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THE FUTURE OF LEARNING

Tablet-based Learning for Foundational Literacy and Math: An 8-month RCT in Malawi (Executive Summary)

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Executive Summary

Imagine seeks to understand whether children with few education alternatives can become literate and numerate using child-directed, technology-enabled learning. To this end, we are building an evidence base for what works, for whom, and under what conditions, in schools and out-of-school settings, in different countries and languages, and with a small collection of promising software, starting with onebillion's *onecourse*.

Study Overview

Prior research on onebillion's literacy and numeracy applications used in the Malawi government primary schools showed promising results. However, the previous randomized controlled trials (RCTs) were conducted over short periods of time (8 and 14 weeks) to establish proof of concept. To help fill the gap in knowledge about the longer-term impacts of this intervention, we conducted an 8-month RCT during the 2018-19 school year to address the following primary research questions:

1. What are the impacts over standard instruction on literacy and numeracy outcomes of using onebillion's *onecourse* software in Chichewa for 40 minutes per day for 8 months?
2. What impact does attendance in the intervention have on learning outcomes?
3. How far do children progress toward reading fluency with comprehension and comparable numeracy skills (i.e., arithmetic fluency with number sense)?
4. How are subgroup characteristics such as school, gender, and age category associated with learning outcomes?

The 8-month study tested the efficacy of onebillion's literacy and numeracy applications in the Chichewa language delivered through the Unlocking Talent implementation model. The study represented an efficacy RCT using a non-clustered, blocked individual random assignment (BIRA) design. Two government primary schools were purposively selected for the study: one urban and one peri-urban school located in the capital region.[1] Conditions in the two communities and schools are challenging. Families in both communities are very low income and face food security issues and other poverty-related challenges. Neither school has electricity and class sizes at both schools are very large (up to 100 children).

[1] The schools were selected to represent an urban and a peri-urban (more rural) environment, to meet sample size requirements, and to meet the criterion of not having used the Unlocking Talent program previously.

All 674 eligible Standard 2 (grade 2) learners ages 6–10 were randomly assigned independently within the two schools to treatment and control groups. The treatment groups used either the literacy or math curriculum—not both—for 40 minutes per day in an effort to maximize time on task in each subject and to isolate the impact of the two applications. A schedule was established so that children in the treatment groups stepped out of different standard classes on different days of the week to attend the learning center. Thus, the intervention represented a supplement to normal instruction in the tablet subject.[2] The control group students continued with standard instruction only. The study used an experimental design to ensure that differences in learning gains between the treatment and control groups can be attributed to the tablet intervention rather than to pre-existing differences among the groups. The experimental design ensures a high level of internal validity that provides rigorous estimates of the impacts at the two schools included in the study. However, due to the purposive selection of the schools, impact estimates may not be generalized to all Malawi government primary schools.

We conducted both impact analysis of the intervention on learning outcomes for the overall sample and exploratory analysis of the association of subgroup characteristics with learning outcomes. We produced two sets of impact estimates: Intent-to-Treat (ITT) estimates representing the impact of being assigned to the intervention, relative to being assigned to the control group; and Treatment-on-the-Treated (TOT) estimates representing the impact of attending the intervention at least 50% of the days that the learning center was open, relative to attending the intervention fewer or no days. Attending at least 50% of the offered days was considered minimum compliance with the treatment. About 88% of the children assigned to treatment met this attendance threshold.

Key Findings

The 8-month RCT in the two Malawi government primary schools produced the following results:

- 87% of learners persisted in the study: 89% of each treatment group and 83% of the control group persisted. After accounting for attrition, baseline equivalence of the final analytic sample was satisfied,[3] supporting the causal validity of our impact findings.
- Impacts[4]
    - The tablet literacy intervention produced a statistically significant positive effect on overall gains in literacy, with an effect size of .34 standard deviations. This translated into gains of 5.3 months of additional literacy learning over the control group for learners in the literacy intervention group, an added value of about 66%.[5]

[2] On average, the treatment represented an estimated 40 percent of additional time in the tablet subject over standard classroom instruction in that subject.
[3] What Works Clearinghouse Standards Handbook (Version 4.0), page 14.
[4] Characterization of effect findings is explained in Chapter IV. We use the following convention based on the What Works Clearinghouse (Procedures Handbook, Version 4.0, pages 21-24) and on effect-size benchmarks proposed by Kraft (2018) for causal studies: we use "statistically significant positive effect" if the treatment effect is both positive and statistically significant; "substantively important positive effect" if the treatment effect is not statistically significant but is positive and equal to or larger than 0.25 standard deviations; "suggesting positive effects" if the treatment effect is not statistically significant but is between 0.15 and 0.25 standard deviations; and "indeterminate effect" if the treatment effect is not statistically significant and is between -0.15 and 0.15 standard deviations. None of the treatment effects for the study fell below -0.15 standard deviations.
[5] The added value % compares the treatment effect size to the average control group growth over the 8 months of the study for the relevant outcome. This percentage is then translated into "additional months of learning," using 8 months as the base learning period. See Chapter IV for an explanation of this method and its limitations.

    - The literacy intervention also produced a substantively important positive effect in reading comprehension (.25 standard deviations) and suggested positive effects in all other targeted literacy subskills (ranging from .16 to .20).
    - The tablet math intervention produced a substantively important positive effect of .29 standard deviations on gains in number identification (a key number sense skill). The math intervention also suggested a positive effect (.15 standard deviations) on gains in pattern completion (another number sense skill). These effects represented an added value of 35% or higher.
    - Attending the intervention at least 50% of the time was associated with even larger positive effects on overall literacy (.40 standard deviations and an added value of 77%) and on number identification (.33 standard deviations).
- Exploratory analysis
    - The peri-urban school exhibited better treatment implementation and better treatment attendance than did the urban school during the 8-month study. While both schools were associated with statistically significant positive effects in overall literacy gains (.40 and .28 standard deviations, respectively), the peri-urban school exhibited a statistically larger gain in decoding (nonword reading) and the urban school a statistically larger gain in listening comprehension. Both skills are considered important for reading comprehension.[6]
    - Intervention effects on literacy and numeracy learning did not differ significantly by gender (male or female) or age category (6–7 years or 8–10 years).
    - Parents, teachers, and school and community leaders were overwhelmingly positive about the impact of the program on learners. More than three-fourths of the 43 adults interviewed at the end of the school year at the two pilot schools reported strong improvement in each of the following areas: children's excitement about school (88%), attendance (85%), achievement in literacy or math (81%), work effort (78%), and confidence as learners (78%).[7]

Conclusion

Findings from the pilot study are positive and encouraging. Some challenges with implementation in this pilot year may have attenuated the impact findings and we anticipate even greater learning effects when we conduct a new study in 2019-20 with a second cohort of Standard 2 learners. We are confident that this child-directed, technology-enabled learning approach can help children to become literate and numerate, but we know that it will take time and determination to achieve these goals.

[6] Nation (2019).
[7] The survey included the universe of Standard 2 teachers and school administrators and an opportunistic sample of parents and teachers.