# Mobile technology to increase parent engagement

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**Abstract.** The untapped potential of mobile applications to increase opportunities for parent engagement is enormous. Parent engagement is widely recognized as critical for children with disabilities, and optimal for children who are considered at risk for delayed development. However, there are many barriers to parent engagement. Mobile technology provides a platform to overcome many of these barriers. An iterative design-based research project was conducted to develop an application for increasing parent engagement. The design process, feasibility testing, and results are presented. Next steps and future opportunities are discussed.

## 1  Introduction

Parents and caregivers are natural and motivated teachers, who can have a positive impact on their children's learning [1], even as children spend time outside the home in childcare or school.  In fact, promoting partnerships with parents to support their engagement in children's learning and development is a key goal of many educational institutions. For example, in the United States (U.S.), The Administration for Children and Families Head Start Preschool Program [2] and the Department of Education's Every Student [3] both emphasize parent engagement in children's learning.  The Individuals with Disabilities Education Improvement Act [4] mandates parent participation and home-school involvement in assessment, planning, and implementation of interventions. Past studies have demonstrated a robust connection between parent engagement and child's achievement and emotional adjustment, irrespective of the socioeconomic background of the family [5]. Unfortunately, factors such as cultural background, language barriers, limited school resources, parent education, and families' limited understanding of the

importance of being involved in their child's education can limit parents' engagement with educators [6]. Given the proliferation of internet-enabled mobile devices across a range of cultural and economic populations, there is growing interest and promising findings in using these tools to promote effective parenting strategies [7] [8]. In this paper, the authors describe the benefits and barriers to parent engagement in their children's education, a beta version of a mobile app designed to facilitate parent communication with preschool teachers, and preliminary findings from pilot tests with a preschool program serving culturally diverse and economically disadvantaged families.

## 2  Parent Engagement

Parent engagement is a dynamic construct that changes over a child's life. Sheridan and colleagues define "parent engagement as behaviors that connect with and support children or others in their environment in way that are interactive, purposeful and directed towards meaningful learning and affective outcomes" [9]. They consider parent engagement to have three dimensions encompassing warmth, support for independence and development, and participation in learning.  Engagement is a more interactive construct than involvement, which Epstein defined as having four dimensions; (1) basic obligations, (2) school to home communications (3) parent involvement at school (volunteering in classrooms), and (4) parent involvement in home activities (such as homework) [10].  Fantuzzo, Tighe and Childs started with Epstein's model, and empirically tested a three factor model which included school-based involvement, home-school conferencing, and home-based involvement [11]. The researchers found parents with higher education, dual-parent household and Head Start programs had the highest amount of school-based involvement, however, this did not influence the amount of home-school conferencing or home-based involvement. Therefore, involvement can be considered to be a more general construct of knowledge or understanding of a child's education, where engagement refers to a more active participatory role in a child's education.

### 2.1 Preschool Benefits

Young children naturally spend more time with their caregivers, and research consistently demonstrates that children who are provided with enriching activities and supportive interactions in the home environment have better academic outcomes [12] [13] [14]. Parent engagement in activities such as reading and having conversations about the events of the day, are particularly important for young children.  For instance, Fantuzzo, McWayne, and Perry found a significant correlation between urban Head Start children's receptive vocabulary and the number of activities in which parents engaged with their children [15]. Researchers have also found that teaching parents to use in-home language enhancement strategies with their children with language delays resulted in significant increases on children's language outcomes [16].

The benefits of parent engagement have been found to promote children's readiness for school after preschool. For example, Sheridan and colleagues found that

preschool children receiving an intervention with an explicit parent engagement component were rated significantly higher by teachers on their oral language, writing, and literacy skills, compared to controls [17], and this effect was even more pronounced for children who were below benchmarks on academic measures and considered at-risk for poor kindergarten readiness. Positive early parent involvement creates a cascade of impacts on children's academic success, later motivations and continued parental involvement in their child's schooling [18]. For example, Gutman & McLoyd found that families of high-achieving urban African-American school-age children in the U.S. were more engaged and communicated more often with their children's school than low-achieving children [19]. Likewise, others report that urban parents who have direct, consistent contact with the school have children with less behavior issues and more positive academic and social experiences at school [20]. Parent engagement is considered a critical component of nearly any early intervention approach for children with special needs [21].

## 2.2 Barriers to Parental Engagement

Despite clear potential benefits for increasing parent engagement, there remains a gap between the ideal models and present practices. Many barriers to parental engagement exist including cultural mismatch between parents and schools, work schedules of parents, multiple households, second language barriers, and parents' beliefs about education [22]. For example, a recent survey by Public Agenda found that 65% of parents wanted to be more involved with their child's education and less than a third of those surveyed were satisfied with the current amount of involvement [23]. Parent engagement is often mediated by socio-economic status, such that parents with more education and income are generally more involved and active in their children's educations due to their increased capacity to do so [24]. Immigrant parents, in particular, face great challenges in understanding the American school system (e.g., the meaning of the grade system), and they typically work long hours that prevent them from being able to have any meaningful dialog with their children's schools [25].

Compounding the difficulties in engaging parents in their children's education, teachers often report that they lack the preparation and confidence to engage families [26]. Early learning programs typically rely on a school-directed approach that is led by professionals, as opposed to one that is co-constructed by the school and family [27]. This uni-directional (school to home, rather than school with home) approach can result in a mismatch of expectations and disconnect between schools and families. Consequently, families may feel excluded and unwelcome, and their role in their children's academic achievement is minimized. This effect is even more pronounced with families who have multiple risk factors such as a child with a disability, parental incarceration, drug-use, or low literacy – in short the very families professionals want to engage are often the hardest to engage [28]. Likewise, when young children have identified disabilities, their communication skills are often low. Effective communication with parents of children who have poor communication skills is critical to ensure transitions between home and school go smoothly. Schools and child care agencies must use innovative practices to promote

greater parent engagement [29]. Therefore, educational institutions must look for new and time-saving tools, such as mobile technology, to increase the capacity for involving and engaging parents effectively.

## 3  Mobile Device Usage

The use of mobile devices across all facets of life is expanding exponentially. As the costs of technology decrease and the general public's familiarity and acceptance of technology increases, there has been a significant upsurge in the use of mobile devices and internet-enabled tools. Based on a survey conducted in Spring of 2013, Pew Research reported that cell phone ownership in America reached 91%, making it the fastest consumer technology to achieve that adoption rate [30]. Furthermore, cell phone adoption is relatively high among populations that are often perceived as slow adopters of new technology. For example, those living in rural communities, without a college education, earning less than $30,000/yr, and ages 55-64 have adoption rates of 85%, 88%, 86%, and 87%, respectively. In the same survey, 56% of respondents reported owning a smartphone, which provides access to the Internet and enables the use of 'apps' (applications): software programs installed on smartphones that provide advanced production, communication and gaming capabilities similar to programs installed on computer programs (e.g., email, calendar, and mapping apps). Among African Americans and Hispanics, smartphone use is estimated to be higher (64% and 60%, respectively) than whites (53%) [31]. Finally, the use of tablets and e-readers has increased from 6% in 2010 to 43% in September 2013 [32]. Adoption of these devices by diverse populations continues to increase at unprecedented rates.

### 3.1 Technology to Support Teacher-Parent Communication

Using technology to support teacher-to-parent and school-to-parent communication has gained significant momentum in the last decade [33]. School- or Student-Management Systems such as Moodle®, Skyward®, and PowerSchool® facilitate electronic communication between teachers and parents and often allow parents to monitor their child's progress. However, these systems are typically used for primary and secondary education and usually only support one-way communication: teacher- or school-to-parent. Also, these systems are typically limited to communicating general announcements about upcoming assignments, parent-teacher conferences, and access to student attendance and performance on tests and assignments.

Unfortunately, early childhood education (ECE) teachers, including those that serve children with special needs and providers have fewer technology tools available to support teacher-parent communication despite the clear need for meaningful family engagement in children's early learning [34] [35] [36] [37]. Because there are different communication needs for ECE providers than K-12, many of the existing large-scale school management systems that integrate with district data management systems are not appropriate for ECE (i.e., birth – preK). For example, instead of providing access to a student's attendance and homework completion records, ECE providers are more likely to

share the week's creative play theme, books that they plan to use during shared reading time, or suggestions for activities or topics to discuss with their child at home related to the current curriculum.

Despite the lack of integrated communication systems such as those used in K-12, Wartella and her colleagues found that nearly half of ECE providers (birth – 3rd grade) reported using the Internet to communicate with parents [38]. The vast majority (82%) of providers reported using email to maintain contact with parents and other team members, and smaller percentages (6-37%) reported using other commercially available social networks (e.g., Twitter, Facebook, MySpace, etc.) for communication. This is in accord with more recent studies that have found that at-risk parents' report a strong desire to use technology to maintain community partnerships with providers and other parents [39]. In a randomized trial of the effectiveness of a cell phone enhanced parent training program, Carta and her colleagues found that parents who communicated with home-visiting providers with cell phones and text messaging demonstrated higher rates of responsive parenting and reduced parenting stress and depression, and that children showed higher rates of positive engagement and adaptive behavior [40]. Powell & McCauley described one preschool center's use of a web log (blog) in which teachers entered brief descriptions of children's daily activities and pictures of their work. Parents responded to the posts, resulting in an ongoing, media-rich dialog between parents and teachers to "help close the communication gap; promote a stronger, more collaborative partnership with parents; and improve the educational experience for teachers, parents, and children alike" [41].

To date, the field lacks empirical support for the use of web resources or mobile devices to increase parent-teacher communication. However, studies of the use of technology in other areas have demonstrated success in improving communication and targeted outcomes. Free and her colleagues' systematic review of studies investigating the use of mobile devices by healthcare providers showed that most studies found at least a modest improvement in communication between patients and providers, and increased appointment adherence, but that more research is needed to investigate impact on health outcomes [42]. Rodgers et al conducted a randomized trial (N=1705) of the effects of a text messaging intervention program on smoking cessation [43]. The intervention group received mobile phone text messages providing advice about how to quit, symptoms to expect, and how to manage symptoms. Six weeks after cessation, statistically significantly more intervention participants (29%) remained smoke free than the control group (13%). Statistically significant differences between groups continued at 12 and 26 weeks post cessation. Using a single group pre-posttest design, Akamatsu, Mayer, and Farrelly found that deaf and hard-of-hearing adolescents' self-reported independence improved after using text messaging to communicate with family and friends [44]. Various forms of text messaging systems have been used in work settings to facilitate communication within and between teams and to augment existing training programs [45] [46] [47].

A clear and notable finding of the work on parent engagement is that when schools and teachers reach out more to parents, parents are more likely to reciprocate and increase involvement with their child's education [17][18][19][20]. Much of this positive involvement is in the form of communication between teachers and parents, and parents

and children.  This involvement creates a cascade of positive outcomes, including increased academic success and social-emotional adjustment. Teachers see children of involved parents as more competent and motivated, and parents feel satisfaction in their child's accomplishments.  A major factor in how much teachers are able to reach out to parents involves the structures in place at educational institutions [48]. Although there is considerable variance in parent engagement among families, overall during the transition from preschool to kindergarten levels of parent engagement tend to drop. The transition to kindergarten is a critical time for children to make gains or fall behind, and little attention is paid to developing strategies to increase levels of parent involvement during this period [49].

While technology holds promise to address these barriers, there is a lack of tools that fit the ECE environment. Despite this, ECE professionals use tools such as the Internet to communicate with parents. Given the finding that more low-income and minority parents use cell phone to access the internet, systems that run on mobile devices hold the most potential to engage hard-to-reach parents [50]. Therefore, a prototype mobile application, called *Family TIES*, designed to 1) support secure, multimedia parent-teacher communication, and 2) provide tools for administrators or master teachers to document and report the amount of parent-teacher communication on a daily, weekly, or monthly basis was developed. The following describes the development and feasibility testing of *Family TIES* in facilitating bi-directional communication between parents and preschool teachers beyond the face-to-face time that they have during child pick-up and dropoff.

## 4 Family TIES Application Development

The development team at Juniper Gardens Children's Project uses an agile development process, similar to what is often referred to as "Scrum" [51]. In the spirit of design-based research [52] [53], this process allows for a small team of developers to develop the application in a way that promotes ongoing revisions, test usability and functionality with the target population, and make iterative improvements based on testing. Overall design is informed by principles of Universal Design [54] and its three keys to optimizing usability and accessibility: 1) Provide multiple means of representation, 2) Provide multiple means of action and expression, and 3) Provide multiple means of engagement with the technology.

In addition, development and design of the *Family TIES* app was driven by three factors relevant to our target population: (a) preschool teachers and at-risk families: they may have limited technology experience [55] [56], (b) teachers' access to mobile devices and wireless internet may be limited in preschool settings [57] [58], and (c) that mobile device usage is distributed primarily across Android (76.6% market share) and iOS (19.7%) operating systems (International Data Corporation, 2014).  Because smartphone usage is distributed across multiple operating systems, we developed the *Family TIES* app with the open-source PhoneGap® framework, which allowed us to develop the app in a single environment. Once finalized, the app can then be deployed across multiple devices

with minimal coding for each unique operating system, which is particularly suitable for an iterative development process that demands frequent revisions.

Development progressed from an initial Focus Group with parents and preschool teachers (N=8), to three rounds of field testing and revision we tested our prototype with five teachers and ten parents and children. The purpose of the Focus Group was to inform initial design specifications and functionality of the app. During the Focus Group, parents and teachers completed a survey asking about their technology use (e.g., preferred devices and frequency of using the internet), their likelihood of using technology to communicate with teachers/parents, and *how* they would use technology to communicate (e.g., daily or multiple times per day, as a group or with individual teachers/parents, etc.). This was followed by an open discussion of these topics with both parents and teachers facilitated by a moderator.

Following the Focus Group, development of the initial iteration of the Family TIES app, in-house testing, and debugging, we conducted two rounds of feasibility testing with a local Head Start program. The purpose of feasibility testing was to explore how parents and teachers used the app to communicate under natural conditions, how often they used it, and the content of their communications with only limited guidance on what to communicate related to their child's curriculum. Data from each round of testing was combined with exit interview surveys to inform iterative improvements in the Family TIES app, support documentation, and parent/teacher training for using the app.
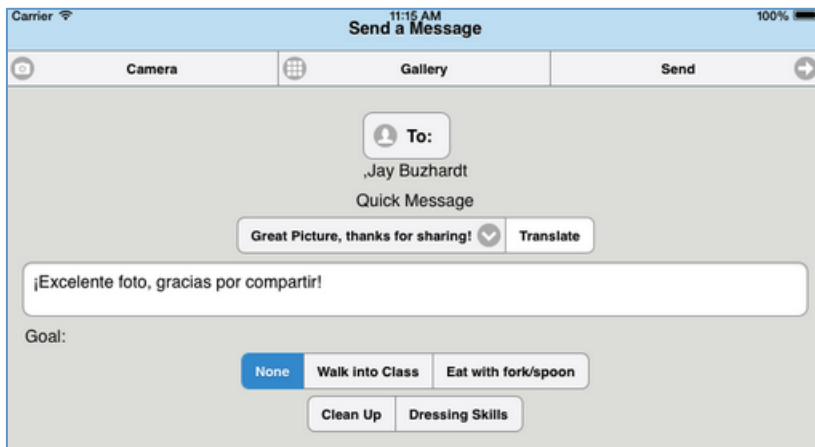
## 4.1 Family TIES Description



**Fig. 1.** Screenshot of the message menu.

Family TIES includes the following features that make it uniquely suited for use by preschool teachers and parents: 1) Messages can be 'tagged' with the relevant curriculum goal (customizable by lead teachers); 2) Prepared 'Quick Messages' for common communications to improve efficiency of communication; 3) Translation tool to support communication between people with different primary languages; 4) Online aggregate report of all communication between teachers and parents within a classroom available to lead teacher; 5) Administrative tools for lead teachers and administrators to control access; and 6) Optional Spanish-language interface. Creating more opportunities for meaningful dialogues between preschool teachers and caregivers 1) improves parents' understanding of their child's curriculum and progress, 2) can help develop parents' skills and confidence in communicating with teachers about their child's progress, resulting in more parent involvement during elementary school years, and 3) allows for increasedopportunity for continuity of pre-academic skills that can be practiced during daily routines at home (e.g., vocabulary enrichment, drawing/naming shapes, and naming days of week/months).

### 4.2 Family TIES Feasibility Testing

**Participants.** Two parent/teacher cohorts tested the app, both of which occurred in the same Early Head Start preschool program. Testing involved two toddler classrooms with one lead teacher. Cohort one included two teachers, five parents and five children. Cohort two included three teachers, five parents and five children. A Master teacher supervised both classrooms. The children in the first round were 18 to 22 months, and the children in the second round were 24 month to 32 months. Children were considered at risk due because their family income was below the U.S. federal poverty level. One child had an identified disability. Parents were majority Hispanic (90%), and spoke Spanish as their first language, and one African-American parent also participated. Parents and teachers completed pre- and post-surveys to assess their satisfaction with Family TIES, features they liked, and features that would improve the application. All the messages shared via the app were stored in a secure online database with the complete message content, date, sender, receiver, subject line and the attached picture (if applicable).

**Procedures.** Prior to each cohort's participation, parents and teachers met as a group with the developers to discuss the purpose of the feasibility test, how to use the app, and to check out the devices they would use during testing. They also practiced sending and receiving messages, including how to take and send a picture through the Family TIES app. Although all families had a cellular phone, most did not have a smartphone. We provided each family with a Droid Razr M® smartphone running the Android operating system (Android 4.1.2, *Jelly Bean*) with a 4G data plan, and the Family TIES app pre-installed with their own account. Each classroom was assigned a Samsung Galaxy® tablet connected wirelessly to the center's Internet connection. At this early stage of testing, it was important that participants used common devices with known platforms and specifications to reduce the possibility that any problems users experienced were due to

software-hardware conflicts. Families could use the smartphones for personal use but were asked not to install new apps.

Teachers were asked to send at least one message a day to each participating parent. Parents were encouraged to respond to messages and to send original messages, particularly about activities related to the child's current curriculum. Beyond these initial instructions and recommendations, participants did not receive further reminders or prompts to use the app. At the end of each cohort's participation (6 weeks each), all participating parents and teachers filled out an exit survey and completed an exit interview with researchers.

Between Cohorts 1 and 2, we made updates to the Family TIES app in response to feedback from teachers and parents. The two most significant changes were improving usability for Spanish-speaking users and adding a feature that allows the user to 'tag' a message with a specific curriculum goal. Users could change the app so that all labels were in Spanish to make it easier to use for users with Spanish as their primary language. Also, frequently used phrases could be translated from English to Spanish, and vice versa to facilitate communication between English and Spanish speakers. The purpose of tagging messages with curriculum goals was two-fold: a) we wanted parents/teachers to be able to quickly identify received messages related to curriculum goals (e.g., "Look at Alecia cutting out square shapes today at her grandma's" would be tagged with *Learning Shapes*) so that they could reply to them more quickly, and b) because the tagging options were displayed on the messaging interface, these options also served as a reminder to share information about activities related to curriculum goals and what the goals are. In addition, we made minor bug fixes, general performance enhancements, and improvements to the user interface. For example, one interface improvement was the addition of a 'quick reply' feature that allowed a user to quickly send a frequently-used message (e.g., "Thank you!, Great picture, Ok, got it!"). Lastly, teachers asked for a "message read" indicator, so they could see that a message was received.

# 5 Results

## 5.1 How did parents and teachers use Family TIES to communicate?

**Table 1.** *Number of messages sent by cohort*

|  | Cohort 1 | | Cohort 2 | | Total | |
|---|---|---|---|---|---|---|
|  | N | % | N | % | N | % |
| **Teachers** | 139 | 49 | 78 | 67 | 217 | 54 |
| **Parents** | 147 | 51 | 39 | 33 | 186 | 46 |

Table 1 shows the number of messages sent by teachers and parents for each cohort. Overall, teachers and parents sent the same amount of messages (p=46%, t=54%). However, we did see differences between the two cohorts. Cohort 1 parents and teachers

sent an equivalent amount of messages (p=51%, t=49%), while teachers in Cohort 2 sent about twice as many messages as parents (p=33%, t=67%).

Figure 2. shows the percentage of messages sent by week. A novelty effect can be seen, with well over half of all messages being sent the first week. This was also caused in part to parents/teachers messaging each other during the first week of use to confirm receipt of prior messages, particularly for Cohort 1.
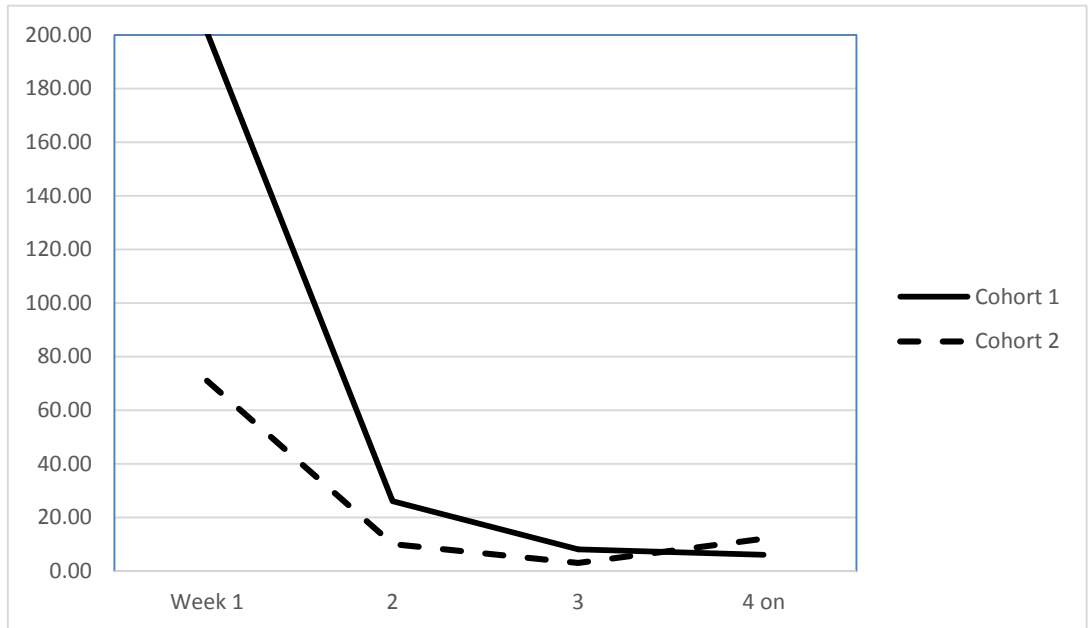


**Fig. 2.** Frequency of total messages sent by week

Analysis of the time it took for parents and teachers to respond to messages indicate that both teachers and parents were relatively quick to reply to messages. Across all messages, 35% of responses occurred on the same day, 12% within 1 day, and 18% within the school week. Figure 3. shows the distribution of messages by day of the week to see how communication was distributed across the week. Communication was highest in the first half of the week, with a substantial decrease in communication starting on Thursday. Saturday and Sunday had the fewest number of messages because teachers were not sharing and parents did not feel the need to share because teachers could only access messages at school.
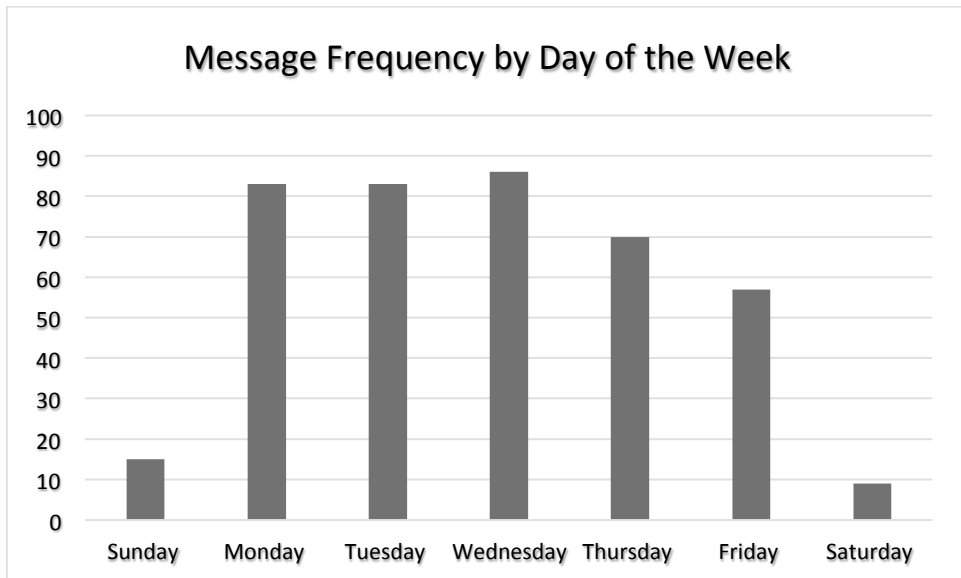
## Message Frequency by Day of the Week

**Fig. 3.** Message frequency by day of the week.

### 5.2 Content of messages

Teachers were encouraged to take pictures and send messages to parents about her current instructional goals and activities that were taking place in the classroom. At first much of the communication was about whether or not the parent had received a message, because the parents did not always reply. For the second cohort, we asked the participants to send more details message about activities and added a quick reply feature making it easier to let the teacher/parent know that they saw the message, reducing the time spent asking recipients if they saw the message.

Message contents were coded by context (home or school) and category of communication (social, scheduling, curriculum, social-emotional, or health). Table 2 lists the codes and frequency of messages. The majority of the communication between teachers and parents was regarding classroom curriculum or child developmental progress. For example, one classroom teacher who did not speak any Spanish could take pictures of the activities that happened in the classroom that day and send the message to the parent who would read it during her lunch or break at work. At pick up, she asked the child about the activity and the child had an opportunity to explain again what she had learned that day. Later at home, when the family's older children were doing homework, the parent showed the child the picture from school and the child eagerly sat down to "do homework" also, gaining another practice time. The parent took a picture of the child engaging in

"homework" and sent it to the teacher, who asked the child about it at school the next day. In this example, the child has gained at the minimum three extra opportunities to practice a skill that would not have happened had the teacher and parents not had the Family TIES system to support the interactions. The second most frequent category was social – pleasant exchanges that did not necessarily related directly to the curriculum, but for the most part were thanking the sender for the picture or commenting on the picture sent.

**Table 2.** Message codes and frequency for each cohort

| Text Message Code | Cohort 1 | | Cohort 2 | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Social | 68 | 22.44% | 38 | 29.46% |
| Classroom-scheduling | 15 | 4.95% | 0 | 0.00% |
| Classroom-curriculum | 69 | 22.77% | 42 | 32.56% |
| Classroom social/emotional/health | 34 | 11.22% | 21 | 16.28% |
| Home-scheduling | 11 | 3.63% | 6 | 4.65% |
| Home-curriculum | 12 | 3.96% | 1 | 0.78% |
| Home-social/emotional/health | 38 | 12.54% | 8 | 6.20% |
| Picture only | 37 | 12.21% | 7 | 5.43% |
| Unable to determine | 19 | 6.27% | 6 | 4.65% |
| | 303 | 100.00% | 129 | 100.00% |

Additionally, we found the teacher and parents used the app to communicate about the routines and health or emotional state of the child. They found it was much easier to send a quick message saying "Rosie did not sleep well last night" through the app instead of trying to talk to the teacher when time was short during the drop-off period. These messages also often indicated preferred activities or enjoyment of the child (e.g."Dale loves the water table"). In cohort 2 we implemented the feature to 'tag' a message with a specific curriculum goal, and specifically encouraged teachers to share information about curriculum activities with parents. The teacher in cohort 2 did then demonstrate an increase in the proportion of messages about the classroom curriculum goals, although the parents in cohort 2 did not increase their messages about doing curriculum activities in the home. The teachers in cohort 2 were focusing on independence skills such as feeding, bathroom skills, and dressing skills, so it may be that was the reason for the increase in social/emotional and health messages. There is also a decrease in the amount of picture

only messages – it could be the tags allowed for participants to quickly choose a message topic.

## 5.3 Participant satisfaction

We conducted exit interviews and administered surveys to all teachers and parents. During the exit interview, parents and teachers were invited to tell us how they liked using the app, and to give suggestions for improvement. Follow-up or clarifying questions were asked, and participants reviewed their statements for accuracy.  The survey consisted of a Likert-type scale of 1-5, with participants stating 1) Strongly disagree, 2) disagree, 3) neither agree nor disagree, 4) agree or 5) strongly agree.   All participants indicated they liked using the app and that it was easy to use.  All parents (n=10) indicated the app helped them to communicate with the teacher. Parents enjoyed receiving pictures of the children's activities during the day, but some parents indicated they would prefer the teacher to give them more specific directions about activities to do at home. In other words, the teacher may assume that a parent will know to ask a child to do a coloring activity after receiving a message that the child worked on colors in school, but for some parents this may not be immediately obvious. Most of the parents made a statement about the increase in communication with the teacher and subsequent increased understanding of what happened at school was extremely valuable to them. Parents enjoyed the opportunity to share the pictures with their child and with other family members and friends. The majority of participants (n=7) felt they had time during the day to use the app, but three participants indicated that finding time to use the app was challenging.  Participants also gave suggestions for features that could be added to the app.  The most frequent request was to add a translation tool that would enable the send to type a message in their language and have it translated into the language of the receiver.  Participants also were interested in adding video to messages.   One of the teachers liked having the spreadsheet of communications and photos and was able to use the information for her portfolio assessments.  She felt that the process of taking pictures during the day helped her remember more of what happened that day, and that she had longer and more detailed conversations with parents as a result.

## 6 Discussion

Giving parents and teachers tools to improve communication has potential to positively impact children's outcomes in school.  Ho and colleagues suggest perceived usefulness and ease of use are critical to teachers' adopting new technology [59].  Family-TIES was rated highly in both usefulness and ease of use, but we found this wasn't enough. If parents and teachers do not know what types of communication are most supportive of children's development, the communication may be surface level sharing of information (involvement) and not promote the type of engagement that leads to positive child outcomes.  This lack of connection of engagement to learning goals is supported in the

existing research on parent-teacher engagement. For example, a recent survey by Public Agenda found that parents knew little about their child's learning and what important milestones they should look for [60]. Similarly, teachers often report they have little preparation for, and do not feel confident in engaging families [61]. Therefore, both parents and teachers need some understanding and learning around how to be engaged with each other in a way that is supportive of the child's learning goals.

## 6.1 Beyond a focus on tools

In today's high stakes educational environment, teachers have a lot of demands on their time and priorities. Likewise, parents have much to juggle in their daily lives. If we want to create an optimal environment that supports authentic parent engagement, the right tools and curriculum is not sufficient. Usability and feasibility is essential for the success of any parent engagement program using technology [62]. In our debriefs with the teachers, we found that the more we could align the app to tasks and activities parents and teachers already do, the more they would use the app. For example, providing the teacher with a spreadsheet of her messages including pictures, subject titles, and dates gave her data for the portfolios she kept for each student. For parents, using a smartphone app put the engagement tool into something they used heavily throughout the day, and could check in less than two minutes was key to making it something they would use. Therefore, the menus and the tools need to be obvious and easy to use. In our pilot study, Spanish-speaking parents indicated that they felt the app increased their ability to communicate with the teacher. There is clearly a need to provide more avenues for communication between teachers and non-English speaking parents. Easy to use translation support would be essential to reach the families who may most benefit from increased engagement with their child's school.

There are many apps that schools and teachers can use to communicate with parents. Table 3. summarizes a snapshot of commercially available apps designed to communicate with parents. However, none of these systems provide the types of supports that parents and teachers may need in order to use the app in an effective way to support child development, especially for children with disabilities. In a study of the popular Fitbit wearable device, users who were most effective at losing weight were the ones who were more engaged with the mobile app. The implication is that the behavioral change was facilitated by the active interaction with information on the app, and the passive receiving of messages about activity was not enough to sustain the behavior changes [63]. In a similar way, parents need to be able to actively interact with their children's teachers, not just passively receive information, in order to provide the type of support at home that increases children's positive outcomes.

**Table 3.** Features of Existing Apps Used to Facilitate Parent-Teacher Engagement

| App | Individualized at parent-child level | Multi-media capability | Parents can message teacher | Coach support | Progress monitoring tools | Translation |
|---|---|---|---|---|---|---|
| WDWDT | X | X | X | | | |
| Remind 101 | | | | | X | |
| Edmodo | X | X | | | X | |
| MySchools App | | | | | | |
| Apps for Ed | | | | | X | |
| My Childcare Tracker | X | X | X | | | |
| Parents Connect | X | X | X | | X | |
| Life.Cubby | X | X | X | | X | |
| Seesaw | X | X | X | | | |
| **Family TIES** | **X** | **X** | **X** | **X**[1] | **X**[1] | **X**[1] |

[1]To be developed in the proposed project.

In sum, although having a tool to increase parent engagement has potential our beta-testing identified that more functionality is needed to 1) increase parents' and teachers' communication about child-focused content (e.g., the child's challenges and successes around pre-literacy goals, developing friendships, examples of growth on social-emotional goals) by improving notifications of incoming messages and prompts/reminders to share, 2) improve parents' and teachers' descriptions of multimedia communications, 3) facilitate communication between English-speaking teachers and Spanish-speaking parents, 4) improve the user interface to decrease the amount of steps needed to send/read messages, 6) text-to-speech tools so that messages can be read to users, 6) support parent reporting of their frequency and fidelity of implementation of parent-child engagement strategies and 7) reports for school administrators or lead teachers that provide summary statistics of communication between parents and teachers, and parent implementation fidelity summaries. We propose that these are tools that would be necessary to see an impact on child outcomes. Figure 4. represents a theory of change, that would be tested in future studies, incorporating what we learned in the pilot study, and outlining future development plans. Proposed new features are in bold.
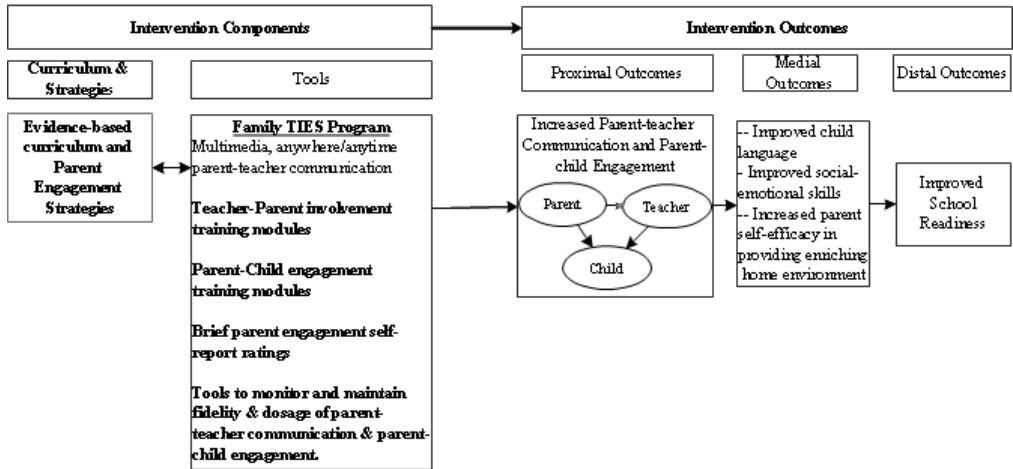
**Fig. 4.** Family TIES Theory of Change

# 7 Summary

Although there are mobile programs on the market that schools can use to communicate with parents, there are no dedicated programs which can address both increasing parental engagement and providing progress monitoring and fidelity measures to ensure effective implementation of interventions for children and families. Innovative tools and programs that take advantage of mobile technology hold great potential for delivering content to parents and teachers. Active engagement with mobile technology may be a key ingredient to increasing parent and teacher uptake of such innovative tools. Additionally, there needs to be more work on using mobile platforms to provide parents and teachers with progress monitoring data that can be easily interpreted and that they can use to inform their active engagement and interactions with children. As preparing young children for academic success has become increasingly critical and at the same time increasingly complex, early childhood professionals will need to use many tools and resources to attain the goal of educating all children.

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