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Family Learning Coach: Engaging Families in Children's Early Literacy Learning with Computer-Supported Tools

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Abstract: Literacy learning is an inherently social activity, best learned within a supportive community network of parents, teachers, and peers who can encourage, model, and coach the child through the learning process. However, most digital literacy tools for beginning readers fail to include this social dimension. In response, we propose the design of a computer-supported community network for children's early literacy learning. This network, centered around children's play on open-ended literacy apps, engages three stakeholders—child, parent, and family learning coach—in the experience. This new coaching role supports the parent-child dyad, using digital tools to provide parents with updates on their child's on-screen learning process, ideas for contextualized parent-child activities, and encouragement in a timely and efficient manner. Initial findings from our exploratory pilot indicate that parents positively perceived the coaches, while coaches' updates increased parent visibility into and informed the content of children's play sessions. This work has implications for both the potential of digitally mediated community networks to facilitate family engagement in children's learning, and the development of a new, supportive role of a family learning coach in the child's learning community.

Keywords: Family engagement, early literacy learning, computer-supported collaborative learning

1. Introduction

Learning technologies are increasingly prevalent in children's homes. When well-designed to encourage open-ended exploration, provide scaffolding, and promote co-creation, these learning technologies can have unique affordances for learning (Hirsh-Pasek et al., 2015; Vaala et al., 2015). However, technology alone is not enough, and can lead to a larger achievement gap unless app creators acknowledge the critical role that parents and other adults play as guides and role models (Guernsey & Levine, 2015). Educational apps designed specifically for parent-child collaborative play can encourage parents to co-engage in their child's on-screen learning process (Takeuchi & Stevens, 2011).

Though the importance of family involvement is well documented, most learning technologies fail to design with the child's parent and family in mind. Many learning apps are opaque, providing no way to share the child's learning process with their parents, while others are solo experiences for the child, ignoring opportunities to engage the parent in the child's learning process (Vaala et al., 2015). For open-ended learning apps in particular, the nature of virtually unrestricted exploration and the personalization of child-directed learning goals make it hard to automate feedback for parents about their children's in-app play. In this way, fully automated solutions are neither feasible nor desirable. Instead, a human element must be incorporated into the system.

Therefore, we propose a computer-supported learning network that engages three stakeholders in the experience: child, parent, and a new adult collaborator whom we call a *family learning coach* (Nazare et al., 2018). This coach uses their background in education and

custom-made data analysis tools to help support the child's learning in a time-efficient manner. The coach analyzes children's play on open-ended apps in order to: (1) track progress the child demonstrates through play, (2) send parents brief, individualized updates about the child's play, and (3) suggest short, contextualized activities for family co-engagement based on the child's play patterns. Please note that we use the term "parent" throughout this paper to mean any caregiver in a child's life who plays a parenting role.

In order to develop this family learning network, we followed a design-based research (DBR) approach: designing, building, and iteratively testing our learning network (Easterday et al., 2014). In the testing phase of our research, we ran a 10-week exploratory pilot with 9 families with children ages 4 to 10. These families were given mobile devices with SpeechBlocks (SB), an open-ended literacy app (Sysoev et al., 2017), and received between one and three updates weekly from coaches about their children's SB play. This pilot is our first effort to create a family learning network that brings together children, parents, and coaches.

The goal of this pilot was to explore how to design a digitally mediated, collaborative system—a family learning network—that could engage both children and parents in literacy-related play, and lead to new knowledge, skills, and attitudes about literacy and playful learning.

The purpose of this paper is to introduce this new family learning network and identify the need for and feasibility of the role of a coach. We do this by presenting the design decisions of our system and sharing the methodology of our exploratory pilot. We then use our pilot results to discuss and define the role of a coach, hypothesize on the skills and digital tools a coach needs, and reflect upon how we could scale up this network to serve more families.

2. Background

Children are spending an increasing amount of time learning from technology-powered experiences, such as learning apps (Donohue, 2016). Families play an integral part in their children's learning process, taking on varied roles such as teachers, collaborators, learning brokers, resource providers, and learners (Barron et al., 2009). Regarding children's literacy specifically, parent-child activities are directly linked to better literacy skills (Fantuzzo et al., 2004; Sénéchal & Young, 2008) and often require minimal time investment and no specific expertise (Pisa in Focus, 2011). These activities can also benefit the parent, as a parent's sense of self-efficacy increases when they believe that their actions have helped their child learn (Hoover-Dempsey et al., 2005). Parents can further be motivated to engage in their child's learning by others (e.g. the child's teacher), who invite parents into the process and actively encourage their involvement (Hoover-Dempsey & Sandler, 1997). To help parents navigate their child's literacy learning process, Sénéchal and Young (2008) suggest coaching parents on how to teach specific literacy skills. Not only does coaching improve a child's literacy acquisition, but the availability of a knowledgeable support for parents can also bolster parents' confidence that their involvement is important and valued (Hoover-Dempsey et al., 2005).

There is a need for programs that coach parents on navigating the manifold educational media available to their children (Donohue, 2016; Guernsey & Levine, 2015). However, few programs help parents understand their child's experience *within* a given media environment such as a learning app. Of the parent-facing programs that do exist, most are analytic dashboards (e.g. LeapFrog Academy[1], PBS Kids Supervision[2], and Amazon FreeTime[3]) that provide parents with quantifiable metrics (e.g. activities or game levels that their child completed) and suggestions for automated generic parent-child activities that build off these topics.

Asynchronous communication with parents (e.g. SMS messages, emails) regarding their children's learning can help spur parent-child activities (York & Loeb, 2014; Mayer et al., 2015). One interesting example of this is the PACT program, which found that using app usage data (i.e. how long a parent used the app) to create SMS messages encouraging parent-child activities prompted parents to read with their children more frequently (Mayer et al., 2015).

There are trade-offs to human-written versus automated communication with parents.

[1] LeapFrog Academy: https://www.leapfrog.com/en-us/app-center/academy/landing.jsp
[2] PBS Kids Supervision: http://pbskids.org/supervision
[3] Amazon FreeTime: http://tcrn.ch/2ooCgHL

Suffoletto (2016) explains that when seeing an SMS, whether computer-automated or human-written, the user likely assumes that the text was written by a human. Although human-written messages have been shown to foster more sustained engagement over longer periods of time than automated messages (Tate et al., 2006), automated messages are less time- and resource-intensive to produce (Castleman & Page, 2015). However, for many open-ended learning apps, automation alone is not enough. Since the learning goals are customizable for open-ended literacy apps, children's in-app actions may not be predictable by a machine (Berland et al., 2014), making them difficult to respond to in an automated fashion. Open-ended apps that follow a constructionist approach to learning provide an open space for learners to actively construct their knowledge through activities that are personally engaging and intellectually interesting rather than instructor-directed (Papert, 1980). Research shows that these experiences are immensely powerful for children's learning (Resnick, 2014) but can be tough for a parent to understand on their own. Thus, some human interpretation is required in the learning loop. In light of this research, we built a family learning network, with the aim of defining this human role for interpreting and communicating play on open-ended literacy apps to support family engagement in their child's learning process.

3. Design

Our family learning network engages three stakeholders in the experience: child, parent, and coach. The child plays with SpeechBlocks (SB), a constructionist literacy learning app focused on helping young children (4-8 years-old) understand letter to sound correspondence in English (Sysoev et al., 2017) (Figure 1A). In SB, children tinker with letters and sounds, make nonsense words, and create and save words that are personally meaningful to them. A speech synthesizer pronounces the letter sequence using rules of English pronunciation when letters are pulled apart, put together, or tapped. All in-app play is captured, time-stamped, and streamed in real-time to a coach.

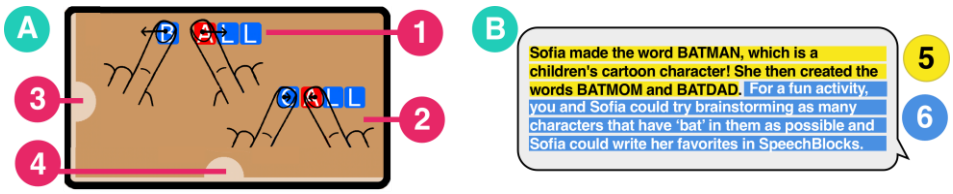

Figure 1. **(A)** Interactions in SpeechBlocks (SB). As children **(1)** pull apart and **(2)** put together letter blocks to make real and nonsense words, a speech synthesizer pronounces the letter sequence using rules of English pronunciation. **(3)** The word drawer, where children can pull out fully-constructed app-generated words and **(4)** the letter drawer, where children can pull out letters of the alphabet to play with. **(B)** Parent SMS update about their child's SB play. Updates **(5)** contain examples of what their child created in SB and **(6)**, once a week, an idea for a parent-child activity based on the child's in-app SB play.

After a child plays with SB, their coach analyzes the play data and translates key insights into short updates that are sent to the child's parent via SMS or email (per parent preference). These updates contain a few sentences about words (real or invented) that the child created (Figure 1B-5) and, once a week, a short (less than 5 minute) activity based off the child's in-app play that the parent and child can do together (Figure 1B-6).

We built a custom coaching console that digitally extends coach-parent interactions (Figure 2). This console augments the coaches' ability to find and share meaningful learning moments with parents. Within the console, coaches do three things: analyze SB play, compose updates, and review/send updates to parents.

The first step a coach takes for each child they coach is to analyze their new SB play (i.e. all of the child's play since the last parent update was sent). To enable this analysis, the console shows coaches a "snapshot view" of the words the child created and a "construction view" where they can delve into the process of how the child constructed these words. In the snapshot view, words are algorithmically annotated to show how they were created (i.e. if the child constructed them

letter-by-letter or by combining fully-constructed app-generated words) and their linguistic attributes (e.g. an English word, a complete reversal of a word, or a nonsense word pronounceable in English) (Figure 2A-1). In the construction view, we use a data visualization called PlayTrees to show the process of how words are created and the auditory feedback heard during play (Soltangheis, 2017). This helps coaches understand children's intentionality and expertise level in forming words. For example, Figure 2B shows a child splitting the word PURPLE into PUR and PLE and merging the words PURR and PULL into PURRPULL.

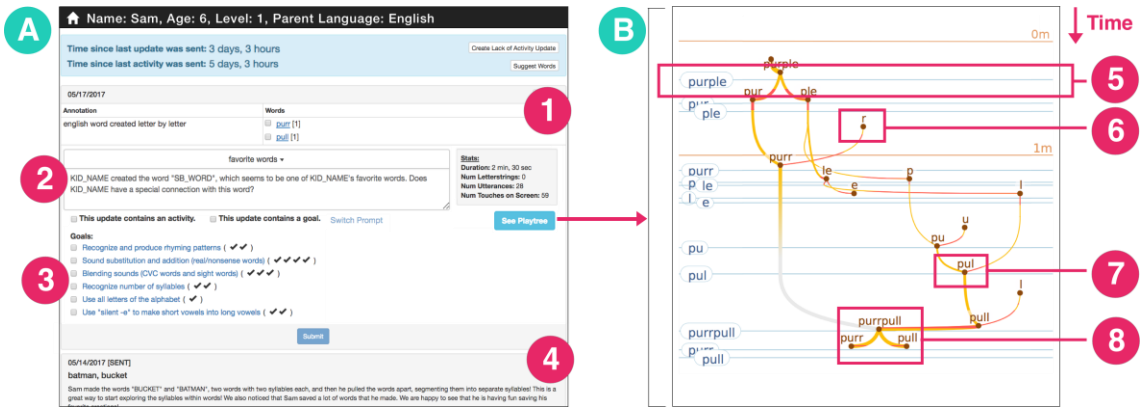

Figure 2. Coaching console. **(A)** Console screen for individual child. **(1)** Snapshot view of words created during child's SB play. **(2)** Dropdown list of update topics that coaches choose from and an area to compose a parent update using example sentences for each topic. **(3)** Way to track goals accomplished in play session. **(4)** History of coach's past parent updates. **(B)** Construction view, with a PlayTree visualization of child's SB play. When a child hears auditory feedback from SB, **(5)** a new blue line appears showing what the child heard. When a child **(6)** drags blocks onto the screen, **(7)** puts blocks together, **(8)** or splits blocks apart, new nodes appear on the PlayTree.

The next step in the coaching process is to compose a parent update. To do this, a coach chooses and categorizes the word(s) to write a parent update about. These categories (Figure 2A-2), created based on examples of past SB play, are: favorite words, repeated words, backwards spelling, sentence formation, plural words, common sounds, names, characters, rearranged words, invented spelling, and "other" (for play that does not fit a category). As the coach selects a category, an example sentence appears, which the coach can swap and customize to avoid repetition. The console also prompts a coach to send a "lack of activity" update if the child has not played with SB in over one week and to include a short (less than 5-minute) activity the parent and child could do together based off the child's past play once a week. When composing updates, coaches have access to a historical view of the child's play and parent updates so they can note trends and view their communication with the parent (Figure 2A-4).

Lastly, the coach reviews and sends parent updates. To ensure the same level of quality across parent updates, a different coach reviews and sends the update. The reviewing coach uses the console's review function to validate the first coach's interpretation of the child's play and check for typos, mistakes, and brevity before sending. The reviewing coach then sends the update via SMS or email (per parent preference) and is responsible for the resulting correspondence with the parent.

As SB is a constructionist learning app that promotes open-ended play, the design of the coaching console emphasizes the process of a child's play. This allows coaches to focus on what and how the child is trying to create, as opposed to reporting on whether the child's creations are correct or not. Similarly, through categorization and example sentences containing process-based language, the console scaffolds coaches to create updates that encourage parents to support their children's process, instead of correct it.

4. Methodology

Following our DBR approach, we ran a 10-week exploratory pilot to test and iterate upon our learning network. The goal of this pilot was to understand if parents found the coaches'

communications useful. To explore this, we asked: did the coaches' updates (a) increase parent visibility into their children's SB play, (b) help them understand what their children learned through playing with SB, and (c) prompt them to engage in the coach-suggested parent-child activities?

4.1 Setting and Participants

Nine families with children ages 4 to 10 in the Greater Boston Area (12 female and 4 male) participated in our exploratory pilot study. All of these families were recruited through a partnership with a free after-school tutoring program for public- and home-schooled children: 6 families had children enrolled in the program, and 3 families were relatives of children in the program. All children attended school in English, but all knew other languages as well: Spanish (69%), Somali (13%), Arabic (13%), Chinese (13%), and Greek (6%). Seven families opted to receive communication in English and 2 families in Spanish. All families were given Android mobile phones with data-only plans. The phones were equipped with parental-control software and only the SB app was accessible on the device. At least one parent in each family received between 1 and 3 updates weekly (depending on the frequency of their child's SB play) from coaches. Although SB is designed for 4-8 years olds, we extended the pilot age-range to 10 years old to include siblings.

4.2 Procedure

Families were required to attend a pre-workshop where they learned about the coaching system, borrowed phones with SB, filled out a survey to capture technology usage in their homes and their communication preference for parent updates (SMS message or email), and met coaches to start forming a relationship. During this time, children took the Reading Skills Inventory[4], so coaches could have an idea of their literacy level. It is important to note that, at this workshop, families were told that there was no specified amount of time their children were expected to play with SB, nor were they required to read or follow the parent updates. In order to see if this network could be sustainable without monetary incentive, families received no compensation for participation.

For this exploratory pilot, three of the researchers, each with backgrounds in education, played the coach role. Each coach spent about 4 hours a week and served approximately 5 parent-child dyads. One coach, a native Spanish speaker, served the families who received parent updates in Spanish. Coaches were responsible for checking children's play on the console thrice a week (Tuesdays, Thursdays, Sundays) and composing updates when there was new play or when the console prompted them to send a "lack of activity" update. Given consistent play, this took coaches approximately 30 minutes per child per week. Coaches were also responsible for reviewing and sending another coach's updates between 5 and 7 p.m. on these three days. This took approximately 10 minutes per child per week. Coaches spent approximately 40 minutes per week corresponding via SMS/email with the parents to whom they sent updates, doing miscellaneous tasks (e.g. further documenting wordplay that was categorized as "other"), and conducting 15-minute phone calls midway through the pilot with the families for whom they were writing updates. During this call, coaches followed a script with questions about how parents felt about SB, the parent updates and activities, and how parents perceived their children felt about SB.

At the end of the pilot, families attended a post-workshop. At the workshop, parents completed a survey about their experience with SB and the coach's updates. Children were interviewed following a script that asked them about their experience playing with SB.

4.3 Iterative Design

Taking a DBR approach, modifications were made to the tool and process during the pilot, based on parent and coach feedback. These modifications were communicated to the parents during the midway check-in, and implemented 5 weeks into the pilot. One major change came as a result of the coaches noting that it was difficult to create meaningful updates and monitor progress without a

[4] The Reading Skills Inventory was developed by Reading Specialist Joyce Goldweitz, who adapted this inventory for assessing reading skills for preschool-aged children.

learning goal in mind. Therefore, we created a set of open-ended learning goals for each literacy level (defined by RSI scores) that coaches could identify within SB play and use to inform progress updates and activities for parents to expand their child's sphere of learning through exploration. A new section of the console was added where coaches could track these goals (Figure 2A-3).

5. Results

To evaluate our family learning network, we strived to understand if parents found the coaches' communication useful. In this section, we examine (a) parent perceptions of the updates they received from the coach and (b) observe if there is evidence of coach-suggested activities in children's SB play. To answer these questions, we assessed parents' subjective experience with the coach and logged all interactions made by the child with SB.

To contextualize what parents were receiving updates on, we provide an overview of how often children played SB during the pilot. On average, children played for 8.36 minutes per day on the days they played (stdev=3.63, min=3.51, max=15.69, median=7.36) and played for 15.06 days (stdev=10.29, min=4, max=41, median=12.5). In total, the 16 children in the 10-week pilot played with SB for a total of 34.13 hours. As a result, there was a large amount of play for coaches to review when composing their parent updates.

5.1 Parent perceptions of coaching updates

We aimed to evaluate how parents perceived the coaches' communication. In particular, we wanted to know if the updates from the coach were enjoyable, in that they were perceived by the parent to be useful and engaging. To address this question initially at a high level, in the post-workshop survey we asked parents to report (a) whether they found the coach to be helpful, using a 5-point Likert scale (1 = "not at all"; 5 = "yes, definitely"); and (b) their overall, qualitative evaluation of the activities (i.e., parents could select any combination of options, including the following: "Interesting," "Annoying," "Boring," "Helpful/Informative," "Not frequent enough," and "I didn't read them"). One parent from each family filled out the survey, yielding 9 unique responses per question. Parents from all but 2 families (77%) indicated that they found the coach to be "definitely" or "most likely" helpful (i.e., the two highest response options on the scale). Likewise, parents from all families indicated that they found the activities either "Interesting" or "Helpful/Informative," and parents from one family even wished they occurred more frequently. Beyond these close-ended questions, parents were asked to give examples of ways they found these activities helpful. For example, one parent commented that they allowed her to "[learn] how to pronounce and work together with [her] kids." Other parents commented on how the updates that "suggest games" and "focus on playing" were "helpful" and "fun."

These findings together suggest that the coach provided useful and engaging information that helped the parents connect with their children's learning. Some parents did, however, suggest that the coach should be even more integrated into the lives of the families. One parent mentioned "home visits or local library visits for check-ins to help inspire kids." While we were encouraged that the parents rated the coaches so highly, it will be important for future iterations of the coach role to take into account the importance of coaches having more than a digital presence.

To delve further into how parents felt specifically about the coaches' updates, we used qualitative analysis methods to identify emergent themes in parents' free-response answers in both the post-workshop survey and midway check-in interviews. Two of the researchers, one who had served as a coach and one who had not, participated in the qualitative analysis, working together to define themes through clustering parent quotes. A third researcher who was not involved in the analysis then verified these themes. There were two emergent themes. First, parents expressed that the updates helped increase their visibility into their children's SB play. Second, the updates seemed to help parents understand what their children had learned through their SB play.

5.1.1 Increasing visibility of children's in-app play

Multiple parents reported that they liked the updates because they increased visibility of what their child was doing when they played with the SB app. For example, one parent said, "I wasn't always watching what they were doing…. I liked getting the text messages [so] I know what they were doing." In fact, a couple of parents reported not knowing where the device with SB was at the time of the midway check-in because it was in the child's possession, and therefore this increased visibility was helpful to them.

Parents also highlighted that they liked learning what words their children felt were important. For example, one mother said she did not realize that her kids knew—or were interested in—the word "Ramadan" until they spelled it in SB: "They made RAMADAN, which I didn't know that they had done. And because…we talk about it at home a little bit, but I don't think I realized the extent to which it impacted them. I'm trying to work out where they actually saw the word RAMADAN, because I don't know where it is written in any of my [stuff]."

5.1.2 Helping understand that their children learned through in-app play

Parents reported feeling that the coach updates helped them learn more about their child's literacy learning process. One mother stated that she liked when the coaches explained "why we [coaches] think Jason[5] [her son] did something" while another said the updates "help [her] understand what Anna [her daughter] needs." Another mother enjoyed when the coaches sent an update about how her daughter tried to construct the word TOASTER by spelling TOAST and adding the letter R to make TOASTR. The mother explained, "what I found interesting was Ella trying to make TOASTER… [it shows] that she's trying to think on her own." Yet another mother commented that she found particularly interesting a coach update that showed how her daughter was spelling her friends' names in SB. Upon reflecting on the coach updates, one parent explained that her child "always refused to read or learn to read" but being able to see her child's progress through this process, she felt "it really helped her [the child] become more confident."

5.2 Do families engage in coach-suggested activities?

Thus far we have shown that, subjectively, parents find value in the coaches' communication. But objectively, did this actually impact how the families interacted with the SB app? Several of the updates sent by coaches contained a suggested activity for children to complete (Figure 1B-6). We wanted to examine if, when an update with a suggested activity was sent, children tended to follow the activity suggestion. This would provide evidence that the activity suggestions were conveyed to children by their parents, given that only parents (not children) received direct communication from the coach.

Of the 180 parent updates sent across the 10 weeks, 75 contained an activity suggestion. To determine whether children followed the suggested activities, we examined all play on SB by the child in the 2 weeks following a suggested activity. We allowed for 2 weeks to elapse between activity suggestion and potential play to give the parents time to discuss the activity with their child. To investigate if the children were following the suggested activities, we manually examined the PlayTree visualizations to see the words each child created on SB. For example, when considering the suggested activity, "for a fun activity, you and your child could try coming up with words that start with the 'sc' sound," we looked for creation of words that start with the letters "sc" in the child's PlayTrees. One limitation of this analysis is that we are unable to detect if a parent and child engaged in the activity together, or if the parent had communicated to the child that they should do the activity on their own.

We found that 8 of the 16 children (50%) followed at least one activity suggestion. Two children followed 2 specific activity suggestions, and 6 children followed one specific activity suggestion. Many parents reported in both the midway check-in and the post-workshop survey that they often found it hard to find time to sit down with their child to work together through an activity. Thus, we are encouraged that for half of the children, the parents were able to receive an activity update and find the time to work on the activity together. Aggregating across our sample, we found

[5] The names of study participants have been changed to protect the identity of the individuals.

that children followed the suggested activities 10 times out of 75 prompts (13.3%); the 95% confidence interval around this rate of activity engagement, as generated from the standard error of a proportion, ranged from .056 to .210. The fact that this confidence interval does not cross 0 suggests that the coach was effective in prompting a significant amount of activity engagement among children. For an activity to be completed, communication must flow through the entirety of the child-coach-parent network. Given this, we are encouraged that 13.3% of the activities were followed as it indicates that the information flowed from the coach to the parent to the child. Additionally, as not all suggested activities were required to take place on the screen, some families may have done activities off screen, rendering their activity completion undetectable and making 13.3% the conservative, lower-bound estimate of suggested activities completed.

6. Discussion

The results of our pilot demonstrate that this family learning network was both feasible and well received by the families. From analyzing the feedback from the families and reflecting on the actions of the coaches, we can better understand and refine the role of the coach. We define the role of the coach to be supporting the family in understanding and contextualizing their children's learning process on open-ended learning apps, such as SB, in order to help parents co-engage with their children in literacy learning experiences. We then identify the responsibilities of a coach that comprise this emerging role, as well as the tools needed to support a coach, and who might be best suited to play this coach role.

There is an important social component to being a coach, in which a core coach responsibility is to form personal connections with the families and build a positive relationship. During our pilot, coaches were introduced to families during the in-person pre- and post-workshops, and communication between coaches and families was sustained through SMS/email updates and one midway phone check-in. This blended in-person and digital method of connecting coaches and families may have helped the families feel more invested in the system. We noticed that parents were more responsive when they knew their coaches. For example, when a coach made a mistake in sending an update, she immediately apologized, and the parent then was more responsive to future updates, possibly because she was reminded that the coach was not an automated system. Similarly, having a strong relationship helps give more insight and context for the coach when analyzing children's play. For example, only after talking with the mother and learning she was pregnant, could the coach recognize that PREGRET was the child's invented spelling of PREGNANT. Without a strong relationship, families may not feel as invested in communicating with the coaches, which is key to a successful learning network.

We plan to foster relationship-building opportunities for coaches and families through more intentional bonding time during the workshops, and more in-person check-ins throughout the program. This may help coaches resolve issues sooner. For example, one parent took the SB phone away from her children because they were fighting over it, and did not tell the coach. The coach continued to send "lack of activity" updates for 4 weeks, until the midway check-in when the parent told the coach that she had confiscated the phone. Similarly, one coach was composing updates in Spanish about the child's English-language play, which made coming up with spelling activities for English play difficult. After communicating with the parent about who works with the child at home, the coach was able to send activities that engaged older siblings to work together with the parent and child. More in-person check-ins would not only give coaches a better insight into the child's environment, but would also benefit the coach-child relationship. One parent highlighted this in her post-workshop survey, suggesting that the updates/activities could be improved by conducting in-person check-ins (e.g. at home or local libraries) to "inspire kids." It is important to remember that the family-coach relationship extends beyond the digital space, and communicating about personal experiences and home environments in order to contextualize the play and the updates requires a level of intimacy that can only grow from taking great care in building a trusting relationship. Thus, we believe that supporting this social component through in-person family check-ins is a crucial part of a coach's role.

The coach's other responsibilities are to use the coaching console to analyze, compose, and review/send updates. The amount of time a coach spent composing, reviewing, and sending updates

(approximately 40 minutes per week per child) is enough to sustain a high frequency of communication with the family, yet is a relatively low time commitment in comparison to what is required for in-person literacy coaching. This is especially promising for highly-active SB users, whose playtime exceeded coaching time. However, for infrequent users, children's playtime sometimes equaled coaching time, similar to in-person literacy coaching. We plan to iterate upon the console's design. For example, while we found it helpful to have the review process in place for this exploratory pilot in order to ensure similar quality updates from all the coaches, we plan to remove this review process and instead allow coaches to communicate directly with the families they create updates for. The review process will be replaced with a coach discussion channel for coaches to communicate asynchronously, and a bi-weekly meeting for coaches to seek advice or discuss ideas. We also plan to introduce the role of a coach coordinator who will provide support to coaches.

This exploratory pilot also helped us understand the type of skills required in a coach, and who might be best suited for this role. An ideal coach is someone who: (a) has empirical skills and knowledge of literacy processes to identify emerging patterns related to literacy development, and (b) is relationship-focused and interested in family and community engagement. Two potential groups that may be well-suited to be coaches are librarians and speech language pathologists (SLPs). Our next steps are to design workshops with librarians—who are often expert community organizers—in which we will use a participatory design approach to develop ways this system might operate in a library setting. We are also in the process of designing a comparison study in which coaches will be trained SLP students, and separate researchers will conduct a study to compare a SB program with and without coaches, in order to better examine the effectiveness of the coaching system. For this upcoming study, we will be scaling up the number of coaches, along with improving upon the coaching console's design to better assist new coaches who are not yet familiar with the coach role and digital tools. We anticipate that, while there may be an initial learning curve to using the coaching console, as coaches become accustomed to the digital tools, they will be able to use them more efficiently.

As this was an exploratory study conducted as part of our DBR approach, one of its major limitations was that the researchers were also the coaches. Furthermore, as researchers, we had been volunteering at the afterschool program where we met once a week with many of the children who ended up participating in this study. Although we did not talk about SB during the afterschool program, these interactions may have influenced the children's and families' perceptions. Families may also have been uncomfortable giving negative feedback, given their familiarity with the researchers. Anonymous surveys may help with this in the future. Although we believe that the relationship between the coach and family is important, it is also important for the researchers to be a step removed from the coach-family interactions. It was sometimes confusing to separate our role as researchers with our role as coaches, and in the future, we plan to address this by playing only the role of researcher and training coaches who interact with the families. Thus, we will be able to conduct research that better examines the role of a coach from an objective research perspective. This will also allow us to run a comparison study between coach and no-coach conditions to understand the effectiveness of a family learning network.

7. Conclusion

In response to the lack of contextualized feedback and co-engagement opportunities for parents in children's open-ended learning apps, we identify the potential new role of a family learning coach who supports a family in understanding, contextualizing, and engaging in their children's learning process on open-ended learning apps. We designed the role of the coach, built a custom coaching console, and ran an exploratory pilot study of the child-coach-parent family learning network. Overall, our family learning network shows promise. Many parents perceived that the coach's updates increased not only their visibility into their children's SB play, but also their understanding of the learning process. There was evidence of children doing the activities suggested in coaches' updates to parents, and parents reported finding the presence of the coach to be helpful. As new open-ended learning apps are developed, and new coaches mold the role of a family learning coach to fit the context of their communities, we hope that this work serves as the first of many examinations of the role of a learning coach within a digitally mediated family learning network.

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