Developing and Testing the Effects of an App-Supported Personalized Literacy Intervention to Improve Reading Engagement and Comprehension

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Background/Context: Decades of research have shown that improving student literacy outcomes is complex, involving multiple levers of change, including skill-building, motivation, and contextual information. Recent evidence shows that including academic content knowledge and explicit instruction in content areas like science or social studies can improve reading outcomes, as can personalized interventions (e.g. Cervetti, Wright, & Hwang, 2016; Connor, 2017). At the same time, student learning during out-of-school time has shown to be vitally important, particularly for low-income students (Kim et al. 2016; Alexander, Entwisle & Olson, 2007; Quinn et al.) and digital learning has become more common through the integration of technology into the classroom (Gambrell et al. 2015). As literacy-supported apps grow in popularity, it becomes increasingly important to understand how the resources complement traditional instruction and support student learning (D'Agostino et al., 2015; Israelson, 2016).

Purpose/ Research Question: This study investigates the effect of a classroom- and app-based personalized literacy intervention designed to improve reading engagement and comprehension. Part of a larger study, this paper tests the first phase of a multi-phased random assignment trial for an adaptive intervention. Specifically, we ask:
1) How can we characterize student engagement with the MORE@Home app during summer?
2) In the context of this SMART trial, does providing instruction and texts that foster deep reading of conceptually related texts lead to more engagement and use of a personalized summer reading app (MORE-DEEP), compared to a typical-practice intervention that promotes wide reading of books tailored to each child's reading level (MORE-WIDE)?

Setting & Participants: In the spring of 2018, 16 K-2- teachers from one Title-I school in a large southeastern city were recruited to participate in the MORE@Home summer study. All students in those classrooms whose parents provided consent were enrolled in the study. Our sample is comprised predominantly of minority students: 68% are African-American, 17% are Hispanic, and another 11% are Asian, Native American, or multi-racial (see Table 1). The sample is balanced in terms of demographics and baseline reading scores across our treatment and control groups.

Intervention: A Model of Reading Engagement (MORE@Home) is a literacy intervention that provides elementary students with access to complex and connected science concepts; comprehension instruction that integrates reading and writing; support for reading at home; and motivational supports. During the school-based component, students received two weeks of literacy instruction and complete reading and writing activities associated with each lesson of the curriculum. The lessons were anchored on the topic of animals and each followed the same structure, including a read aloud, goal-setting, vocabulary development, word reading, academic discussion and writing, and an exit ticket to practice material learned during the lesson.

The @Home component of the intervention lasted for the duration of summer vacation. During the last two weeks of school, students picked out 10 books to take home and over the summer had the opportunity to use the MORE@Home to complete reading activities matched to the books they chose. In the treatment group (MORE-DEEP), all book options were aligned with the topic of animals and animal survival and designed to reinforce topical interest developed during the in-class lessons. Additionally, each book's app activities were tailored to the student's reading level. The control group (MORE-WIDE) received a typical-practice curriculum that included 2 weeks of lessons, 10 books to keep, and access to the MORE@Home app. However, the lessons in this group mirrored typical balanced literacy practice and the books available for selection were varied in topic but leveled near the students' independent reading level.

Research Design: This study leverages a sequential multiple assignment randomized trial (SMART) design (Almirall et al. 2018) to develop and test an adaptive literacy intervention. First, teachers in the study were randomly assigned to provide either the MORE-DEEP or MORE-WIDE curriculum to their students at the end of the school year. Students were then individually randomized to determine when they should be assessed for responsiveness to the intervention and what type of additional support they received if they were identified as non-responders. The study was pre-registered prior to the start of the intervention.

Data Collection and Analysis: The school district provided demographic, attendance, and test score data from 2017-2018. The MORE@Home app usage data is used as an intermediary outcome to assess engagement with reading over the summer. Two other sources of data will explore the effects of the intervention on student engagement and student literacy outcomes. Upon returning to school in Fall 2018, students were asked to self-report on their reading motivation using Me and My Reading Profile (MMRP) and which of their 10 books they read over the summer. Additionally, student test scores on the Fall 2018 MAP will be the primary outcome on reading skills. These data will be available for analysis by the end of October.

Findings/Results: The MORE@Home app was downloaded 134 times during the summer of 2018, but only used by 74 unique students. The majority of initial app access occurred during the first two weeks of summer vacation, but new students continued to engage throughout the summer (Figure 1). Overall, students who accessed the app read 4.9 books and completed 56 activities (see Table 2). We find that the MORE-DEEP intervention had a slight positive but statistically insignificant effect on app usage statistics. Students in the treatment group were 5.7 percentage points more likely to have accessed the app, and completed about 1.5 more activities.

Preliminary Implications: These results point to initial results about the role of the MORE-DEEP intervention in increasing student reading skills and reading engagement over the summer. Overall, usage of the app was fairly low, but students who did access the app completed, on average, about half of the available activities. The results from this phase of the study will be combined in the coming months with results from the two additional sequences of random assignment to identify which combination of interventions, timing, and additional supports is most effect at improving student engagement and reading comprehension.

Table 1. Demographic Characteristics of Participants

Characteristic	Overall Sample	Treatment Group	Control Group
Male (%)	45.7	47.8	43.6
Race			
African American (%)	68.0		
Hispanic (%)	16.7	14.0	19.5
White (%)	4.5	5.1	3.8
Asian (%)	3.7	2.9	4.5
Other (%)	7.0	5.9	8.2 *
English Language Learner (%)	9.7	9.6	9.8
Have IEP (%)	8.6	11.0	6.0
Attendance 2017-2018 (%)	94.5	95.3	93.7
Spring MAP RIT Score			
Kindergarten	156.8	157.4	156.2
First grade	177.2	177.2	177.2
Second grade	181.5	181.1	181.8
Number of Students	275		

Notes: two-sample t-test with * $p<0.05$

Figure 1. Timing of Initial App Access by Students

Table 2. Summary App Usage Statistics

Usage Statistic	Sample Mean	Sample Standard Deviation
Number of downloads	134.0	
Number of students accessed	74.0	
Books accessed*	4.9	3.4
Activities completed*	56.1	46.0
Unique activities completed*	53.3	42.6
Number of days accessed*	3.6	2.7

Notes: *These are calculated based on sample who accessed the app.

Table 3. Effects of MORE-DEEP on App Usage

Outcome	MORE DEEP v WIDE Difference	Standard Error	P-Value
Probability of accessing app	0.06	0.05	0.295
Number of books accessed	0.11	0.42	0.794
Number of activities completed	1.39	5.03	0.783
Number of unique activities completed	1.45	4.67	0.757
Number of days accessed	-0.09	0.33	0.789

Notes: ~ 0.10 * 0.05 ** 0.01

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