Summary of Research on onebillion's Learning Software

A Substantial Body of Rigorous Evidence

At least nine randomized controlled trials (RCTs) have been conducted on onebillion's learning software in different countries, languages, and settings (e.g., in school, out of school, and refugee camps). These RCTs have consistently shown that onebillion's software produces positive and significant learning gains in literacy and numeracy. The attached Table 1 summarizes key details of these studies.

Imagine's Research

Imagine Worldwide conducted five of the nine RCTs mentioned above; detailed results are presented in Table 2. We built upon the early proof-of-concept RCTs conducted by the University of Nottingham over 8 weeks and 14 weeks to investigate whether the observed short-term impacts would be sustained over longer periods of time (i.e., over 8 months and over 2 school years). Imagine's interest is not just in producing a statistically significant increase in learning that might translate into a few more letters, words, or numbers, but ultimately in helping children to become readers and to attain a similar skill level in mathematics (i.e., attaining end of 4th-grade standards). We also sought to test whether the tablet program could produce positive learning impacts in refugee settings, which include some of the most marginalized children. Finally, we replicated studies conducted in Malawi, in government schools and a refugee camp, in Tanzania. Over 4 years, our RCTs used three different versions of onebillion's software, with results indicating increasing impacts with successive software versions. Further, our studies to date have shown that girls benefit at least as much as boys through the tablet program.

Although average efficacy impacts have been consistently positive and significant, we also found that a substantial proportion of learners remained non-readers despite using onebillion's software. About 40% of learners in both the Global Learning XPrize RCT and Imagine's 2-year RCT remained non-readers after using the tablet program for 15 months and 13 months, respectively. Being a "non-reader" means not being able to read a single word of connected text (that is, text presented as sentences in a paragraph). To understand factors influencing non-progress in reading, we conducted an initial exploratory study that showed that children's visual working memory skills uniquely predicted high versus low progress in reading over and above some other known predictors of early literacy development (such as home literacy and learning environment and age). We investigated instructional strategies that have been shown to be effective in addressing working memory deficits, and shared these with onebillion to inform software improvements.

As we conclude our initial efficacy research phase, we are now focusing our research on supporting continuous improvement--of the software and of implementation practices in the field. We will be extending our research on non-progress in reading during the next couple of years and will conduct additional research to understand better for whom the software is working, for whom it is not, and why. We are also conducting implementation research to understand barriers to and enablers of quality program implementation as we expand.

Research Reports and Presentations

Imagine's studies have met rigorous design and analysis standards. Our studies were shaped and reviewed by our founding research advisory group of highly respected experts as well as by our research partners. All of our RCTs have met baseline equivalence standards for the final analytic samples, supporting the causal validity of the findings.

Imagine's Research

- "Tablet-based Learning for Foundational Literacy and Math: An 8-month RCT in Malawi." (2020). *Imagine Worldwide Technical Report*. Link.
- "2-year RCT of EdTech in Malawi." (2022). *Imagine Worldwide Research Brief*, No. 1. Link.
- "Technology-enabled Learning in a Second Language: A Proof-of-Concept RCT with Refugee Children in Malawi" [Conference presentation]. CIES 2021. Available on request.
- "Autonomous Learning for Supplemental Education in Tanzania (ALSET): Independent Efficacy RCTs." (2023). Summary of Findings. Available on request.
- "RCT evidence and continuous improvement of an EdTech intervention" [Conference presentation]. mEducation 2023. Available on request.
- "An exploratory analysis of divergent patterns in reading progression during a tablet-based literacy program." In *Frontiers in Education*, 23 February 2023. LInk.

Selected Additional Research

- Pitchford (2015). "Development of early mathematical skills with a tablet intervention: a randomized control trial in Malawi." Available here.
- Outhwaite et al. (2017). "Closing the gap: Efficacy of a tablet intervention to support the development of early mathematical skills in UK primary school children." Available here.
- Pitchford et al. (2017). "Unlocking Talent through Technology: Improving Learning Outcomes of Primary School Children in Malawi." Report prepared for Voluntary Service Overseas. Please contact the author.
- Pitchford et al. (2018). "Interactive Apps Promote Learning of Basic Mathematics in Children With Special Educational Needs and Disabilities." Available here.
- Outhwaite et al. (2019). "Raising Early Achievement in Math with Interactive Apps: A Randomized Control Trial." Available here.
- King et al. (2019). Global Learning XPRIZE Data Summary. RTI International presentation. Available here.

Table 1. Rigorous Studies of onebillion's Software

#	RCT Brief Name	Research organization	Year concluded	Country	Setting	Treatment duration	Target Pop.	Software version*	Subject	Language	Daily Dosage	Effect sizes (statistically significant) Math	Literacy
1	Proof of Concept Math	U Nottingham	2013	Malawi	In school	8 weeks	Grades 1-3	Proc. v1	Math	Chichewa	1 hour/day	Overall math = .63	—
2	Proof of Concept Literacy	U Nottingham	2017	Malawi	In school	14 weeks	Grades 1-3	Proc. v1	Literacy	Chichewa	1 hour/day	—	Overall literacy = .42
3	8-month RCT	Imagine	2019	Malawi	In school	8 months	Grade 2	Proc. v1	Literacy or Math	Chichewa	40 min/day literacy OR math	Early math = .15 - .29	Overall literacy = .34
4	Global Learning XPrize	RTI	2019	Tanzania	Out of school	15 months	9-11 year-olds	Community	Literacy & Math	Swahili	Unlimited	Math various = .56 - 1.09	Literacy various = .32 - .95
5	Refugee Camp Math RCT	Imagine	2020	Malawi	Refugee camp - informal school	5 months	Preschool 3-Grade 3	Proc. v1	Math	English	20 min/day	Early math = .36	—
6	Multi-country Study	U Nottingham	2021	Ethiopia, Kenya, Malawi	In school	12 weeks	Grade 1	Proc. v1	Math	Multiple	30 min/day	Overall math = .28 - .39	—
7	2-year RCT	Imagine	2021	Malawi	In school	13 months	Grades 2-3	Proc. v2	Literacy or math	Chichewa	40 min/day literacy OR math	Overall math = .54	Overall literacy = .37
8	Refugee Camp RCT	Imagine	2022	Tanzania	Summer break	8 weeks	Grades 1-3	Adaptive v1	Literacy & math	Swahili	40 min/day combined	Overall math = .44	Overall literacy = .20
9	5-month RCT	Imagine	2022	Tanzania	After school	5 months	Grades 1-3	Adaptive v1	Literacy & math	Swahili	40 min/day combined	Overall math = .26	Overall literacy = .34

* "Procedural v1" was the original self-paced version; v2 had more content. "Community" was created for XPrize. "Adaptive v1" had the same content as Procedural v2 but used diagnostic tests to deliver content at the right level.

References:

1 Pitchford (2015). Development of early mathematical skills with a tablet intervention: a randomized control trial in Malawi. Frontiers in Psychology, 6:485.

2 Pitchford, Hubber, and Chigeda (2017). Unlocking Talent through Technology: Improving Learning Outcomes of Primary School Children in Malawi. Report prepared for Vountary Service Overseas. Author.

3 Levesque, Bardack, and Chigeda (2020). Technical Report: Tablet-based Learning for Foundational Literacy and Math: An 8-month RCT in Malawi. Imagine Worldwide: Research Brief No. 1. https://www.imagineworldwide.org/wp-content/uploads/An-8-month-RTC-in-Malawi_Final-Report_Jan-2020.pdf

4 King, Presley, Pouezvara, Gove (2019). Gobal Learning XPrize Impact Presentation (https://shared.rti.org/content/global-learning-xprize-data-summary#); Levesque and Bardack independent analysis of XPrize data.

5 Levesque, Bardack, Chigeda, and Winiko. Presentation at CIES 2021. Presentation available on request.

6 Pitchford (2021). Implications from a Multi-country Study. Presentation at the 2021 mEducation Symposium.

7 Levesque, Bardack, Chigeda, Bahlibi, and Winiko (2022). Impacts of a 2-year education technology program on early primary learning in Malawi amid disruptions due to COVID-19. Imagine Research Brief No. 1 to be found on Imagine's website at https://www.imagineworldwide.org/resources/.

8 Levesque, Chigeda, Mgumia, Bardack, Bahlibi, Diazgranados (forthcoming). Details available on request.

9 Ibid.

Table 2. Imagine RCTs of onebillion's software: Impact results

	Government primary schools			Refugee camp schools	
Setting					
Study #	1	2	3	4	5
RCT short name	8-month	2-year	TZ-Host	Dzaleka	TZ-Camp
Number of schools in study	2	2	1	1	1
Number of learners in study(1)	674	578	300	317	300
Intervention description					
Country	Malawi	Malawi	Tanzania	Malawi	Tanzania
School authority	Government	Government	Government	Private	Private
Software version(2)	Proc. v1	Proc. v2	Adaptive v1	Proc. v1	Adaptive v1
Intervention duration	8 months	13 months	5 months	5 months	8 weeks
Implementation model	School day	School day	After school	School day	School break
Software language	Chichewa	Chichewa	Kiswahili	English	Kiswahili
Subject(s)	Read or Math	Read or Math	Read + Math	Math only	Read + Math
Daily tablet usage time	40 min	40 min	40 min	20 min	40 min
Total time on task (in hours) per subject for treatment group	56	101	20	19	8
Literacy impact results					
Intent-to-Treat					
Effect size for overall literacy (EGRA average % correct)	0.34*	0.37*	0.34**	--	0.20+
% added value(3)	66%	32%	51%	--	56%
Added value in weeks or months(4)	5.3 mos	4.2 mos	2.6 mos	--	4.5 wks
Rate of advancing on reading benchmark vs. control	1.50x	1.50x	1.80x	--	1.53x
% of treatment group attaining emergent or fluent status	9%	29%	11%	--	12%
Treatment-on-the-Treated					
Percent of treatment group attending at least 50% of time	88%	77%	71%	--	67%
Effect size (s.d.'s) - EGRA average % correct	0.40*	0.47*	0.49**	--	0.29+
Mathematics impact results					
Intent-to-Treat					
Effect size for overall math (EGMA average % correct)	0.07(5)	0.54**	0.26*	0.02(5)	0.44***
% added value(3)	7%	28%	67%	5%	239%
Added value in weeks or months(4)	0.6 mos	3.6 mos	3.4 mos	0.2 mos	19 wks
Rate of advancing on math benchmark vs. control	1.40x	1.40x	1.92x	1.30x	1.14x
% of treatment group attaining emergent or fluent status	19%	72%	12%	46%	79%
Treatment-on-the-Treated					
Percent of treatment group attending at least 50% of time	88%	83%	71%	70%	67%
Effect size (s.d.'s) - EGMA average % correct	0.07	.65***	0.37*	0.03	0.65***

+Statistically significant at p<0.10 level, * at p<0.05 level, ** at p<0.01 level, and *** at p<0.001 level.

(1)Studies 1&2 each had two treatment groups (literacy and math) and one control group resulting in three groups of (roughly) equal size, while studies 3-5 each had one treatment group and one control group of (roughly) equal size.

(2)"Procedural v1" was the original self-paced version; v2 had more content. "Adaptive v1" had the same content as Procedural v2 but used diagnostic tests to deliver content at the right level.

(3)% added value is derived by dividing the treatment effect by the control group effect. Control group effects = (average control group post-test minus the average control group pre-test) divided by the average standard deviation of the pre- and post-test scores.

(4)Added value in terms of weeks or months is derived by multiplying the % added value by the number of weeks or months of the intervention.

(5)Math effect sizes for Studies 1&4 were originally calculated for number sense skills only, due to the limited math content of Procedural v1. For comparison purposes, the same math outcome measure is used here across all studies (i.e., overall EGMA average % correct).