Exploring SpeechBlocks: Piloting a Constructionist Literacy App with Preschool Children

Sysoev, I., Hershman, A., Fine, S., Roy, D., Soltangheis, M., Fitzpatrick, B.

MIT Media Lab
Cambridge, MA

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Abstract— We have developed a mobile app, SpeechBlocks, that aims to provide self-expressive, social literacy learning opportunities. We are running a two-month pilot with 16 preschoolers to explore the efficacy of this open-ended digital literacy intervention. This paper summarizes the technology, methodology, and preliminary findings.

Most educational apps prescribe to an instructionist model of learning, where the main interaction is drag-n-dropping to complete a word or puzzle (Vaala, Ly, & Levine, 2015). These structured, rewards-based apps may produce correct answers, but that does not mean children understand or are engaged (Hirsh-Pasek et al., 2015). Instead, taking a child-centered, "constructionist" approach to learning facilitates deeper and more meaningful engagement (Papert, 1987). Research shows that expressing yourself through constructing your learning environment helps develop a richer understanding and relates to increased intrinsic motivation and self-efficacy; especially in relation to literacy development (Zosh, Brinster, & Halberda, 2013; Resnick, 2006). Child-driven learning opportunities are even more beneficial when they involve social collaboration (Bodrova & Leong, 2007; Montessori, 1917). Yet, despite the evidence from the literature, there is an absence of self- expressive and socially engaging early literacy apps (Vaala et al., 2015).

SpeechBlocks, developed in the Laboratory for Social Machines at the MIT Media Lab, is a self- expressive literacy app that follows a constructionist approach to learning by teaching alphabetic principles through manipulating letter blocks. Phonemes are heard when letter blocks are tapped, put together (blending into words), or pulled apart (segmenting). There is no correct combination of letters (can create real and nonsense words), no extrinsic rewards, and contingent interactions have immediate feedback. Words and letters from the "word shelf" act as scaffolds that children can use and remix. Since we do not currently have social or personalized scaffolding features built into this first version of the app, we intentionally designed activities to produce and examine these features outside of the app before incorporating them into our next iteration.

In collaboration with Northeastern University, we are running a ten week pilot of SpeechBlocks with 16 preschool students (4-5 year olds) at the Russell Call Children's Center. We are using a battery of standardized pre-literacy assessments for pre- and post-screenings. During the pilot children play with SpeechBlocks twice a week as part of their normal classroom routine in groups of four for 10- 15 minutes. Each child receives his/her own mobile device with SpeechBlocks. Activities vary in the amount of scaffolding and structure, ranging from unstructured free-play to scaffolded. We are experimenting with different materials to see how children use them with SpeechBlocks.

Our software has been instrumented to record and save every interaction the child has within the app, which we can replay to see a descriptive log of the processes children used and the types of words made. Data is also collected by two video cameras and timestamped researcher observation notes. We have time-synched the data and can replay it, allowing us to review behavioral and contextual data at the same time. To analyze this rich set of data, we combined two frameworks: Four Indicators of Learning (Petrich, Wilkinson, & Bevan, 2012) and ILAUGH Model of Social Thinking (Winner, 2009). The combination of these two frameworks help us to understand how children are using SpeechBlocks as a tool to "tinker" with letters to explore words and sounds, to express themselves (both within and outside of the app), and to connect and communicate with their peers. In addition to analyzing the qualitative data, this framework will help us investigate quantitative indicators, such as duration on task.

We are currently collecting data and see some interesting trends from this pilot. Preliminary results suggest that children are more engaged with SpeechBlocks during unstructured and scaffolded play than when the activity is structured. At week one, most of the children were engaged for the entire session of free-play with SpeechBlocks. Most words made within the first week were nonsense words (e.g. FUVV). By week three, children were less engaged and played less during a structured activity where they used SpeechBlocks to create words/sounds for a story. Children were most engaged and made more words in SpeechBlocks at week five, during unstructured free-play where cartoon cards were optional scaffolds. Children's words, with the aid of the cartoon cards, were longer and more intentional (e.g. SINK, SIMBA). Children engaged in more peer collaboration and had relevant conversations about the words made in SpeechBlocks during less structured and more scaffolded activities. Some children looked at other's screens, aided in spelling, talked about cartoons, and imitated other's words. Some students use SpeechBlocks as a tool to make and write words that were on the edge of their literacy skills based on their pre-screening scores. Lastly, we can see that children are more engaged and excited because they feel a sense of agency and authorship. Children demonstrate their excitement about the words they make by yelling to peers and adults, "I made this word!"

We cannot yet determine whether these increases in engagement, number of real words, and social interactions are due to an increase in literacy skills or a growing familiarity with SpeechBlocks. Further investigation into the increase of children's word production within and outside of SpeechBlocks will be examined at the end of this pilot. We plan to use our final results to explore this distinction and examine the ways this constructionist literacy app may contribute to early literacy learning.

One challenge is that there is no concrete way to measure complex and abstract concepts such as open-ended learning, self-expression, engagement, and social pragmatics. Since SpeechBlocks is exploratory, there is no correct way to play or demonstrate mastery. However, by using a combination of frameworks to analyze a rich data set, we will be able to examine many interesting components that occur over the ten weeks.

Our next step is to use insights from this pilot to inform the design of our next iteration. We have already seen some promising observations from this study that support the potential for a constructionist early literacy app to engage children. In the future, we hope this pilot serves as the foundation to explore the potential of using our method of collecting rich contextual data to give researchers, parents, and professionals a descriptive look at how children actually learn when they are actively involved, supported, and engaged.

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