



Global Learning XPRIZE Field Test Data Report **Kitkit School**

An in-depth data brief, analyzing the effects of Kitkit School, a digital early learning solution and competition co-winner, over the course of the 15-month field test in remote villages in Tanzania

The Global Learning XPRIZE catalyzed breakthrough technology solutions that enable children in developing countries to learn basic reading, writing, and arithmetic



Across the world, over 250 million children cannot read, write, or demonstrate basic arithmetic skills (UNESCO, 2014). About one in every five children are out of school and the number has barely changed over the past five years (2018). Additionally, research shows that the world must recruit 68.8 million teachers to provide every child with primary and secondary education by 2030 (2019). While a multitude of programs exist to stem the challenges, they cannot scale fast enough to meet demand.

To help solve this problem, the XPRIZE Foundation launched a global competition in 2014 that challenged teams around the globe to develop effective, scalable solutions that enable children to teach themselves basic reading, writing, and arithmetic within 15 months. Over 400 teams from 40 countries responded to the call.

In September 2017, five finalists were selected and, from December 2017 to March 2019, those solutions were brought to 170 remote villages in Tanzania with the support of implementation partners UNESCO and the World Food Programme, as well as government and local community leaders.

This report examines the Global Learning XPRIZE Dataset published by XPRIZE to understand the effects of grand prize winner **Kitkit School**.

Global Learning XPRIZE Randomized Controlled Trial Field Test

 **15**
MONTHS

 **170 remote**
Tanzanian
Villages

 **2700**
CHILDREN
AGES 7-11

CONTROL GROUP OF
361 IN **30**
CHILDREN IN VILLAGES



About Kitkit School by Enuma, Inc.

Kitkit School, developed by Enuma, Inc., is designed to provide children with the foundations and practice needed to build fundamental skills in literacy and math. It is a self-directed, tablet-based learning suite with a comprehensive curriculum that spans pre-kindergarten to 3rd grade, with over 2,200 interactive educational activities. The breakthrough platform includes a game-based Learning App, library of hundreds of books, videos, and songs, and a collection of digital learning tools for support and self-expression.

With the needs of children, including those with special needs or without access to resources, at the core of their work, the Enuma team uses user experience and accessible design to deeply engage early learners while helping them gain confidence in early literacy, math, and beyond.

To learn more, visit www.kitkitschool.com

About XPRIZE

XPRIZE designs and operates incentive-based competitions to solve humanity's grand challenges. Founded in 1995 by Peter Diamandis, XPRIZE uses gamification, crowdsourcing, and incentive prize theory to provide incentives for high-profile competitions that bring about radical breakthroughs across all disciplines to develop innovative ideas and technologies.

The XPRIZE Foundation has awarded more than \$140 million across competitions in subjects including spaceflight, health, energy, and education with the launch of the five-year-long Global Learning XPRIZE competition.

To learn more, visit <http://www.xprize.org>

DATA COLLECTION

The published Global Learning XPRIZE dataset contains data collected during the 15-month field test in Tanzania from December 2017 to March 2019. The participating children were divided into 5 treatment groups and one control group. Each treatment cohort used tablets with the learning software developed by one of the five Global Learning XPRIZE finalist teams, while the control group did not use any tablets.

Assessment Tools

- Early Grade Reading Assessment (EGRA)
- Early Grade Mathematics Assessment (EGMA)

Field Test Procedure

- The baseline was conducted in August 2017 and the endline in March 2019
- Randomized controlled trial
 - 421 students from 29 villages (sites 57-85) comprised the Kitkit School treatment group
 - A total of 2,041 participants from 168 villages were used for the assessment, with 30 villages assigned to control

Participants

- Self-Reported Age of Participants
 - Less than 9 - 8%
 - 9 years - 39%
 - 10 years - 29%
 - 11 years - 22%
- 74% of the children reported as never attending school at baseline
- 80% of the children reported as never being read to at home at baseline

The analysis herein shows outcomes comparing the control group to the Kitkit School treatment groups combined.

KITKIT SCHOOL'S RESULTS

Over the course of the 15-month field test, the total Kitkit school playtime was 1,197 hours (average 285 hours per pupil). Among 421 pupils in the field test, 248 randomly-selected pupils were tested by using EGRA and EGMA at the baseline and the endline.

LITERACY

The randomized controlled trial design of the GLXP field study made it feasible to estimate the impact of Kitkit school on learning. Table 1, organized according to subtasks from the Kiswahili EGRA instrument, shows the mean scores at the baseline and endline tests as well as average gains of pupils using Kitkit school (treatment pupils) and those in the control group.

For syllables-sound fluency, the treatment pupils identified an average of 1.61 syllables per minute at the baseline test were able to identify 18.36 syllables per minute after the intervention. This average gain (16.75) of the treatment pupils was 4.7 times greater than the average gain (3.55) of the control pupils. The treatment pupils demonstrated similar improvement patterns for familiar words, invented words, and oral reading fluency subtasks which are timed tests: the average gains of treatment pupils were 5.2, 4.9, and 4.5 times greater than the ones of the control pupils, respectively. The percent correct scores were presented for non-timed subtasks: reading comprehension, listening comprehension, and writing (dictation). In the reading comprehension subtask, the treatment and control pupils

answered 0.8 and 0.4 percent correct out of 5 questions at the baseline test, respectively. It means that most pupils in both groups couldn't solve a single question. In fact, 97 percent of the treatment pupils and 98 percent of the control pupils scored zero. At the endline test, however, the two groups performed quite differently. The treatment pupils answered 17.6 percent correct out of 5 reading comprehension questions, which means the proportion of pupils who obtained zero-score dropped to 64 percent. As for the control pupils, the proportion of the zero scored pupils dropped only to 89 percent. For listening comprehension and writing, the average gains of the treatment pupils were 2.5 and 2.3 times greater than the ones of the control pupils, respectively.

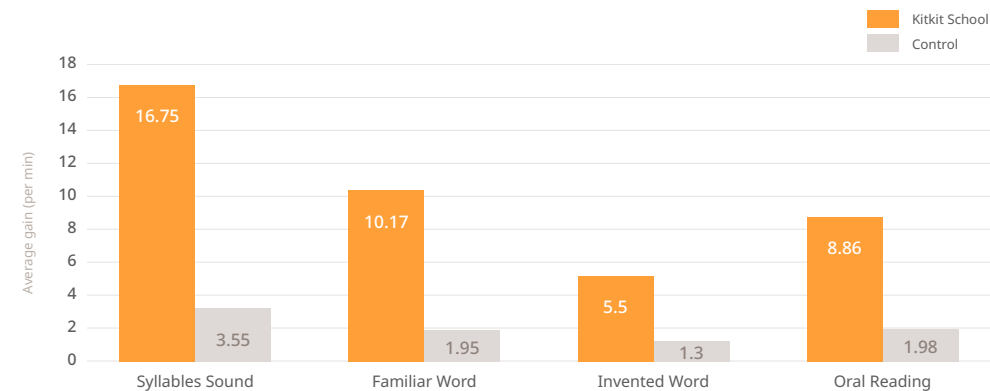
In order to examine the effectiveness of the intervention statistically, effect sizes^[1] were calculated. Effect sizes were moderate to large across the EGRA subtasks, with an average overall effect size of 0.7.

[1] Cohen's d was used for the effect size. An effect size is calculated by dividing the causal program effect by the pooled standard deviation. It is a measure of the effectiveness of an intervention that can be compared against the effects in other programs. Cohen suggested that $d=0.2$ be considered a 'small' effect size, 0.5 represents a 'medium' effect size and 0.8 a 'large' effect size. (Cohen, 1988)

Table 1. Literacy Results

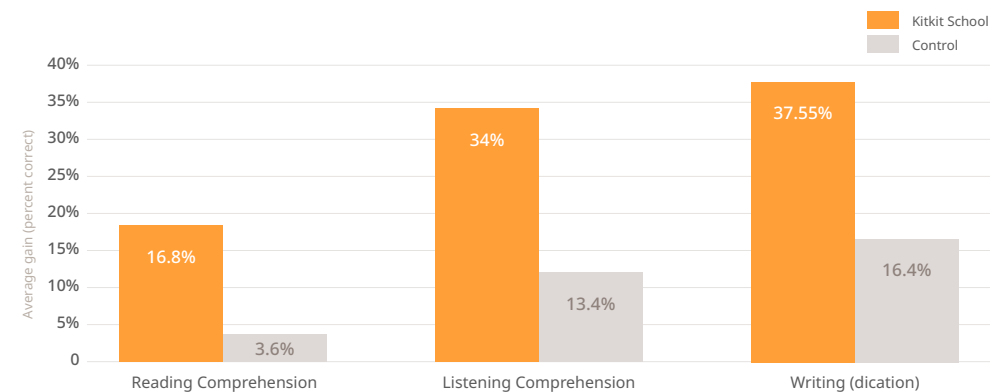
EGRA subtasks	Kitkit School (N=248)			Control (N=361)			Cohen's <i>d</i>
	Baseline	Endline	Gain	Baseline	Endline	Gain	
Syllables Sound Fluency (correct syllables per min.)	1.61	18.36	16.75	1.05	4.6	3.55	0.79
Familiar Word (correct words per min.)	0.81	10.98	10.17	0.54	2.49	1.95	0.73
Invented Word (correct words per min.)	0.46	5.96	5.5	0.32	1.45	1.13	0.68
Oral Reading Fluency (correct word per min.)	0.76	9.61	8.86	0.47	2.45	1.98	0.68
Reading Comprehension (% correct out of 5 questions)	0.8%	17.6%	16.8%	0.4%	4%	3.6%	0.61
Listening Comprehension (% correct out of 5 questions)	38.4%	72.4%	34%	34%	47.4%	13.4%	0.6
Writing - Dictation (% correct out of 9 points in 4 questions)	18.89%	56.44%	37.55%	13.56%	30%	16.44%	0.84

EGRA timed subtasks



Average gains of the treatment group are **4 to 5 times greater** than the control group for EGRA timed subtasks

EGRA non-timed subtasks



Average gains of the treatment group are **2 to 4 times greater** than the control group in EGRA non-timed subtasks

MATH

Table 2 shows the mean scores at the baseline and endline tests as well as average gains in subtasks from the EGMA instrument. There are three timed subtasks (number identification, addition 1, and subtraction 1) and five non-timed subtasks (quantity comparison, missing number, word problem, addition 2, and subtraction 2) in EGMA.

Just as the EGRA results, the timed subtasks of EGMA measured pupils' performances per minute. For 'number identification', the treatment and control pupils identified average 2.58 and 2 numbers per minute at the baseline, respectively. After the 15 month-intervention, the treatment pupils were able to identify an average 10.66 numbers per minute, compared to 4.3 numbers in the control pupils. The mean gain of the treatment pupils is 3.5 times greater than the one of the control pupils. For 'addition level 1' and 'subtraction level 1', the treatment pupils solved average 1.13 addition and 0.91 subtraction items per minute at the baseline. Then, at the endline, they were able to solve average 6.43 addition items and 5.05 subtraction items per minute. The average gains of the treatment in addition 1 and subtraction 1 were 3.8 and 5 times greater than the ones of the control pupils, respectively.

For 'quantity comparison' among the non-timed subtasks, the treatment pupils scored an average 17.3 percent correct out of 10 questions at the baseline were able to score 45.9 percent correct at the endline. On the other hand, the control pupils were able to score an average 18.4 percent correct even at the endline. When it comes to compare the gains, the gain of the treatment is 6 times greater than the one of the control pupils. The pupils' performances were substantially poor in the other four non-timed subtasks: missing number, word problem, addition 2, and subtraction 2. At the baseline, more than half of pupils[2] scored zero in the missing number and word problem subtasks. And more than 90% of pupils scored zero in the addition 2 and subtraction 2 subtasks. These patterns were similar to the control pupils. After the intervention, however, the gains of the percent-correct scores were substantially different between the treatment and control pupils. The gains of the treatment pupils were 4, 1.9, 5.7, and 7.4 times greater than the ones of the control pupils.

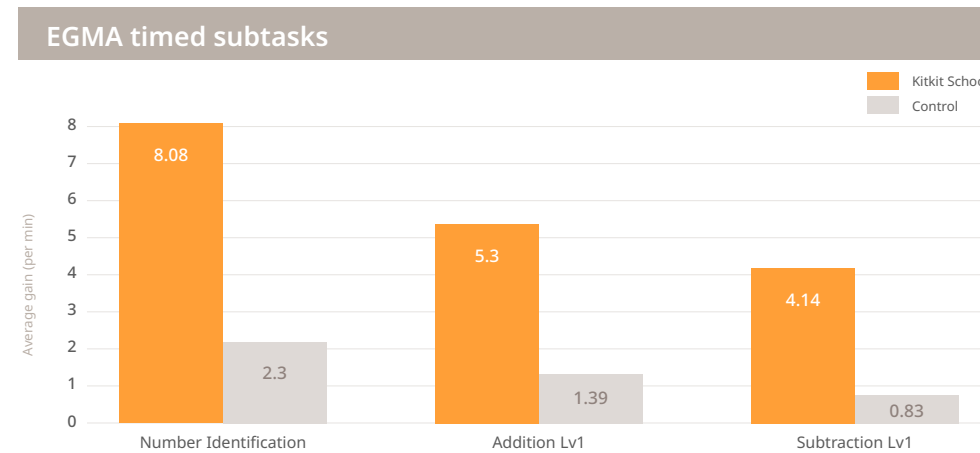
The effect sizes in the math test were moderate to large across the EGMA subtasks except for word problem, with an average overall effect size of 0.84.

[2] As for treatment pupils, 68%, 59%, 95%, and 97% of them scored zero in missing number, word problem, addition 2, and subtraction 2, respectively.

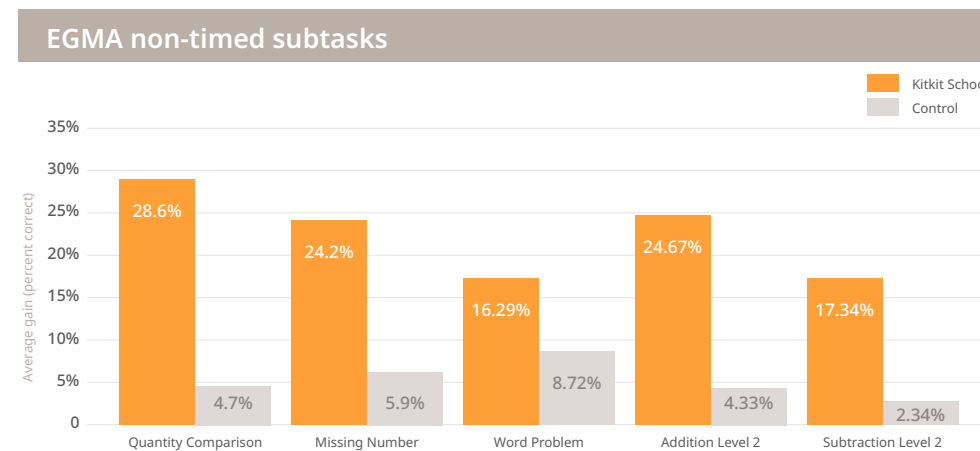


Table 2. Math Results

EGMA subtasks	Kitkit School (N=248)			Control (N=361)			Cohen's <i>d</i>
	Baseline	Endline	Gain	Baseline	Endline	Gain	
Number Identification (correct numbers per min.)	2.58	10.66	8.08	2	4.3	2.3	1.28
Quantity Comparison (% correct out of 10 questions)	17.3%	45.9%	28.6%	13.7%	18.4%	4.7%	0.78
Missing Number (% correct out of 10)	5.5%	29.7%	24.2%	4.8%	10.7%	5.9%	1.16
Addition Level 1 (correct numbers per min.)	1.13	6.43	5.3	0.85	2.24	1.39	0.9
Subtraction Level 1 (correct numbers per min.)	0.91	5.05	4.14	0.47	1.3	0.83	0.83
Word Problems (% correct out of 7 questions)	12.57%	28.86%	16.29%	7.57%	16.29%	8.72%	0.35
Addition Level 2 (% correct out of 3 questions)	2.33%	27%	24.67%	2%	6.33%	4.33%	0.75
Subtraction Level 2 (% correct out of 3 questions)	1.33%	18.67%	17.34%	0.33%	2.67%	2.34%	0.68



Average gains of the treatment group are **3 to 6 times greater** than the control group in EGMA timed subtasks



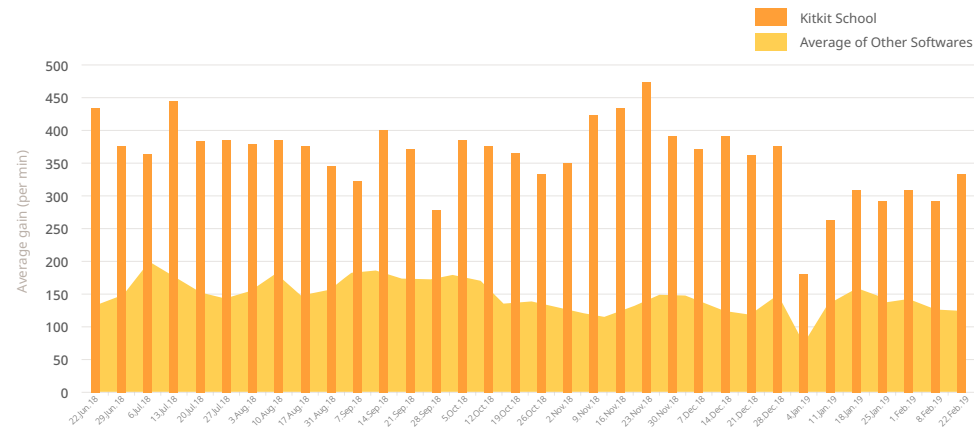
Average gains of the treatment group are **1.8 to 7 times greater** than the control group in EGMA non-timed subtasks

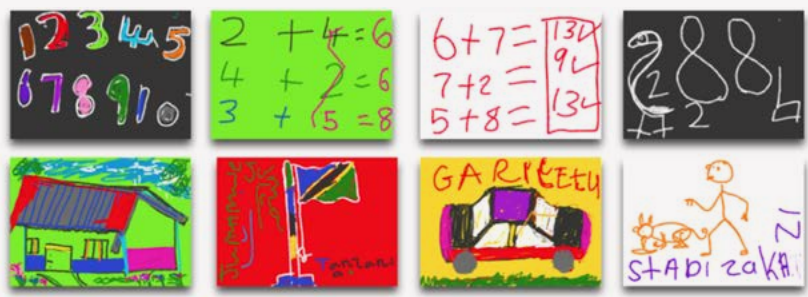
USER ENGAGEMENT

Children who learned with Kitkit School showed consistent and high levels of engagement throughout the project duration. The below graph shows the number of unique tablets that generated log data during the project period. This is equivalent to the number of children who used each learning program, given that one tablet was assigned to one child. Over the course of the field testing period, the children using Kitkit outnumbered those using other learning programs.

As such, it can be deduced from the level of weekly active users that Kitkit School's learning philosophy, which ensures fun and positive learning experiences with gamification and scaffolded curriculum, works for children. Kitkit School's learning results tell us that an engaged learner is a dedicated learner.

Weekly Active User Count (15 Months)





SELF-EXPRESSION AND ASPIRATION TO LEARN

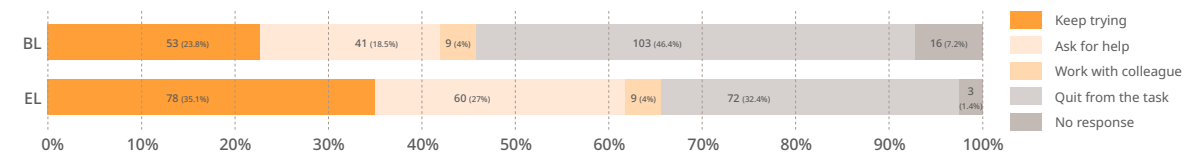
In addition to the learning gains in literacy and numeracy and high levels of user engagement, students developed digital literacy and positive attitudes towards learning through their use and exploration of Kitkit School.

Children who had never been exposed to these technologies, many of whom came from villages without electricity, learned how to use digital tools and expressed their ideas and thoughts. As collected samples of student artwork evidence, students used these tools to practice the concepts introduced in the app and were self-motivated to learn.

The self-reported survey on Social-Emotional Competencies conducted by UNESCO National Commission in Tanzania with the University of Dar es Salam for GLXP field test evaluation also implies the growth of positive behaviors to handle challenges and aspirations toward learning.

On persistence, children were asked what to do when experiencing difficulties on a task. While a majority of children (46%) responded they quit from a difficult task in the baseline survey, the same response was reduced to 32% in the endline survey. Instead of quitting, more children responded that they 'keep trying' (increased from 23.9% to 35.1%) or 'ask for help' (increased from 18.5% to 27%), both are considered one of self-regulatory strategies (Schunk & Zimmerman, 1994).

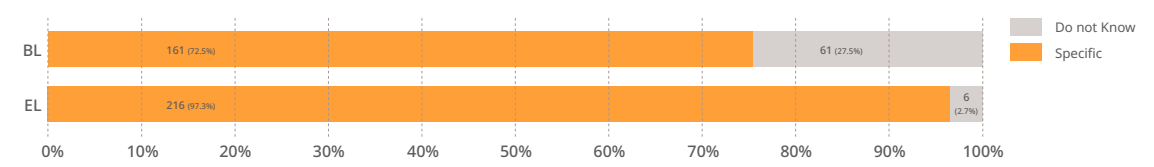
What do you do when experiencing difficulties on a task?



Note: the question used in the survey for the persistence item: "In a situation where you are performing a particular task and then you experience difficulties, what do you do".

On future aspirations, the UNESCO social-emotional survey also evidenced that more children became specific about their future aspirations after participating in the intervention. In the baseline survey, 27.5% of the children responded that they did not know what they would like to do when they grow up. In the endline survey, only 2.7% of them did not have specific aspirations for their future. Teacher, farmer, driver, doctor, business consisted of the top 5 of their lists, taking 66% of the responses.

Who would like you to become when you grow up?



Note: the question for the future aspirations: "When you grow up, who would you like to become?" The response count of the top 5 aspirations in the endline survey is teacher, farmer, driver, doctor, and business.

Like Mrs. Levira, the vitongoji mama and baba were key players for the success of the implementation of the Global Learning XPRIZE initiative, and their work during and long after the duration of the field test will contribute to the empowerment members of rural, remote and underprivileged communities.

On students' readiness to learn...

"We know from the baseline, most of [the children] were out of school. After the field test, they saw themselves as fit for school and wanted to enroll [...] Now that they can read and write, they can fit in the school system. They were proud and were eager to attend."

"You can imagine [some of the children] were walking 9-10 kilometers to the site. It was not easy, but they were motivated to come and to learn each day."

"The fact that [students] could repeat a lesson [in Kitkit School] when they needed more practice really excited them because this could not happen in the regular school [...] it gave them confidence."

On the impact of Kitkit School on families...

"Some of [the parents] were afraid of the tablets but when they realized what it was and what it was doing for the children, then they were all very excited about it!"

"The children were also really committed to staying clean after watching the video on how to use the tablets, washing their clothes, and taking great pride in being ready to use the tablets... even the parents began changing their behavior."



Photo: Ms. Levira, June 2019

SUMMARY

The Global Learning XPRIZE concluded in May 2019, but the impact of the competition will be felt long after. The results from the 15-month field test proved not only that children can teach themselves, but demonstrated the power of technology to transform learning and deliver positive outcomes regardless of initial capacity or access to school or resources.

Kitkit School delivered some of the highest gains for students participating in the field test, with the highest levels of engagement among finalists and benefits that extended beyond academics and to their families and communities. Kitkit School represents a breakthrough intervention that delivers significant learning gains and that deserves further study and investment.



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