2019 KIRINDON LITERACY STUDY: USING ABRACADABRA AND READS.

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For the past four years, World Vision Canada and Kenya, the Centre for the Study of Learning and Performance, and the Aga Khan Academies have collaborated on a literacy and numeracy project in a remote region of Narok County called the Trans Mara. WV typically establishes Area Development Projects in vulnerable regions where their educational and health services are most needed. The objective of this collaborative project was to improve the teaching and learning within this county. According to the Narok county director, Steve Gachie (2020) in Kirindon an average student from grades 1 to 3 scores **400 out of 800** on a combination of end-of-the-year exams. This is well below the national average. There are many educational challenges in teaching and learning in this region affected by its remoteness that lead to poor student outcomes and why it was decided to undertake this project. Could the challenges of working in a remote and vulnerable region be overcome using educational software and ongoing professional development and support leading to demonstrative student success?

In order to improve early primary students' achievement, three tools within the Learning Toolkit software—ABRACADABRA (ABRA), READS and ELM have been used throughout Early Childhood, and grade 1, 2, 3 classes in seven primary schools. These tools are both evidence-based and evidence proven, meaning that their design is based on theory and research and the tools are validated in longitudinal field experiments. ABRA and READS have been researched quite extensively, not only in Kenya but in other places in the world. All the results are significantly positive and practically large (Abrami, Lysenko & Borokhovski, 2020)

In 2019, one class was pulled to participate as an experimental group and a second as a control group in a small-scale study looking specifically at the effectiveness of using and ABRA and READS on the development of literacy skills. The following report summarizes this study.

Research Design

A pre-test/post-test control group design was used in this study. One pair of teachers, with their classes matched on pre-test scores and other characteristics as closely as possible, were part of experimental or control conditions. To optimize the ABRA-READS implementation, the experimental teacher was supported extensively by her colleague with extended experience of using the software in her instruction. While the ABRA-READS intervention unfolded in the experimental class, the control teacher used traditional method of reading instruction.

Sample

Two grade-one English teachers and their students from **two World Vision schools** in **Kirindon** participated in this study. This comprised of **one experimental** teacher who used ABRA-READS as part of her English Language instruction with her **40 students** and **one control** teacher and her **40 students** who did not use the tools. From the total sample of 80 first-graders, 2 control students did not write the post-test therefore leaving the **data of 78 students for analyses** (N_c= 40 and N_e= 38).

The ABRA-READS Intervention

The intervention started in **term 2 in April of 2019** after the pre-test student data were collected. The experimental teacher attended an initial training workshop and the follow-up support sessions held for teachers on how to use ABRA and READS to teach literacy. She was provided with teaching materials including an ABRA curriculum developed expressly to align the use of the tool with the Kenyan English Language requirements for grade-one students. The materials also included lesson plans, classroom activities, and job aids for teachers. The use of these materials was suggested rather than prescribed and their use was left at the teacher's discretion. Multimedia scaffolding and support for teachers and students embedded in ABRA were also available. As mentioned earlier, a **seasoned ABRA/READS teacher** from the same school **supported the use of both tools** in the experimental class.

In total, the ABRA **intervention lasted for about 20 weeks** during the second and third terms. Weekly **one 45-minute-long ABRA and READS lesson** was conducted in the experimental class. Classmate laptops were used for the instruction. Since the student-laptop ratio was 2 to 1, to increase the exposure time to the tools, teachers placed **students in dyads** where students took turns to interact with the computer. About two weeks of the intervention were spent at the outset familiarizing students with computer learning environments in general and ABRA-READS navigation in particular.

Instruments

Student Achievement Measures

The *Group Reading Assessment and Diagnostic Evaluation, GRADE* (Williams, 2001) was used for the purposes of this study. GRADE is a standardized measure designed to assess reading skills and to monitor reading progress. It contains five core subtests of Word Reading, Word Meaning, Sentence Comprehension, Passage Comprehension and Listening Comprehension.

Word Reading and **Word Meaning** subtests each measure slightly different **vocabulary related skills**. Word Reading 28 items measure a student's ability to both decode regularly spelled words (e.g. excitement) and recognize sight words (e.g. their). The teacher reads a target word, and then reads a sentence that contains this word and then repeats the word. The student picks the target word from a list of four or five choices. Word Meaning subtest includes 27 items measuring both word decoding or sight-reading and understanding of early-reading vocabulary. Teachers neither read any of the words nor identify pictures. Students are to read a word and to make one choice among the four picture distractors to match the word.

Sentence Comprehension and **Passage Comprehension** subtests each measure **reading comprehension skills**. Each of the 19 Sentence Comprehension items is a sentence with a missing word. Students are to select one correct word among four single-word choices. This subtest identifies if the student can comprehend the sentence as a whole thought by using contextual cues, knowledge of grammar and vocabulary. Passage Comprehension subtest measures reading comprehension skills with a variety of multiple-choice questions (e.g. questioning, clarifying, summarizing and predicting) about each of the 28 passages of different types (e.g. poem, fiction, science) on different topics and of different lengths (short, medium and long).

Seventeen **Listening Comprehension** items measure **linguistic comprehension** without printed cues. Students are to listen and understand orally presented text and choose one of the four pictures that best corresponds to what is read to them. The item types focus on the skills of vocabulary, grammar and inference.

Consistently with previous studies of ABRA/READS in Kenya, we used **GRADE Level 2** to measure the development of reading skills as it allows for testing a broad group of elementary students (from grade 1 to grade 3). The **test was administered** to the experimental and control students in **March 2019** (form A) to collect baseline data and in **September 2019** (form B) to assess end-of-year reading achievement. It is important to note that at the pre-test three of the five GRADE subtests were administered to grade-one students in both

conditions. These were Listening Comprehension, and Vocabulary subtests including Word Reading and Word Reading. At the post-test, students completed all five GRADE subtests.

Teacher Measures

The *Literacy Instruction Questionnaire* (LIQ; Abrami et al., 2011) was used to **collect information** about the **English Language instruction**. This is a CSLP-developed instrument that elicits teacher reports on aspects of the instructional methods they used in their classroom over the past semester. Specifically, the questionnaire includes three sections to explore: 1) approaches to reading and comprehension instruction; 2) use of technology; and 3) student-teacher interaction. Based on the findings of the *National Reading Panel* (NRP report, 2000), the 23 items **inquire about the activities students engage in to develop their reading and comprehension skills including phonemic awareness, phonics, oral reading fluency, vocabulary, comprehension and writing**. To capture the possible changes in the literacy instruction, the teachers were asked to complete the questionnaire at the pre- and post-test. However, the post-test questionnaires were made available for the analysis.

Analyses

Before the main analyses, standard procedures were used to verify, clean the data and test them for normality. No anomalies were discovered. **Composite scores** were created when possible. These were: **Vocabulary** (Word Reading + Word Meaning); **Reading Comprehension** (Sentence comprehension + Passage Comprehension) and **Total GRADE** (Vocabulary + Reading Comprehension + Listening Comprehension). It is important to note that the Total GRADE composite we aggregated in this study differed from the GRADE Total Test score that did not include Listening Comprehension since it measures comprehension without printed cues.

For the GRADE achievement measures, first analyses of variance (ANOVA) on pre-test scores was used to test for the baseline differences between the experimental and control groups. Second, we used the analysis of covariance (ANCOVA) to compare the average change rates of the two groups after statistically adjusting for the possible pre-test differences between them as measured by the GRADE pre-test composites. Since Reading Comprehension composite scores were only available at the posttest, we used the GRADE pre-test Vocabulary Composite to adjust the initial difference between the groups. In addition to all the statistical analyses of significance, standardized effect sizes are reported. We also report each group's descriptive statistics including mean scores and standard deviations.

Results

Student Achievement: Overall GRADE Results

In order to answer the question if using ABRA and READS impacted students' reading skills as measured by GRADE, we first compared the test scores of the control and experimental students at the baseline, before the ABRA/READS intervention. At the pretest, the experimental and control groups did not differ significantly on the three GRADE basic scales as well as the two composite scores of Vocabulary and Total GRADE**.** Specifically, the coefficients were: $F(1, 76) = 1.10$, $p = 0.30$ (Listening Comprehension); $F(1, 76) = 0.12$, $p = 0.73$ (Word Reading); $F(1, 76) = 1.46$, $p = 0.23$ (Word Meaning); $F(1, 76) = 1.09$, $p = 0.23$ (Vocabulary composite) and $F(1, 76) = 1.68$, $p = 0.20$ (Total GRADE composite as a combination of Listening Comprehension and Vocabulary scores). Overall, these results suggest that **the experimental and control students were mostly equivalent in literacy skills at the outset of the ABRA/READS intervention**. A summary of the descriptive statistics and ANCOVA results by group on the GRADE subscales and composites at pre- and post-test are reported in Table 1.

The results show reading gains from pre-to post-test for the students in both experimental and control classes. At the same time, the **effects consistently favour the students who used ABRA and READS**. The analyses found that after exposure to the ABRA and READS instruction, the students improved their scores at a higher rate than their peers from the control class. Specifically, **the ABRA/READS students showed significantly larger**

improvements in Vocabulary (F (1, 75) = 16.71, p = 0.000), **Reading** Comprehension (F (1, 75) = 5.42, p = 0.02) and **Total GRADE** (F (1, 75) = 13.18, p = 0.000). The progress of the experimental students in Listening Comprehension was noticeable albeit non-significant what would be expected considering quite low statistical power due to the modest sample size in this study.

Consistent with the above results are the **effect sizes** as expressed by partial eta-square ANCOVA coefficients (variance explained by group membership). They **vary from small (0.02 for Listening Comprehension) to medium (0.07 for Reading Comprehension) and large (0.18 and 0.15 for Vocabulary and Total GRADE respectively).**

Table 1
GRADE means (adjusted means in parentheses), standard deviations, and group difference ANCOVA coefficients
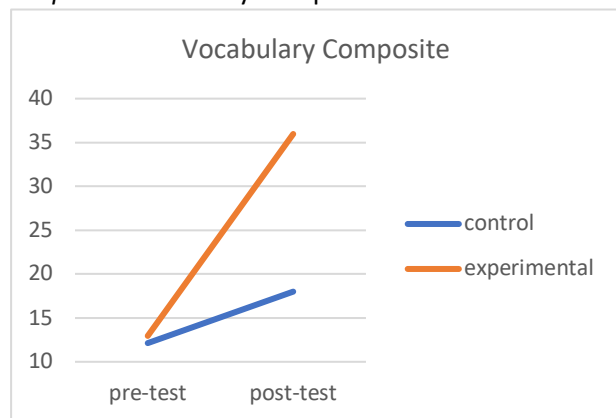
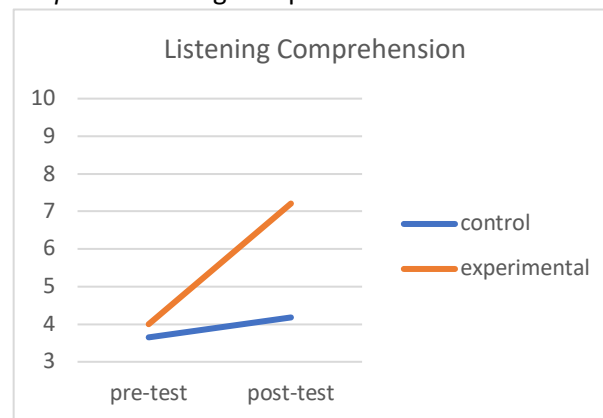| GRADE scales	ABRA-READS students (N= 38)		Control students (N=40)		Difference between the groups (F value and significance)
	Post	Pre	Post	Pre	
Word Reading (WR)	14.16	6.23	10.55	6.05	
Standard Deviation	*6.13*	*2.42*	*4.89*	*2.36*	
Word Meaning (WM)	22.00	6.68	7.45	6.08	
Standard Deviation	*2.34*	*2.60*	*2.97*	*1.80*	
Vocabulary Composite (WR+WM)	35.97(35.78)	12.92	18.00(18.41)	12.13	16.71***
Standard Deviation	*7.29*	*3.53*	*7.24*	*3.19*	
Sentence Comprehension (SC)	7.00		2.55		
Standard Deviation	*2.46*		*1.72*		
Passage Comprehension (PC)	6.39		0.00		
Standard Deviation	*2.66*		*0.00*		
Reading Comprehension Composite (SC+PC)	13.39(13.23)		2.55(2.81)		5.42*[1]
Standard Deviation	*3.62*		*1.72*		
Listening Comprehension (LC)	7.21(7.17)	4.00	4.18(4.13)	3.65	1.21
Standard Deviation	*1.44*	*1.45*	*1.74*	*1.49*	
Total GRADE (VC+RCC+LC)	56.58(56.19)	16.92	24.72(25.09)	15.77	13.18***
Standard Deviation	*10.04*	*3.87*	*7.71*	*3.93*	

* p< .05, *** p<.000
[1] pre-test GRADE Vocabulary composite was used for adjustment

The graphs on the next page visually represent the change in mean scores in the experimental and control groups for the GRADE subtests where pre- and posttest scores were available. These are **Vocabulary Composite** (graph 1), **Listening Comprehension** (graph 2) and **Total GRADE composite** (graph 3). As illustrated by the graphical representation of results, **the experimental students' gains were important**.
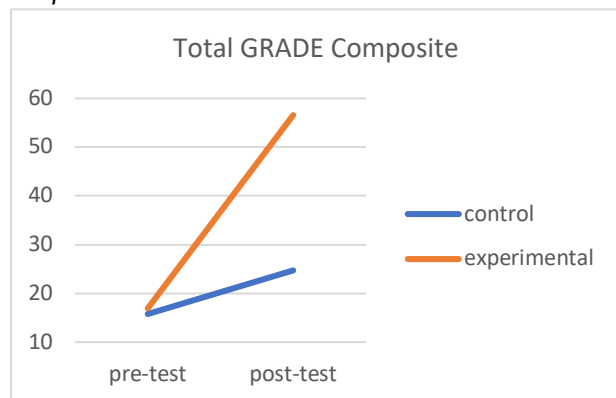
Graph 1. Vocabulary Composite

Vocabulary Composite

	pre-test	post-test
control	12	18
experimental	13	36

Graph 2. Listening Comprehension

Listening Comprehension

	pre-test	post-test
control	3.6	4.2
experimental	4.0	7.2

Graph 3. Total GRADE

Total GRADE Composite

	pre-test	post-test
control	16	24
experimental	16	56

It is important to note, that at the posttest an average student from the ABRA/READS class was able to complete correctly 36 out of 55 Vocabulary items, 13 out of 47 Reading Comprehension items and 7 out of 17 items on Listening Comprehension. We compiled **Table 2** to summarize **the percentage of experimental and control students at and above the GRADE test norms** (grade 1, end of the academic year), according to which 50% of grade-one students should achieve the threshold of: 31 on Vocabulary Composite; 14 on Reading Comprehension Composite; and 13 on Listening Comprehension. The table suggests that **after being exposed to ABRA and READS reading instruction, an average grade-one student from Kirindon might perform similarly to an average first-grader from the US on a standardized measure of vocabulary and reading comprehension skills**. On the contrary, progress in listening comprehension is not large enough.

Table 2
Percentage of students reading at and above the GRADE average

	Vocabulary Composite (31 and more)	Reading Comprehension Composite (14 and more)	Listening Comprehension (13 and more)
ABRA-READS group	74%	53%	0%
Control group	1%	0%	0%

Future focus of implementation may be placed on the development of listening comprehension skills with grade-one students**.** This need arises from the fact that in rural areas such as Kirindon the use of the English language outside school might be less than in the urban areas such as Mombasa. For instance, Marten in Brown, Asher and Simpson (2006) state that population of rural areas in Kenya tend to speak their native languages

rather than the official languages of English and Kiswahili. In this context, English language teaching becomes more of a second language instruction, whereas the development of listening comprehension requires special effort. This is because acquiring listening comprehension in a second language is a different cognitive process than the acquisition of listening skills in one's mother tongue (Churchland, 1999).

Teacher Self-reports

The experimental and control teachers and the expert teacher completed the *Literacy instruction Questionnaire* at the posttest and the summary of their self-reports follows.

- As it would be expected, such literacy components as alphabetics, fluency, vocabulary and comprehension have been addressed more frequently in the experimental instruction where students interacted with ABRA-READS software designed to develop this range of literacy skills. For instance, the control teacher (5 years of teaching experience) reported having taught phonics and phonemic awareness occasionally (4-6 times per term) whereas the teachers in the experimental group (10 and 12 years of teaching experience) addressed these two key literacy areas twice as often.
- Reading aloud was the only technique that the control teacher used to develop reading fluency whereas the students in the experimental condition were also exposed to guided and repeated reading activities as well as reading in pairs and groups.
- With the exception of question answering, reading comprehension activities were not used in the control classroom. On the contrary, in the experimental class, students were involved in asking questions, predicting, monitoring comprehension, summarizing and sequencing.
- In addition to spelling activities used in both conditions, experimental instruction also offered guided writing, filling worksheets and editing. Commenting on their student achievement by the end of grade one, the control teacher noted that her students "can blend 3 letter words"; experimental students were reported to be able to decode 4- and 5-letter words and "to convey the message by use of pictures".

GRADE implementation   ABRA Implementation

The teacher with extended experience of using the ABRA-READS software, who extensively supported the experimental teacher, summarizes the 2019 grade-one students' learning outcomes as follows:

> "Literacy and numeracy skills has been achieved so far as learners are able to read and decode given words. What is so interesting is that the software makes these learners so active and reason faster. Manipulation skills in this grade is so much developed perhaps because the learners began using the software from ECDE. It really amazes me how they mastered the sounds, that they could blend three to

four letter sound so fast, and within a short time! The software is child friendly that make learning so interesting. Being the fourth group to use the software since 2016, and the first class to use the toolkit right from ECDE (PP2), I [Naomi] am very proud to attest the fact that the class is far much ahead as compared to every first classes. The Learning Toolkit really enhances the very early literacy and numeracy skills! Early use of the software, yields big payoff!"

Conclusions

When used with grade-one students from Kirindon schools, **ABRA and READS resulted in positive effects on the students' reading skills, mostly benefiting their vocabulary knowledge and reading comprehension skills**. **Such significant improvements in these reading skills allowed these students to perform on par with, or better than, their average grade-one peers from North America.**

Integrating ABRA-READS in classroom instruction and, therefore, spending more time on phonics and phonemic awareness, as well as bringing **more diversity to fluency and comprehension activities** in teaching grade-one students may account for the **important shifts in the reading competencies of the experimental group**. For example, the expert teacher who supported this class describes the comprehension skills of her own grade-four class who have been using the software since 2016:

"A continued use of LTK has really enhanced acquisition of literacy. This has been depicted by grade 4 students from KIMINTET PRIMARY SCHOOL, who have been interacting with the software since 2016. Then they were in grade 1 luckily enough LTK landed just right on their heads and on time! The class has shown a clear indication of the toolkit enhancing literacy and numeracy skills. It is a different class altogether as far as academic performance is concern in the entire school. I [Naomi] being their class teacher since then, I was like seeing a mountain in front as they were joining grade 4 early this year. Amazingly, they did well in their first exams for English despite the fact that they were introduced to choices of ABCD for the first time. Actually, these boys and girls are really doing well in comprehension part of these papers. The two passages contained in an English paper is their favorite and they sweep all the answers here. I have been analyzing this from term 1 and mark you, for this term (term 3) was an exemplary one! Almost the whole class of 42 students got the comprehension questions right. This great performance in English has led to great performance in other subjects as well. So there has been a shift in literacy!"

When we agreed to work together on this project, we did so because it promised to be difficult and would test the efficacy of the LTK+ software and our approach to professional development. The promise of difficulty was met but the results underscore that the challenges were worth overcoming.

We believe that this is an outstanding outcome of the combined efforts of WV, AKAM, the CSLP and especially the teachers and their students who participated with enthusiasm and commitment. It signals clearly that underperformance can be dramatically reversed and students in remote, isolated and vulnerable regions are capable of scaling the heights of learning of their urban and educationally privileged peers.

At local request, we are now expanding the project in the Trans Mara region and will be working with 22 schools. We hope and expect the same positive results as illustrated here. The teachers and students deserve this level of success.

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