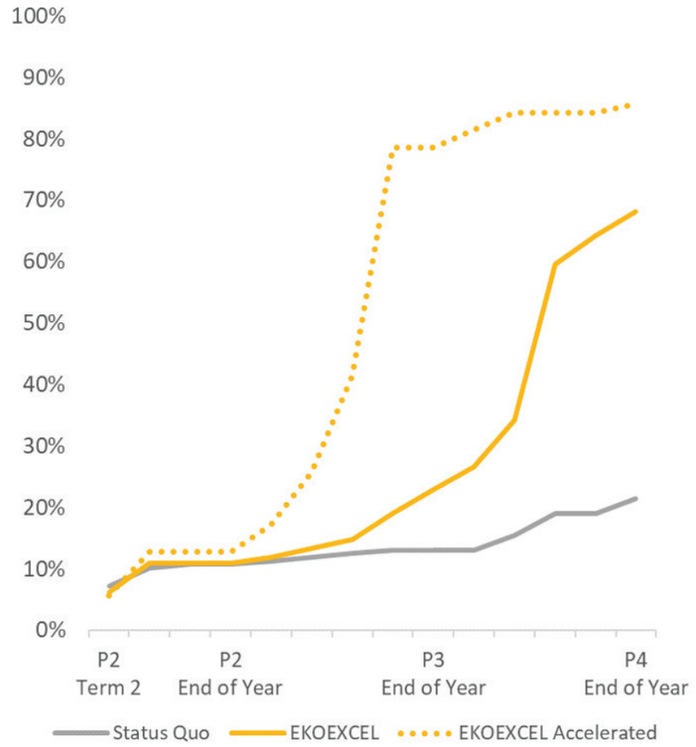


The impact of the EKOEXCEL school results in a larger proportion of pupils reaching proficiency levels at a faster rate; by the end of Primary 4, just under 70% of pupils at EKOEXCEL schools are expected to reach proficiency while it takes until the end of Primary 5 for the same proportion of pupils to reach the same levels at status quo schools.

Growing More by Learning from Top Performers

This accelerated growth is impressive, but there is still a large gap to fill. Through improved quality assurance and continued performance management, literacy growth could approach levels seen in the six top performing EKOEXCEL schools, where literacy growth for non-zero pupils averaged 9.0 words per minute and 57% of pupils were transitioned from non-readers to emergent readers. Figure 24. shows how sustained accelerated growth could result in the majority of pupils reaching proficiency before the end of Primary 3. Note that students at the top performing EKOEXCEL schools had similar baseline performance to students at the 6 comparison schools. Furthermore, these comparison schools perform similarly to all other status quo schools. This suggests the observed differences for these positive outlier schools are due to school management rather than underlying differences among students.

Figure 24. Projected Proficiency Growth by Treatment & Top Performing Schools

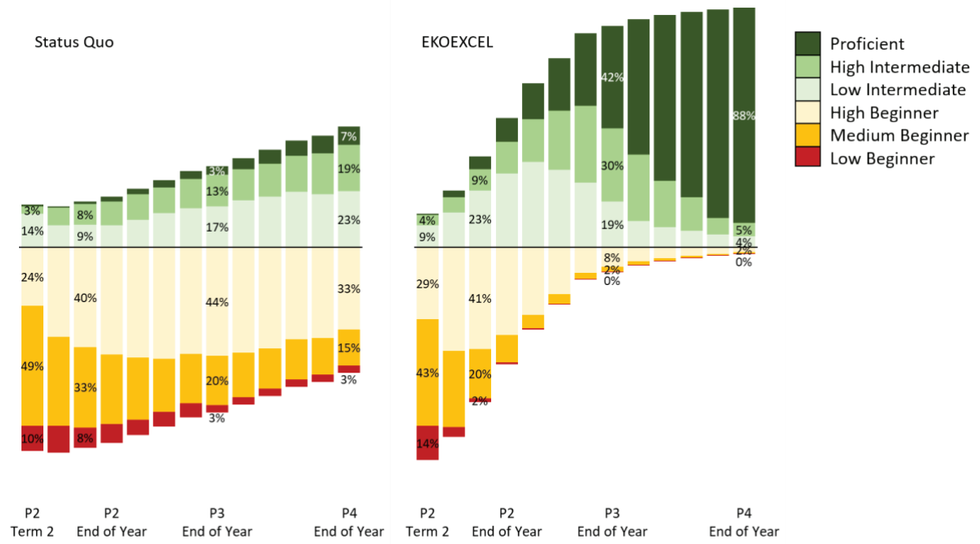


Accelerated Learning in Literacy and Numeracy

These predictions, though, are based solely on passage fluency scores, and do not take into account overall movement in literacy across subtasks, including reading comprehension ability.They also do not include any projection estimates on numeracy. To make these projections, we can use the IRT estimates and their literacy and numeracy categorizations.[15] Taking this approach, we estimate that by the end of P4, the majority of EKOEXCEL pupils are not only reading fluently, but also have much higher levels of reading comprehension with 88% reaching level 6 (where students can read around 90 words per minute and answer the majority of reading comprehension questions) compared to 7% at control schools.

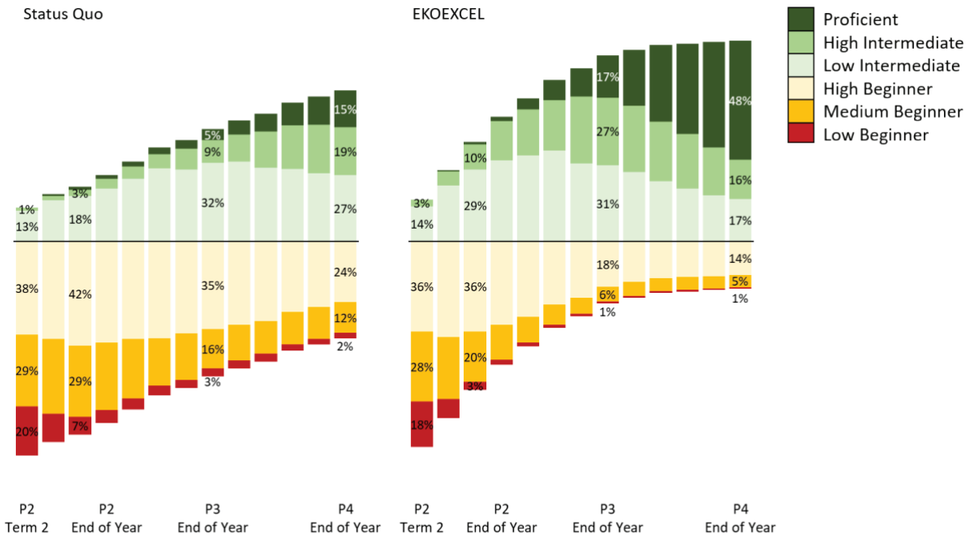
[15] We projected growth using two methods. The first estimated performance based on movement between categories assuming the patterns we observed at midlines persist through the future. For example, at EKOEXCEL, if 20% of pupils moved from level 4 to level 5 between baseline and midline, we assume that 20% of pupils in level 4 at midline will move to level 5 over the next seven weeks. Second, we projected linear growth using the raw IRT values. Our final estimate is derived from averaging these two growth projections. Because this methodology is different from our literacy projections, our IRT category projections do not perfectly align with the literacy proficiency projections.

Figure 25. Projected Literacy Performance: Control Schools vs EKOEXCEL



We predict similar differences in numeracy, though the impact appears less pronounced. We find that 48% of pupils reach category 6 - students who can quickly do simple addition and subtraction problems (relying on mental math) and are accurate in solving more difficult addition and subtraction problems using pen and paper. These pupils are also able to ascertain a multiplication or division problem within a word problem and solve it correctly.

Figure 26. Projected Numeracy Performance: Control Schools vs EKOEXCEL



VI. Conclusion

The pandemic-induced school interruption has increased the pressure on schools to accelerate learning for affected pupils. In just a short demonstration period, EKOEXCEL has proven to generate more effective school management, better classroom culture, and more learning opportunities for students. Should the gains observed during this initial period continue over time, schools enrolled in EXOEXCEL will help their pupils to achieve literacy and numeracy proficiency at much higher levels.

Appendix

Sample

Table 1. EGRA EGMA Counts by Sample and Grade

		1. Full Baseline			2. Completed Schools			3. Primary 2 Girls		
		S.Q.	EKOEXCEL	Total	S.Q.	EKOEXCEL	Total	S.Q.	EKOEXCEL	Total
KG	LGEAs	20	20	20	12	12	12			
	Schools	29	29	58	12	13	25			
	Pupils	350	422	772	130	155	285			
	Girls	180	191	371	60	63	123			
	Boys	170	231	401	70	92	162			
P2	LGEAs	20	20	20	12	12	12	19	19	19
	Schools	30	30	60	13	13	26	26	26	52
	Pupils	495	553	1048	196	205	401	168	212	380
	Girls	228	273	501	83	113	196	168	212	380
	Boys	267	280	547	113	92	205			
P5	LGEAs	20	20	20	12	12	12			
	Schools	30	27	57	13	12	25			
	Pupils	537	522	1059	201	211	412			
	Girls	252	253	505	89	103	192			
	Boys	285	269	554	112	108	220			
ALL	**LGEAs**	**20**	**20**	**20**	**12**	**12**	**12**	**19**	**19**	**19**
	Schools	**30**	**30**	**60**	**13**	**13**	**26**	**26**	**26**	**52**
	Pupils	**1382**	**1497**	**2879**	**527**	**571**	**1098**	**168**	**212**	**380**
	Girls	**660**	**717**	**1377**	**232**	**279**	**511**	**168**	**212**	**380**
	Boys	**722**	**780**	**1502**	**295**	**292**	**587**			

Table 2. Teach School Counts by Sample and Grade

	Full Sample			Restricted Sample		
Grade	S.Q.	EKOEXCEL	Total	S.Q.	EKOEXCEL	Total
ECD	17	17	34	15	15	30
Grade 2	18	18	36	16	16	32
Grade 5	18	17	35	16	15	31
Total	***18***	***18***	***36***	***16***	***16***	***32***

Subtask Descriptions

Figure A1. EGRA Subtask Descriptions[16]

Subtask	The subtask contains...	...which measures...	...which is an important building block towards literacy because...
Listening Comprehension	Basic questions about a very simple short story – both read aloud by the assessor	A pupil's ability to understand basic spoken English	Understanding spoken English is necessary for reading. This subtask also helps engage the pupil and make them comfortable speaking up on subsequent subtasks.
Letter Sounds	Upper and lower case letters, arranged in random order	A pupil's knowledge of individual sounds associated with each letter	It is a prerequisite for being able to combine the sounds of multiple letters into words.
Onset Sounds	Words arranged in random order (read out loud to the pupil by the assessor)	A pupil's ability to identify the initial sounds of each word	It tests phonemic awareness, or "the understanding that speech is comprised of individual sounds," (Yopp 1992). This is fundamental for later linking sounds to letters and then words.
Non-Word Reading	A set of made-up words, which are words that follow the basic rules of the language of assessment but have no meaning	A pupil's ability to decode ("sound out") unfamiliar words	To be proficient readers, children must learn to both recognize sight words (common words that children are encouraged to memorize) and to decode unfamiliar words by linking sounds of the letters together. Reading from a list of non-words tests the latter without the possibility of sight word recognition.
Familiar Word Reading	A set of familiar words selected from early grade reading texts	A pupil's ability to decode unfamiliar words as well as her/his recognition of sight words	The ability to recognize and decode individual words is a prerequisite for linking the words together to read an entire passage of text fluently.
Passage Fluency I	A short passage of early Primary 2 level text	A pupil's ability to read age appropriate text aloud accurately, at sufficient speed	Reading with sufficient speed and accuracy is a necessary precursor for reading comprehension. Pupils must link words together fast enough for their working memories to be able to retain the information conveyed by the text. When pupils are not yet reading with automaticity, they must focus on decoding words, which takes more time and results in slower reading. Once pupils are able to read with sufficient speed and accuracy, they can focus on the meaning of the content.
Reading Comprehension I	Five questions about the text read in the Passage Fluency I subtask	A pupil's ability to understand and communicate the meaning of text	Reading comprehension is a prerequisite for children to use reading as a tool to receive information. It is a necessary precursor for later academic and vocational success.
Passage Fluency II	A medium-length passage of early Primary 5 level text	Same as Passage Fluency I above	Same as Passage Fluency I above
Reading Comprehension II	Six questions about the text read in Passage Fluency II	Same as Reading Comprehension I above	Same as Reading Comprehension I above

Figure A2. EGMA Subtask Descriptions[17]

[16] This table draws on material in Gove and Wetterberg (2011) and Yopp (1992).

[17] This table draws on content from Clarke et al. (2008) and Fuson (2004).

Subtask	The subtask contains...	...which measures...	...which is an important building block towards numeracy because...
One-to-One Correspondence	Ten rows of ten circles for the pupil to count	A pupil's ability to 1) recognize the items they need to count and 2) recognize and mentally flag the items that have already been counted	Counting strategies are an essential precursor to further and deeper mathematical knowledge and skills.
Number Identification	A set of numbers increasing in complexity from single digit to triple digit	A pupil's ability to identify the number-words associated with each written number with sufficient speed	Clear communication about numbers is essential for math learning. Understanding the number words contributes to place value awareness, which is a critical component of successful computation.
Quantity Discrimination	Ten pairs of numbers increasing in complexity from single to triple digit	A pupil's ability to judge which number is larger	Quantity discrimination demonstrates a critical link to an effective and efficient counting strategy for problem solving (Clarke et al. 2008).
Addition Level I	A set of 20 addition problems that increase in complexity to require carrying and involving two digit numbers	A pupil's ability to solve simple addition problems with sufficient speed	Addition I and Subtraction I reveal a pupil's fact fluency - how quickly and accurately they can recall basic facts. Performing well on fact fluency shows that the pupil has the building blocks to tackle increasingly complex computations.
Subtraction Level I	A set of 20 subtraction problems that increase in complexity to require borrowing and involving two digit numbers	A pupil's ability to solve simple subtraction problems with sufficient speed	
Addition Level II	A set of five addition problems that increase in complexity from adding a single and a double digit number together to adding two double digit numbers together	A pupil's ability to solve more complex addition problems	Addition II and Subtraction II reveal a pupil's understanding of the computation algorithm - if they can align face values and carry or borrow correctly. The understanding of computation and integration of methods, and practice with both, leads to "computational fluency," (Fuson 2004).
Subtraction Level II	A set of five subtraction problems that increase in complexity from subtracting a single digit number from a double digit number to subtracting a double digit number from another double digit number	A pupil's ability to solve more complex subtraction problems	

Figure A3. EGMA Subtask Descriptions Continued

Subtask	The subtask contains...	...which measures...	...which is an important building block towards numeracy because...
Word Problems	Five word problems involving basic addition and subtraction (read out loud to the pupil by the assessor)	A pupil's ability to select operations, and their ability to accurately solve the problem using the operation they selected.	The ability to correctly select an operation for a real world situation demonstrates a basic understanding of the meaning of the operation. This understanding is essential for more complicated applications as well as for basic algebraic thinking.
Multiplication	A set of 20 multiplication problems that increase in difficulty from fast facts to multiple digit problems	A pupil's ability to quickly answer multiplication facts and solve problems with standard computation	Multiplication fast facts and computation are essential for problem solving in geometry and algebra.
Division	A set of 20 division problems that increase in difficulty from fast facts to multiple digit problems	A pupil's ability to quickly answer division facts and do some long division	Division fast facts and computation are essential for problem solving in geometry and algebra.

School Management Survey Rubric

School Management Survey Rubric					
		Points:	0	1/2	1
Goal / Vision	Statement (2x)	Focused Statement	Unclear	Fuzzy	Clear
	Specific Focus (2 pts max)	Student's Future	No Mention	n/a	Mention
		Academic Excellence	No Mention	n/a	Mention
		Caring Environment	No Mention	n/a	Mention
		Community Asset	No Mention	n/a	Mention
	Teacher Buy In (2 pts max)	Attendance/ Show Up	No Mention	Mention	+ Measure / Monitor
		Effort / Work Hard	No Mention	Mention	+ Measure / Monitor
		Caring / Support	No Mention	Mention	+ Measure / Monitor
	Community Buy In (2 pts max)	Attendance/ Show Up	No Mention	Mention	+ Details
		High Expectations / Standards	No Mention	Mention	+ Details
		Celebrate / Support	No Mention	Mention	+ Details
	Manager Support (2 pts max)	Communication	No Mention	Mention	+ Details
		Physical Presence	No Mention	Mention	+ Details
		Resource Provision	No Mention	Mention	+ Details
Curriculum / Materials	Curriculum (2x)	Set Curriculum / Text	No Mention	Mention	+ Name / Details
		[If No] Credible Guidance	No Mention	Mention	+ Details
	Lesson Plan (2x)	Expected	No	n/a	Yes
		Reviewed >= 1 / Month	No Mention	Mention	+ Details
		Monitored	No Mention	Mention	+ Details

	Resources (2x)	Materials Available	No Mention	Mention	+ Details
Instruction	Teaching Methods	Expectations	No Mention	Mention	+ Details
		Development / Training	No Mention	Mention	+ Details
		Observation >= 1x / term	No Mention	Mention	+ Details
	Accountability	Daily Teacher Attendance	No Mention	Mention	+ Details
	Pupil Progress	Daily Pupil Attendance	No Mention	Mention	+ Details
		Teacher Monitoring	No Mention	Mention	+ Details
		School Monitoring	No Mention	Mention	+ Details
Parent Engagement	Progress Reporting	Parents aware of pupil progress	No Mention	Mention	+ Details
	Participation	Parent participation encouraged	No Mention	Mention	+ Details
	Training / Support	Instruction / guidance offered	No Mention	Mention	+ Details
Central Office Support	Manager	Knows how well school functions	No Mention	Mention	+ Details
		Intervenes when problems occur	No Mention	Mention	+ Details
		Builds principal's capacity	No Mention	Mention	+ Details

Teach Rubric

Elements from the Teach rubric are captured below. For more details on Teach, please visit the World Bank for the detailed training manual and training materials.

Item		Description	Responses	Notes
Time on Learning		**The teacher maximizes time on learning**		
	0.1	The teacher is teaching or provides a learning activity for most students	Yes/No	
	0.2	Students are on task	Low/Medium/High	N/A if 0.1 is No
Supportive Learning Environment		**The teacher creates a supportive learning environment**	**1 to 5**	
	1.1	The teacher treats all students respectfully	Low/Medium/High	
	1.2	The teacher uses positive language with students	Low/Medium/High	
	1.3	The teacher responds to students' needs	Low/Medium/High	N/A if no needs observed
	1.4	The teacher does not exhibit gender bias and challenges gender stereotypes in the classroom	Low/Medium/High	
Positive Behavioral Expectations		The teacher sets clear behavioral expectations for classroom activities	**1 to 5**	
	2.1	The teacher acknowledges positive student behavior	Low/Medium/High	
	2.2	The teacher redirects misbehavior and focuses on the expected behavior rather than the undesired behavior.	Low/Medium/High	
	2.3		Low/Medium/High	
Lesson Facilitation		**The teacher facilitates the lesson to promote comprehension**	**1 to 5**	
	3.1	The teacher explicitly articulates the lesson objectives and relates activities to the objectives	Low/Medium/High	
	3.2	The teacher's explanation of content is clear	Low/Medium/High	
	3.3	The teacher makes connections in the lesson that relate to other content knowledge or students' daily lives	Low/Medium/High	
	3.4	The teacher models by enacting or thinking aloud	Low/Medium/High	

Checks for Understanding		**The teacher checks for understanding for most students**	**1 to 5**	
	4.1	The teacher uses questions, prompts, or other strategies to determine students' level of understanding	Low/Medium/High	
	4.2	The teacher monitors most students during independent/group work	Low/Medium/High	N/A if no independent work
	4.3	The teacher adjusts teaching to the level of students	Low/Medium/High	
Feedback		**The teacher provides feedback to deepen understanding**	**1 to 5**	
	5.1	The teacher provides specific comments or prompts that help clarify students' misunderstandings	Low/Medium/High	
	5.2	The teacher provides specific comments or prompts that help identify students' successes	Low/Medium/High	
Critical Thinking		**The teacher builds students' critical thinking skills**	**1 to 5**	
	6.1	The teacher asks open-ended questions	Low/Medium/High	
	6.2	The teacher provides thinking tasks	Low/Medium/High	
	6.3	The students ask open-ended questions or perform thinking tasks	Low/Medium/High	

Time to Learn

Table 3. Time on Task: Attendance

	Attendance (P2 Girls)	Attendance (13v13)	Differential Impact on Girls Attendance
	(1) Partial	(2) Partial	(3) Partial
Treatment Impact on Attendance	0.07+	0.02	-0.01
	(0.04)	(0.03)	(0.02)
Treatment Differential Impact on Female Attendance			0.06
			(0.04)
Female			-0.06*
			(0.03)
Kindergarten		-0.05*	-0.05*
		(0.02)	(0.02)
Primary 5		0.00	0.00
		(0.02)	(0.01)
Constant	0.82**	0.92**	0.95**
	(0.04)	(0.02)	(0.02)
Number of Observations	442	1,200	1,200
R-squared	0.01	0.01	0.01

Table 4. Time on Task: Teach Measures

	Teacher Always Provides Learning Materials		Most Pupils Engaged All the Time	
	(1) Partial	(2) F.E.	(3) Partial	(4) F.E.
Treatment Impact on Teach	-0.015	0.014	0.091	0.149*
	(0.083)	(0.078)	(0.087)	(0.057)
Number of Students		-0.003		-0.010**
		(0.002)		(0.002)
Class Length		0.000		0.001+
		(0.000)		(0.000)
Primary 2		0.274*		-0.033
		(0.125)		(0.107)
Primary 5		0.356**		0.177
		(0.105)		(0.105)
Subject - Language		0.057		0.123
		(0.097)		(0.091)
Subject - Other		0.098		-0.555**
		(0.117)		(0.130)
Segment		0.019		-0.314**
		(0.078)		(0.069)
Constant	0.765**	0.561**	0.692**	0.915**
	(0.064)	(0.112)	(0.067)	(0.089)
Number of Observations	144	144	139	139
R-squared	0.000	0.191	0.011	0.367

The Learning Environment

Table 5. Learning Environment Regression Results

	Supportive Learning Environment		Positive Behavioral Expectations	
	(1) Partial	(2) Controls	(3) Partial	(4) Controls
Treatment Impact on Teach	0.333*	0.359**	0.925**	1.028**
	(0.132)	(0.111)	(0.252)	(0.182)
Number of Students		-0.006		-0.006
		(0.004)		(0.007)
Class Length		0.000		-0.000
		(0.000)		(0.001)
Primary 2		-0.042		0.023
		(0.193)		(0.297)
Primary 5		0.091		0.310
		(0.161)		(0.275)
Subject - Language		0.077		0.176
		(0.171)		(0.270)
Subject - Other		-0.724		-0.890*
		(0.483)		(0.367)
Segment		-0.102		-0.602**
		(0.099)		(0.162)
Constant	3.500**	3.653**	3.357**	3.513**
	(0.108)	(0.175)	(0.224)	(0.240)
Number of Observations	148	148	148	148
R-squared	0.064	0.238	0.152	0.407

Instructional Quality

Table 6. Instructional Quality Regression Results

	Lesson Facilitation		Teacher Checks for Understanding		Teacher provides feedback		Teacher builds students' critical thinking skills	
	(1) Partial	(2) Controls	(3) Partial	(4) Controls	(5) Partial	(6) Controls	(7) Partial	(8) Controls
Treatment Impact on Teach	-0.012	0.096	-0.141	-0.038	-0.167	-0.052	-0.196	-0.184
	(0.164)	(0.138)	(0.239)	(0.213)	(0.292)	(0.274)	(0.163)	(0.111)
Number of Students		-0.008		-0.020**		-0.017**		-0.011*
		(0.007)		(0.007)		(0.006)		(0.005)
Class Length		-0.001		-0.001+		-0.002+		0.000
		(0.001)		(0.001)		(0.001)		(0.000)
Primary 2		0.168		0.586+		0.373		0.400+
		(0.229)		(0.303)		(0.316)		(0.206)
Primary 5		0.191		0.482		0.315		0.511**
		(0.225)		(0.286)		(0.308)		(0.185)
Subject - Language		0.210		-0.026		-0.283		0.147
		(0.177)		(0.248)		(0.187)		(0.159)
Subject - Other		-0.964		-1.430**		-0.317		0.244
		(0.657)		(0.342)		(0.615)		(0.174)
Segment		-0.926**		-0.071				
		(0.196)		(0.191)				
Constant	3.114**	3.469**	3.000**	3.286**	2.129**	2.535**	1.914**	1.741**
	(0.102)	(0.218)	(0.198)	(0.321)	(0.246)	(0.279)	(0.147)	(0.161)
Number of Observations	148	148	148	148	148	148	148	148
R-squared	0.000	0.306	0.004	0.221	0.004	0.170	0.015	0.269

EGRA/EGMA Zero Score Reduction - Primary 2 Girls

Table 7. Zero Score Reduction EGRA

	Letter Sounds		Onset Sounds		Non-word Reading		Familiar Word Reading		Passage Fluency		Reading Comprehension	
	(1) Partial	(2) Full	(3) Partial	(4) Full	(5) Partial	(6) Full	(7) Partial	(8) Full	(9) Partial	(10) Full	(9) Partial	(10) Full
Treatment Impact on Zero Scores	-0.10	-0.12	-0.03	-0.04	-0.00	0.00	-0.04	-0.03	-0.05	-0.06	-0.01	-0.02
	(0.08)	(0.07)	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.07)	(0.07)	(0.04)	(0.04)
Baseline Performance	0.31**	0.31**	0.06	0.06	0.64**	0.64**	0.44**	0.42**	0.42**	0.40**	0.72**	0.69**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)
Child Age		0.02		-0.00		0.03*		0.02		0.04*		0.02+
		(0.01)		(0.01)		(0.01)		(0.01)		(0.02)		(0.01)
Home Language English		-0.02		0.05		0.01		0.02		0.01		-0.01
		(0.06)		(0.04)		(0.04)		(0.04)		(0.06)		(0.03)
Child Had Lunch Yesterday		-0.12		-0.34+		-0.08		0.04		-0.20		-0.22
		(0.16)		(0.17)		(0.06)		(0.04)		(0.28)		(0.19)
Child Had Dinner Yesterday		0.11		0.09		0.15		0.03		-0.01		-0.07
		(0.12)		(0.09)		(0.12)		(0.07)		(0.14)		(0.07)
Child Had Breakfast this Morning		-0.01		0.02		-0.03		0.06		0.06		-0.04
		(0.09)		(0.05)		(0.04)		(0.04)		(0.09)		(0.06)
Constant	0.20**	0.22	0.21**	0.52*	0.25**	0.05	0.07+	-0.24	0.22**	0.11	0.21**	0.48+
	(0.05)	(0.27)	(0.04)	(0.22)	(0.05)	(0.17)	(0.04)	(0.16)	(0.05)	(0.34)	(0.06)	(0.25)
Number of Observations	380	362	379	361	379	361	378	361	378	360	380	362
R-squared	0.12	0.15	0.01	0.03	0.38	0.42	0.28	0.27	0.18	0.20	0.42	0.41

Table 8. Zero Score Reduction EGMA

	Quantity Discrimination		Addition 1		Addition 2		Subtraction 1		Subtraction 2		Word Problems	
	(1) Partial	(2) Full	(3) Partial	(4) Full	(5) Partial	(6) Full	(7) Partial	(8) Full	(9) Partial	(10) Full	(11) Partial	(12) Full
Treatment Impact on EGRA Scores	-0.00	-0.00	0.01	0.01	-0.18*	-0.16*	-0.07	-0.06	-0.14+	-0.15*	-0.12+	-0.11+
	(0.02)	(0.02)	(0.04)	(0.04)	(0.07)	(0.07)	(0.05)	(0.05)	(0.07)	(0.08)	(0.06)	(0.06)
Baseline Performance	0.21	0.11	0.31**	0.31**	0.30**	0.30**	0.32**	0.34**	0.30**	0.31**	0.20**	0.18**
	(0.14)	(0.12)	(0.09)	(0.09)	(0.05)	(0.05)	(0.06)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)
Child Age		-0.00		0.00		0.00		-0.01		-0.03		0.02
		(0.00)		(0.01)		(0.02)		(0.01)		(0.02)		(0.01)
Home Language English		0.00		0.02		0.06		0.01		-0.02		-0.05
		(0.01)		(0.04)		(0.05)		(0.04)		(0.06)		(0.05)
Child Had Lunch Yesterday		0.01		0.04		0.06		-0.39**		-0.36**		0.25**
		(0.01)		(0.03)		(0.22)		(0.12)		(0.09)		(0.08)
Child Had Dinner Yesterday		0.01		0.00		0.02		0.20*		-0.01		-0.08
		(0.01)		(0.07)		(0.11)		(0.08)		(0.14)		(0.13)
Child Had Breakfast this Morning		0.02+		-0.00		0.05		0.12*		0.05		0.06
		(0.01)		(0.07)		(0.07)		(0.06)		(0.09)		(0.09)
EGMA Conducted in English	0.02	-0.01	0.04	0.01	0.30**	0.11	0.14**	0.47*	0.38**	0.97**	0.26**	-0.03
	(0.01)	(0.05)	(0.03)	(0.15)	(0.07)	(0.32)	(0.03)	(0.22)	(0.06)	(0.25)	(0.05)	(0.24)
Constant	0.02	-0.01	0.04	0.01	0.30**	0.11	0.14**	0.47*	0.38**	0.97**	0.26**	-0.03
	(0.01)	(0.05)	(0.03)	(0.15)	(0.07)	(0.32)	(0.03)	(0.22)	(0.06)	(0.25)	(0.05)	(0.24)
Number of Observations	380	362	378	360	378	360	378	360	377	359	378	360
R-squared	0.05	0.02	0.15	0.15	0.13	0.13	0.14	0.19	0.10	0.12	0.07	0.07

Table 9. EGRA/EGMA Differential Attrition by Subtask

	Letter Sounds	Onset Sounds	Non-word Reading	Familiar Word Reading	Passage Fluency	Reading Comp.	Quantity Disc.	Addition 1	Addition 2	Subtraction 1	Subtraction 2	Word Problems
	(1) Partial	(2) Partial	(3) Partial	(4) Partial	(5) Partial	(6) Partial	(7) Partial	(8) Partial	(9) Partial	(10) Partial	(11) Partial	(12) Partial
Differential Impact on Attrition	-0.00	0.21	-0.00	-0.00	-0.00	-0.34+	0.16	0.01	0.10	0.01	0.05	0.32+
	(0.00)	(0.14)	(0.00)	(0.00)	(0.00)	(0.18)	(0.11)	(0.01)	(0.10)	(0.01)	(0.15)	(0.16)
Baseline Performance	0.00	-0.12	-0.00	-0.00	-0.00	0.10	-0.18*	-0.01+	-0.18*	-0.02*	-0.13	-0.30*
	(0.00)	(0.11)	(0.00)	(0.00)	(0.00)	(0.16)	(0.09)	(0.01)	(0.08)	(0.01)	(0.12)	(0.14)
Treatment Impact on Attrition	-0.05	-0.12*	-0.06	-0.05	-0.05	-0.04	-0.16+	-0.12	-0.08	-0.10+	-0.07	-0.12+
	(0.05)	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)	(0.09)	(0.07)	(0.05)	(0.06)	(0.05)	(0.06)
Constant	0.18**	0.21**	0.18**	0.19**	0.19**	0.17**	0.29**	0.23**	0.22**	0.23**	0.20**	0.23**
	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.07)	(0.06)	(0.04)	(0.05)	(0.04)	(0.06)
Number of Observations	442	441	441	442	442	442	442	441	441	441	441	441
R-squared	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.02

EGRA/EGMA Differential Growth by Subtask

Table 10: EGRA Differential Growth by Subtask, Grade and Sample

		EKOEXCEL			Control			Difference in Difference
		Baseline	Midline	Difference	Baseline	Midline	Difference	
Listening Comprehension	KG (13v13)	7.5%	15.7%	8.2%	8.2%	11.5%	3.3%	4.8%
Letter Sounds	KG (13v13)	0.5	3.2	2.8	0.6	1.2	0.6	2.2
Letter Sounds	P2 Girls (26v26)	6.0	14.5	8.5	7.2	10.9	3.6	4.9
Letter Sounds	P2 (13v13)	6.3	14.9	8.5	4.7	8.4	3.7	4.8
Onset Sounds	KG (13v13)	21%	24%	3.0%	18%	25%	6.7%	-3.7%
Onset Sounds	P2 Girls (26v26)	29%	34%	5.4%	30%	30%	0.2%	5.1%
Onset Sounds	P2 (13v13)	27%	32%	5.0%	26%	30%	3.4%	1.6%
Non-word Reading	KG (13v13)	0.0	0.1	0.0	0.3	0.5	0.2	-0.1
Non-word Reading	P2 Girls (26v26)	2.9	4.3	1.4	2.7	2.9	0.2	1.1
Non-word Reading	P2 (13v13)	3.9	4.9	1.0	1.7	2.2	0.4	0.6
Familiar Word Reading	KG (13v13)	0.2	0.4	0.1	0.7	1.2	0.5	-0.4
Familiar Word Reading	P2 Girls (26v26)	8.3	12.0	3.7	8.3	9.7	1.4	2.3
Familiar Word Reading	P2 (13v13)	9.8	13.1	3.3	5.8	7.2	1.4	1.9
Passage Fluency 1	P2 Girls (26v26)	9.8	13.7	3.8	9.7	12.0	2.3	1.5
Passage Fluency 1	P2 (13v13)	11.3	15.1	3.8	6.4	7.9	1.5	2.3
Passage Fluency 1	P5 (13v13)	56.1	65.3	9.2	50.2	59.7	9.4	-0.3
Reading Comprehension 1	P2 Girls (26v26)	5%	7%	2.3%	5%	6%	0.8%	1.4%
Reading Comprehension 1	P2 (13v13)	6%	7%	1.3%	2%	4%	1.8%	-0.6%
Reading Comprehension 1	P5 (13v13)	30%	37%	6.9%	27%	33%	5.7%	1.2%
Passage Fluency 2	P5 (13v13)	38.6	45.5	6.9	34.3	41.7	7.4	-0.5
Reading Comprehension 2	P5 (13v13)	8%	11%	3%	6%	10%	4%	-0.7%

Table 11: EGMA Differential Growth by Subtask, Grade and Sample

		EKOEXCEL			Control			Difference in Difference
		Baseline	Midline	Difference	Baseline	Midline	Difference	
One-to-One Correspondence	KG (13v13)	25.9	35.7	9.8	29.5	32.7	3.1	6.6
Number Identification	KG (13v13)	4.6	5.8	1.2	5.1	5.8	0.7	0.6
Quantity Discrimination	KG (13v13)	22%	34%	12%	21%	28%	7%	5.2%
Quantity Discrimination	P2 - Girls (26v26)	67%	71%	5%	63%	68%	5%	-0.5%
Quantity Discrimination	P2 (13v13)	67%	74%	7%	65%	71%	6%	0.3%
Addition Level 1	KG (13v13)	0.6	1.7	1.1	1.3	1.0	-0.3	1.4
Addition Level 1	P2 - Girls (26v26)	5.9	7.1	1.2	5.5	6.0	0.6	0.6
Addition Level 1	P2 (13v13)	6.0	6.6	0.6	5.4	6.1	0.7	-0.1
Addition Level 2	P2 - Girls (26v26)	27%	35%	8%	23%	24%	1%	7.1%
Addition Level 2	P2 (13v13)	28%	32%	3%	24%	26%	2%	1.3%
Addition Level 2	P5 (13v13)	67%	73%	6%	63%	68%	4%	1.9%
Subtraction Level 1	P2 - Girls (26v26)	3.6	5.7	2.2	3.7	4.7	1.0	1.2
Subtraction Level 1	P2 (13v13)	3.7	4.9	1.3	3.6	4.5	0.9	0.3
Subtraction Level 2	P2 - Girls (26v26)	15%	23%	9%	15%	17%	2%	6.5%
Subtraction Level 2	P2 (13v13)	15%	21%	7%	13%	17%	4%	2.4%
Subtraction Level 2	P5 (13v13)	47%	58%	11%	45%	48%	3%	7.8%
Word Problems	P2 - Girls (26v26)	21%	27%	6%	20%	23%	2%	3.8%
Word Problems	P2 (13v13)	22%	26%	4%	19%	24%	5%	-0.7%
Word Problems	P5 (13v13)	47%	54%	7%	45%	55%	10%	-2.1%
Multiplication	P5 (13v13)	2.4	2.6	0.2	2.2	2.7	0.5	-0.3
Division	P5 (13v13)	1.6	1.8	0.2	1.2	1.5	0.3	-0.1

EGRA/EGMA Regression Results - Primary 2 Girls

Table 12. EGRA Results for Primary 2 Girls

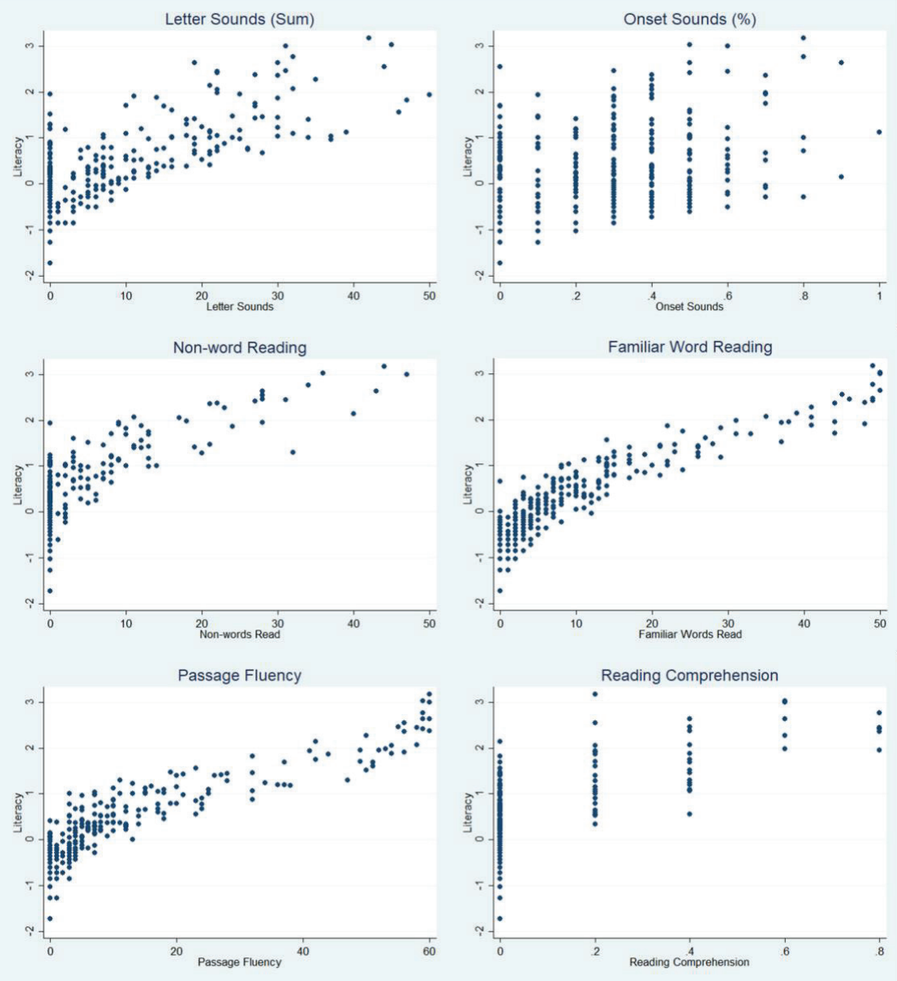
	Letter Sounds		Onset Sounds		Non-word Reading		Familiar Word Reading		Passage Fluency		Reading Comprehension	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(9)	(10)
	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full
Treatment Impact on EGRA Scores	4.52**	5.00**	0.04	0.05	1.14*	1.17*	2.23**	2.12**	1.55+	1.78*	0.01	0.02
	(1.66)	(1.61)	(0.03)	(0.03)	(0.55)	(0.51)	(0.65)	(0.67)	(0.90)	(0.88)	(0.01)	(0.01)
Baseline Performance	1.27**	1.45**	0.08	0.05	1.56**	1.63**	1.01**	0.95**	1.05**	1.02**	1.92**	1.72**
	(0.39)	(0.40)	(0.26)	(0.26)	(0.34)	(0.36)	(0.17)	(0.16)	(0.18)	(0.18)	(0.63)	(0.63)
Baseline Squared	-0.00	-0.01	-0.25	-0.15	-0.03	-0.04	0.01	0.01	0.01	0.01	-3.86	-3.08
	(0.03)	(0.03)	(0.90)	(0.91)	(0.02)	(0.03)	(0.01)	(0.01)	(0.00)	(0.01)	(2.44)	(2.51)
Baseline Cubed	-0.00	-0.00	0.65	0.55	0.00	0.00	-0.00	-0.00	-0.00+	-0.00*	3.17	2.49
	(0.00)	(0.00)	(0.80)	(0.82)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(2.15)	(2.26)
Child Age		-0.27		-0.00		-0.23		-0.11		-0.20		-0.01*
		(0.31)		(0.01)		(0.15)		(0.24)		(0.26)		(0.00)
Attended ECD		4.16*		0.03		1.67*		0.43		0.28		0.01
		(1.76)		(0.04)		(0.65)		(0.66)		(1.17)		(0.01)
Home Language English		1.11		0.02		-0.38		0.32		-0.55		0.01
		(1.30)		(0.02)		(0.62)		(0.54)		(0.82)		(0.01)
Child Had Lunch Yesterday		6.72*		0.18**		0.52		3.23+		4.52		0.08
		(2.53)		(0.05)		(0.92)		(1.71)		(3.00)		(0.06)
Child Had Dinner Yesterday		-1.61		-0.03		-1.60		-2.82		-1.10		-0.01
		(3.28)		(0.06)		(1.52)		(2.73)		(1.96)		(0.04)
Child Had Breakfast this Morning		-0.02		-0.03		-0.21		1.12		0.73		0.02
		(1.83)		(0.04)		(0.87)		(0.87)		(1.56)		(0.02)
Constant	3.12**	-4.38	0.27**	0.12	-0.16	1.68	0.61	-0.40	0.57	-1.78	0.01	-0.03
	(1.05)	(4.94)	(0.03)	(0.13)	(0.29)	(1.71)	(0.55)	(3.04)	(0.59)	(4.27)	(0.01)	(0.07)
Number of Observations	380	362	379	361	379	361	378	361	378	360	380	362
R-squared	0.52	0.54	0.06	0.07	0.74	0.76	0.88	0.88	0.89	0.89	0.59	0.60

Table 13. EGMA Results for Primary 2 Girls

	Quantity Discrimination		Addition 1		Addition 2		Subtraction 1		Subtraction 2		Word Problems	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full
Treatment Impact on EGRA Scores	0.01	0.01	0.72	0.53	0.09*	0.09*	1.14*	1.22**	0.07+	0.07*	0.04	0.04
	(0.02)	(0.02)	(0.56)	(0.51)	(0.04)	(0.04)	(0.48)	(0.44)	(0.04)	(0.03)	(0.03)	(0.03)
Baseline Performance	0.27	0.01	1.15**	1.17**	0.46	0.28	0.47+	0.56*	1.31**	1.27**	0.74*	0.65*
	(0.55)	(0.54)	(0.23)	(0.22)	(0.29)	(0.32)	(0.25)	(0.25)	(0.46)	(0.45)	(0.28)	(0.30)
Baseline Squared	0.40	0.87	-0.11*	-0.12**	-0.26	0.21	0.02	0.01	-2.91*	-2.77+	-1.76	-1.39
	(1.07)	(1.05)	(0.04)	(0.04)	(0.96)	(1.03)	(0.05)	(0.05)	(1.44)	(1.38)	(1.13)	(1.17)
Baseline Cubed	-0.14	-0.39	0.01*	0.01**	0.23	-0.05	-0.00	-0.00	2.00+	1.87+	1.54	1.13
	(0.62)	(0.60)	(0.00)	(0.00)	(0.76)	(0.82)	(0.00)	(0.00)	(1.09)	(1.04)	(1.07)	(1.09)
Child Age		0.02*		0.04		0.00		0.17		0.02+		0.01
		(0.01)		(0.13)		(0.01)		(0.13)		(0.01)		(0.01)
Home Language English		0.02		-0.50		-0.03		-0.15		-0.00		0.04+
		(0.02)		(0.52)		(0.03)		(0.49)		(0.04)		(0.02)
Child Had Lunch Yesterday		-0.07		-2.30*		-0.19		2.08*		0.02		0.02
		(0.08)		(0.96)		(0.19)		(0.98)		(0.10)		(0.06)
Child Had Dinner Yesterday		-0.04		0.61		0.04		-0.86		-0.02		0.02
		(0.04)		(0.68)		(0.08)		(1.29)		(0.07)		(0.06)
Child Had Breakfast this Morning		0.01		0.00		0.03		-0.77		0.03		-0.03
		(0.03)		(0.62)		(0.05)		(0.70)		(0.04)		(0.05)
EGMA Conducted in English		-0.06+		1.14		0.13**		2.08**		0.14**		-0.03
		(0.03)		(0.82)		(0.04)		(0.61)		(0.03)		(0.08)
Constant	0.38**	0.38**	2.37**	3.72+	0.15**	0.10	2.66**	-1.89	0.11**	-0.25	0.16**	0.10
	(0.09)	(0.14)	(0.49)	(1.89)	(0.03)	(0.14)	(0.46)	(1.94)	(0.03)	(0.15)	(0.03)	(0.15)
Number of Observations	380	361	378	359	378	359	378	360	377	359	378	360
R-squared	0.39	0.40	0.33	0.34	0.17	0.19	0.24	0.28	0.12	0.15	0.08	0.09

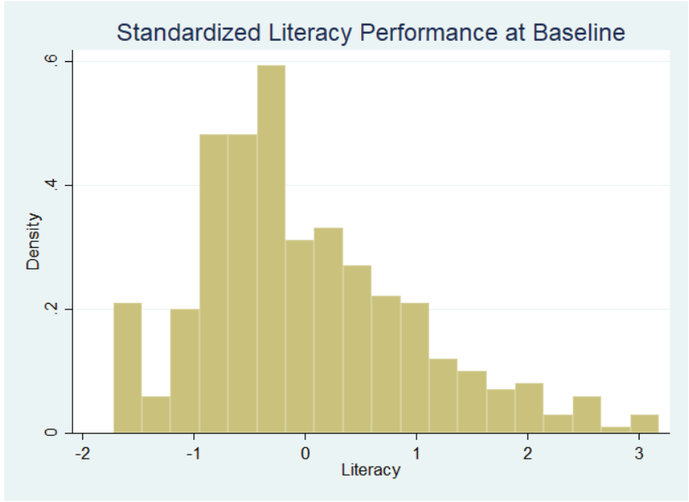
Estimating Literacy and Numeracy - An IRT Approach

Literacy

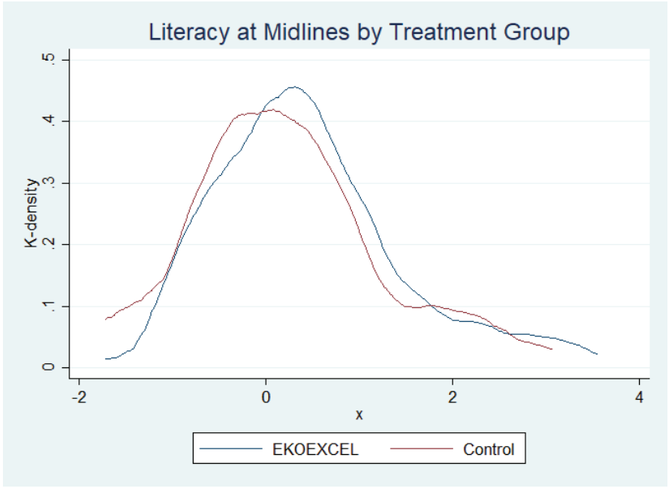


Using the matched sample of P2 girls, we look at all 276 (100 letter sounds, 10 onset sounds, 50 non-words, 50 familiar words, 61 words in a passage, and 5 reading comprehension questions) items that could be attempted by a student. We remove any items that were completely missed at the baseline, resulting in a total of 227 literacy items. For these 227 literacy items, we fit a one-parameter IRT model (which calculates difficulty of the item based on the overall group performance but does not calculate the item's discrimination) and then calculate individual latent abilities based on performance on all literacy items. The figure above shows the relationship between each subtask total (x-axis) and the literacy score (y-axis).

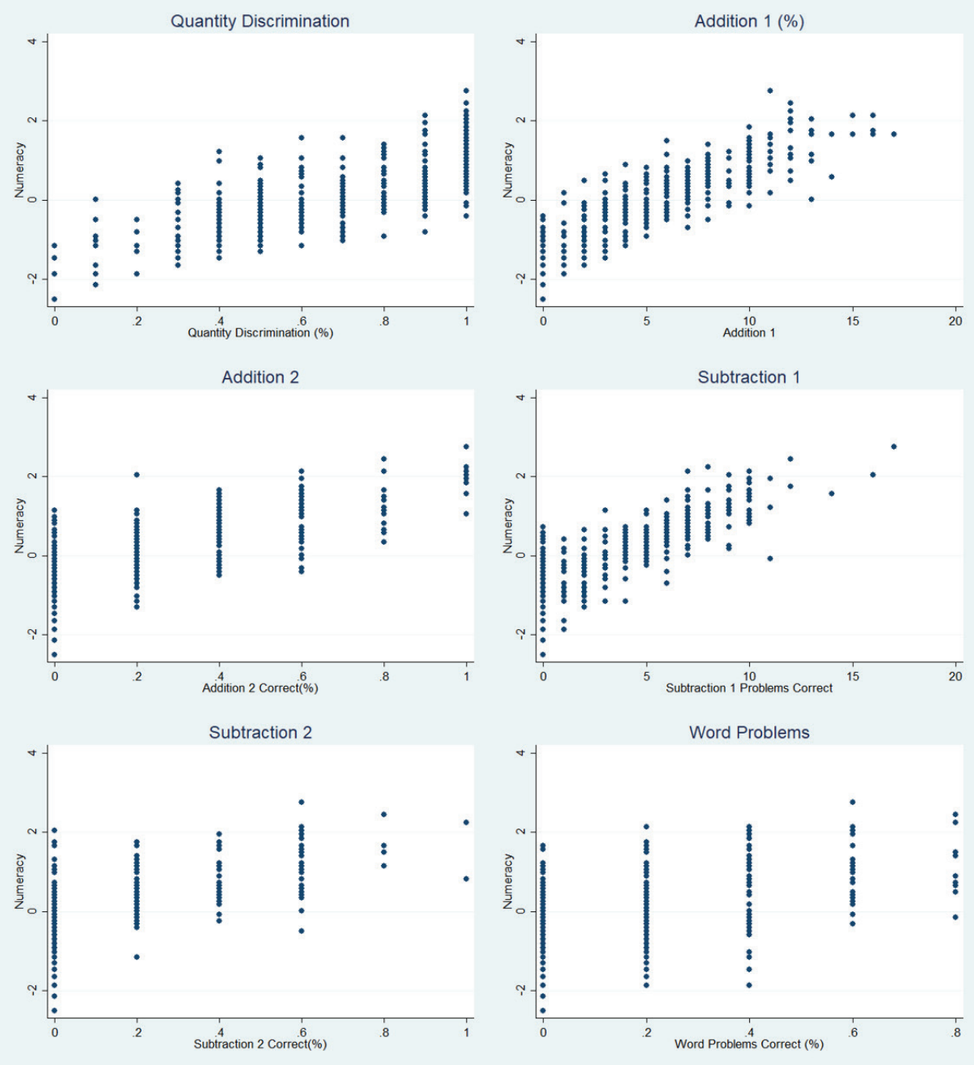
The resulting literacy score is a standardized value (mean of zero and standard deviation of 1) ranging between -1.72 and 3.18. This method addresses the preponderance of zero scores at the baseline, although our final literacy estimate still has 5% of pupils bucketed into the lowest category (as they scored zero on every item) and the distribution is right skewed.



We then use these estimates to predict the latent literacy score of the control and treatment groups at the midline. Below, we show the distribution of treatment and control endline literacy scores in a kdensity chart; we see the distribution has shifted to the right.

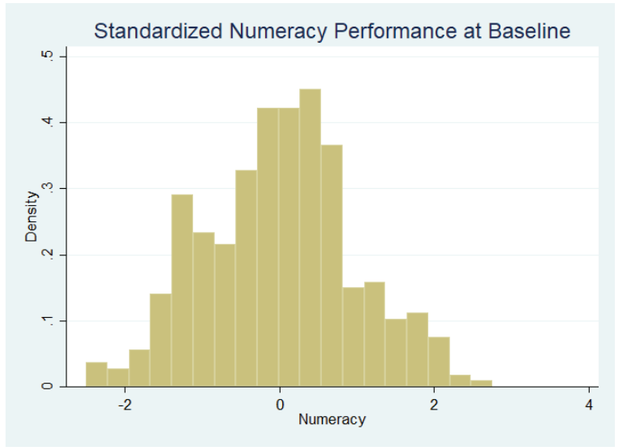


Numeracy



Using the matched sample of P2 girls, we look at all 65 (10 quantity discrimination problems, 20 addition level one, 5 addition level two, 20 subtraction level one, 5 subtraction level two, and 5 word problems) items that could be attempted by a student. We remove any items that were completely missed at the baseline, resulting in a total of 63 numeracy items. For these 63 numeracy items, we fit a one-parameter IRT model (which calculates difficulty of the item based on the overall group performance but does not calculate the item's discrimination) and then calculate individual latent abilities based on performance on all numeracy items. The figure above shows the relationship between each subtask total (x-axis) and the numeracy score (y-axis).

The resulting numeracy score is a standardized value (mean of zero and standard deviation of 1) ranging between -2.50 and 2.75. This method addresses the preponderance of zero scores at the baseline, and only 1% of the pupils scored zero on every question across subtasks.



We then use these estimates to predict the latent literacy score of the control and treatment groups at the midline. Below, we show the distribution of treatment and control endline numeracy scores in a kdensity chart; we see the distribution has shifted to the right.

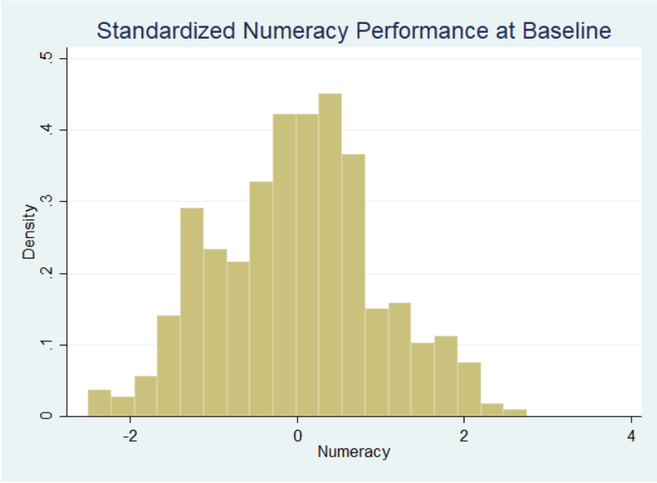


Table 14. IRT Regression Results Literacy and Numeracy

	Literacy		Numeracy	
	(1) Partial	(2) Full	(3) Partial	(4) Full
Treatment Impact on Standardized Scores	0.26*	0.27**	0.25*	0.25*
	(0.10)	(0.10)	(0.10)	(0.10)
Baseline Performance	0.86**	0.86**	0.72**	0.71**
	(0.04)	(0.04)	(0.04)	(0.04)
Child Age		0.01		0.03
		(0.02)		(0.02)
Home Language English		-0.03		-0.05
		(0.08)		(0.10)
Child Had Lunch Yesterday		0.45*		-0.26
		(0.17)		(0.25)
Child Had Dinner Yesterday		-0.07		0.02
		(0.20)		(0.20)
Child Had Breakfast this Morning		0.02		-0.04
		(0.09)		(0.13)
Constant	0.18*	-0.49	0.19*	0.13
	(0.07)	(0.31)	(0.07)	(0.35)
Number of Observations	380	377	380	377
R-squared	0.69	0.69	0.51	0.51

Robust standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

EGRA/EGMA Standardized Results - Primary 2 Girls

Table 15. Standardized EGRA Results

	Letter Sounds *Sounds per Minute*		Onset Sounds *% Correct*		Non-word Reading *Sounds per Minute*		Familiar Word Reading *Words per Minute*		Passage Fluency *Words per Minute*		Reading Comp. *Percent Correct*	
	(1) Partial	(2) Full	(3) Partial	(4) Full	(5) Partial	(6) Full	(7) Partial	(8) Full	(9) Partial	(10) Full	(9) Partial	(10) Full
Treatment Impact on EGRA Scores	0.44**	0.48**	0.20	0.24+	0.16*	0.16*	0.17**	0.16**	0.08	0.09+	0.07	0.10
	(0.16)	(0.15)	(0.14)	(0.14)	(0.07)	(0.07)	(0.05)	(0.05)	(0.05)	(0.05)	(0.08)	(0.09)
Baseline Performance	1.24**	1.28**	0.10	0.10	1.39**	1.42**	1.14**	1.10**	1.16**	1.16**	1.58**	1.45**
	(0.14)	(0.16)	(0.10)	(0.10)	(0.23)	(0.24)	(0.06)	(0.06)	(0.10)	(0.10)	(0.43)	(0.42)
Baseline Squared		-0.03		0.00		-0.03		-0.01		-0.01		-0.05*
		(0.03)		(0.04)		(0.02)		(0.02)		(0.01)		(0.02)
Baseline Cubed		0.12		0.07		-0.04		0.03		-0.03		0.04
		(0.12)		(0.10)		(0.08)		(0.04)		(0.04)		(0.08)
Child Age		0.64**		0.85**		0.07		0.24+		0.24		0.57
		(0.24)		(0.22)		(0.12)		(0.13)		(0.16)		(0.41)
Home Language English		-0.15		-0.16		-0.22		-0.21		-0.06		-0.08
		(0.31)		(0.30)		(0.21)		(0.20)		(0.11)		(0.29)
Child Had Lunch Yesterday		0.00		-0.13		-0.03		0.08		0.04		0.12
		(0.17)		(0.17)		(0.12)		(0.07)		(0.08)		(0.11)
Child Had Dinner Yesterday	0.47**	-0.17	-0.03	-0.78	0.16+	0.44+	0.09+	-0.01	0.09	-0.03	0.33+	0.00
	(0.14)	(0.44)	(0.12)	(0.60)	(0.09)	(0.25)	(0.05)	(0.22)	(0.06)	(0.23)	(0.19)	(0.48)
Child Had Breakfast this Morning	386.00	367.00	385.00	366.00	385.00	366.00	384.00	366.00	384.00	365.00	386.00	367.00
	0.51	0.53	0.06	0.07	0.74	0.76	0.88	0.88	0.89	0.89	0.59	0.60
Constant	3.10**	-4.25	0.27**	0.11	-0.16	1.75	0.61	-0.33	0.56	-1.46	0.01	-0.03
	(1.05)	(4.85)	(0.03)	(0.13)	(0.29)	(1.70)	(0.55)	(3.04)	(0.59)	(4.29)	(0.01)	(0.07)
Number of Observations	386	367	385	366	385	366	384	366	384	365	386	367
R-squared	0.51	0.53	0.06	0.07	0.74	0.76	0.88	0.88	0.89	0.89	0.59	0.60

Table 16. Standardized EGMA Scores

	Quantity Disc. *% Correct*		Addition 1 *Questions / Minute*		Addition 2 *% Correct*		Sub. 1 *Questions / Minute*		Sub. 2 % Correct		Word Problems *% Correct*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(10)	(11)
	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full
Treatment Impact on EGRA Scores	0.04	0.05	0.17	0.11	0.32*	0.30*	0.31*	0.31*	0.27+	0.28+	0.19	0.18
	(0.08)	(0.08)	(0.14)	(0.13)	(0.15)	(0.15)	(0.13)	(0.12)	(0.16)	(0.16)	(0.15)	(0.15)
Baseline Performance	0.60**	0.62**	0.43**	0.39**	0.38**	0.38**	0.57**	0.59**	0.61**	0.60**	0.21*	0.22**
	(0.08)	(0.08)	(0.09)	(0.08)	(0.10)	(0.10)	(0.08)	(0.07)	(0.13)	(0.13)	(0.08)	(0.08)
Baseline Squared	0.05	0.04	-0.05	-0.05	0.00	0.02	0.04	0.00	-0.47*	-0.47*	-0.15	-0.13
	-0.05	-0.05	-0.04	-0.04	-0.11	-0.11	-0.09	-0.09	-0.22	-0.21	-0.1	-0.1
Baseline Cubed	0.00	-0.02	0.09*	0.09**	0.01	0.01	-0.02	-0.01	0.10+	0.10+	0.06	0.04
	-0.05	-0.05	-0.03	-0.03	-0.05	-0.06	-0.03	-0.03	-0.05	-0.05	-0.05	-0.05
Child Age		0.07**		0.00		0.00		0.04		0.07		0.02
		(0.02)		(0.03)		(0.04)		(0.04)		(0.05)		(0.04)
Home Language English		0.02		-0.08		-0.05		0.04		0.08		0.21+
		(0.07)		(0.13)		(0.12)		(0.13)		(0.16)		(0.12)
Child Had Lunch Yesterday		-0.25		-0.63*		-0.77		0.54+		0.06		0.10
		(0.29)		(0.25)		(0.70)		(0.28)		(0.45)		(0.29)
Child Had Dinner Yesterday		-0.15		0.15		0.13		-0.26		-0.12		0.08
		(0.15)		(0.18)		(0.27)		(0.34)		(0.28)		(0.30)
Child Had Breakfast this Morning		0.02		0.00		0.13		-0.20		0.16		-0.16
		(0.10)		(0.17)		(0.20)		(0.20)		(0.19)		(0.23)
EGMA Conducted in English	0.11	-0.24	0.16	0.83+	0.00	0.33	0.26*	-0.36	0.43*	-0.47	0.22+	-0.15
	(0.07)	(0.38)	(0.11)	(0.46)	(0.13)	(0.59)	(0.12)	(0.55)	(0.19)	(0.75)	(0.13)	(0.63)
Constant	0.11	-0.24	0.16	0.83+	0.00	0.33	0.26*	-0.36	0.43*	-0.47	0.22+	-0.15
	(0.07)	(0.38)	(0.11)	(0.46)	(0.13)	(0.59)	(0.12)	(0.55)	(0.19)	(0.75)	(0.13)	(0.63)
Number of Observations	386	367	384	365	384	365	384	365	383	364	384	365
R-squared	0.39	0.39	0.33	0.33	0.17	0.18	0.23	0.26	0.12	0.13	0.08	0.08

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