

Abstract Title Page

Paper Title:

ICT, Literacy and Teacher Change: The Effectiveness of ICT Options in Kenya

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Abstract

Limit 4 pages single-spaced.

Background / Context:

There is a dearth of literature that use research design for causal inference that estimate the effect of ICT programs on literacy outcomes in early primary, particularly in Sub-Saharan Africa. There are several programs that have used ICT at a large scale, including Los Angeles, Peru, Nicaragua, Rwanda and an ongoing program in Turkey. Seldom have the studies directly estimated the effect of the ICT program on learning, as the measures used have typically been a middle level of the causal chain (Strigel & Pouezevara, 2012).

Mobile phones are increasingly available in the market, and several authors argue that mobile learning is an increasingly ideal way to increase outcomes at scale (UNESCO, 2012; GSMA, 2012; McKinsey & Co., 2012; Vosloo, 2012). There are concerns that using mobiles for learning would differentiate by gender (Murthy, 2011). Fewer studies have estimated the impact of e-readers on learning, though some recent studies in Kenya and Ghana are promising (Worldreader, 2012).

Analyses of the impact of large scale tablet and laptop initiatives is somewhat discouraging. The World Bank blog of ICT Specialist Michael Trucano recently presented an analysis of several countries programs, including the USA, Uruguay, Thailand, Peru, Kenya, Rwanda, Turkey, India, Argentina and Portugal (Trucano, 2013). Few of these studies consider cost when estimating impact, and the impacts identified remain small or not yet determined. In all of the studies researched, in fact, there was no attempt to compare the cost and effectiveness of different ICT interventions within one study.

Purpose / Objective / Research Question / Focus of Study:

The Kenya PRIMR Initiative aims to improve literacy learning by aligning learning materials and teacher practices with current research, providing ongoing instructional support and observation, and supplying instructional materials and English and Kiswahili books for students. PRIMR is a partnership between USAID/Kenya and the Ministry of Education, with implementation by RTI International. Embedded in PRIMR is a study of the effectiveness and cost-effectiveness of ICT in Kenya, located in Kisumu county.

The fundamental question that the Kisumu county ICT intervention study answers is how and whether a set of ICT interventions in Kenya improve pupil achievement in Class 2. The use of ICT is intended not to introduce teachers and pupils to ICT, but to determine whether and how ICT can improve and simplify teaching and learning. The design of the ICT program is to determine the effect of ICT when it is embedded within a larger instructional reform program. This is notable since we can compare ICT options against each other rather than simply against control. In this study, each ICT intervention is being compared against each other and the control group to measure effectiveness and cost-effectiveness. As noted, the ICT trial is being implemented and managed by the PRIMR Initiative in Kisumu County.

Setting:

PRIMR's ICT study is located in Kisumu county. Zones of schools within Kisumu were randomly assigned by zone to three treatment and one control groups. Kisumu county is in the western part of Kenya and borders Lake Victoria. It includes Kisumu town, one of the larger towns in Kenya. Zones were randomly selected from the entire list of zones in Kisumu, stratified by urbanicity. The zones were then assigned to treatment groups so that each treatment group has a randomly selected rural and peri-urban zone.

Population / Participants / Subjects:

The ICT-based intervention consists of three treatment groups of 20 schools, as follows: (1) The first group is using tablets to bolster the Teachers' Advisory Centre (TAC) Tutor instructional support system. (2) In the second subgroup, teachers are using enhanced teachers' guides on tablets, specially fitted with PRIMR instructional materials, as well as specially designed classroom pedagogical supports, including virtual flashcards, additional reading materials, and the RTI-developed continuous-assessment software called Tangerine:Class™. This treatment is being implemented. (3) The third subgroup of schools is using e-readers to help pupils practice their reading skills. Finally, 20 schools (2 zones) are serving as controls, but will have intervention support in 2014. Table 1 presents the population of schools and pupils in each treatment group.

Intervention / Program / Practice:

The core PRIMR instructional intervention included the following components: Inexpensive books, limited instructional aids, self-contained lesson plans, supplementary readers, modest training and focused classroom observations. The ICT sub-study included these same interventions, as well as the additional ICT components below. The three ICT interventions differed in the level at which the ICT was applied. The three treatment groups were:

- **E-readers for pupils.** Pupils in this treatment group received a basic Amazon Kindle e-reader pre-loaded with the English and Kiswahili PRIMR book, and more than 200 titles appropriate for Class 2 learners in English, Kiswahili and the local language of the area, called Dholuo. Each school in the e-reader intervention had an afternoon session for pupils which allowed them to read the supplementary books or PRIMR books at their leisure. The intervention was otherwise the same as the rest of the PRIMR intervention.
- **Tablets for teachers.** Teachers in this treatment group each received a Google Nexus tablet. The tablet was pre-loaded with multimedia versions of the lesson plans that allowed the pupils to hear pronunciations of the words and sounds, as well as dramatic readings of the pupil stories and teacher read-alouds. The tablets also were pre-loaded with a virtual flash card program that allowed the teachers to help the pupils become comfortable with letter sounds in both Kiswahili and English. The tablets also had a program designed to provide continuous assessment feedback to the teachers based on progress with PRIMR lessons.
- **Tablets for TAC tutors.** The third treatment group in the Kisumu study provided TAC tutors, or instructional coaches/supervisors, with a tablet. This tablet was loaded with tools to

help the TAC tutors support the teachers in implementing the program, similar to the paper tools used in other zones.

The ICT sub-study is therefore a comparison of not only the effectiveness of ICT in comparison to control, but in comparison to other ICT interventions at different levels. The study includes a cost element as well, as the additional cost of the programs is compared with the control scenario, and the treatment groups are compared against each other.

Research Design:

All four treatment and control groups were subjected to a rigorous set of baseline (January 2013), midterm (June 2013) and final (October 2013) assessments, using the Early Grade Reading Assessment (EGRA) tools to determine what causal effect each ICT intervention has on student achievement. This design, mixed with the randomized assignment of schools to the interventions, allow us to estimate what impact each ICT intervention has on student achievement. The design will also allow for estimation of whether and how the ICT interventions affected student outcomes over and above the standard PRIMR package of interventions.

Data Collection and Analysis:

Data was collected by Kenyan field staff who had worked with PRIMR lead implementer RTI International since 2007 on several studies using EGRA. The January 2013, June 2013 and October 2013 assessments utilized standardized interrater reliability measures that showed .95 reliability scores across the measures. Utilization of electronic data collection tools, specifically Tangerine, have removed data entry errors and standardized cleaning codes in Stata simplify the cleaning processes dramatically.

Data analysis was undertaken using Stata, and the svy subset of commands was utilized to account for the sampling decisions. The svy commands also account for the nested nature of the data and groups the standard errors at the correct level. Analysis was quite simple. Given the randomized control design, that utilized random selection and random assignment methods, simple comparisons between treatment and control can be used to estimate impact. However, given that there were a few items where there were differences in outcomes between treatment and control groups, we supplement the basic analyses with a difference in difference model. Effect size calculations use the pooled standard deviations between the various assessments.

Findings / Results:

The June 2013 midterm assessment showed significant gains in English and Kiswahili letter sound fluency and oral reading fluency, and modest gains in reading comprehension for all treatment groups compared to control, as indicated in *Figure 1*. The impact of all three treatment groups was significant.

In order to maximize the initial gains made in the PRIMR ICT zones for the remaining intervention period in Kisumu and also in other parts of Kenya, we submit the following recommendations. The ICT analysis shows statistically significant differences between all three

treatment groups (e-readers for students, tablets for teachers and tablets for TAC tutors) and the control group at the midterm. However, there were no statistically significant differences between the three treatment groups. Additional analyses (see Figure 2) show the cost effectiveness of the programs and the evidence is strong that the e-reader program is far less cost-effective than the other treatment conditions, including control.

Conclusions:

With respect to the ICT experiment, there is little evidence available on the effects of ICT interventions in sub-Saharan Africa. In addition, what little evidence exists suggests that ICT programs are not often ineffective. However, in a context where printed material is quite expensive, e-readers may dramatically expand access to print. Similarly, the lack of integration of ICT into the formal system is often decried by the Kenyan Ministry of Education. The ICT program is under careful examination in order to determine the lessons learned for Kenya's own ICT program, with an emphasis on rapidly expanding access to ICT for primary school.

Appendix A: References

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Appendix B: Tables and Figures

Table 1. Treatment groups for Kisumu ICT Study

Treatment Group	Intervention	Schools	Pupils
PRIMR + TAC tutor tablet	TAC Tutors with tablets for supervision and assessment	20	701 339
PRIMR + teacher tablet	Teachers with tablet with multimedia lesson plans, virtual flashcards, and continuous-assessment tools	20	432 452
PRIMR + pupil e-reader	Pupils with e-readers, loaded with PRIMR content, Kenyan textbooks, and supplementary reading materials	20	603 328
Control	None	20	1000

Figure 1. Gains in English and Kiswahili letter sound fluency and oral reading fluency, by ICT treatment

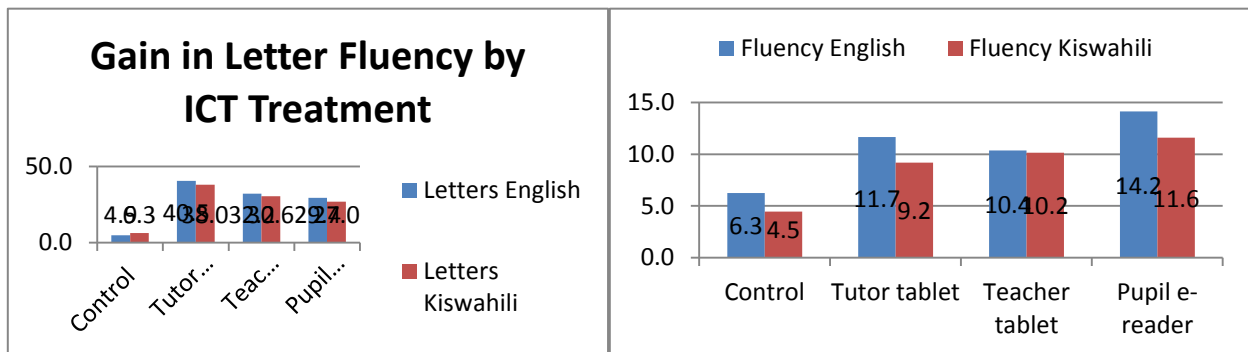


Figure 2. Cost-effectiveness of ICT Options in Kenya, at midterm (June 2013)

