A systematic search and comparative analysis of commercial mobile apps for parent-teacher communication

Jinghan Ni
University of Michigan Ann Arbor, USA
jinghann@umich.edu

Abstract

Background: Communication between teachers and parents has been shown to improve outcomes for students. Mobile apps are increasingly used to facilitate communication between teachers and parents in various educational contexts. However, there are a large number of apps available, and information about their intended use and quality can be difficult to find.

Objective: To improve our understanding of the landscape of mobile apps for parent-teacher communication, I performed a systematic search of commercially-available mobile apps along with a comparative analysis of their quality. The following research questions guided this work: R1: What features do commercially-available (apps available for free or apps offering a free trial) parent-teacher communication apps have? R2: What are the current strengths and weaknesses of parent-teacher communication mobile apps? The Mobile Application Rating Scale (MARS) was used to describe and analyze the features of apps and evaluate their quality.

Methods: A search for 7 keyword pairs related to parent-teacher communication was conducted in the Apple App Store and the Google Play Marketplace. A Google search for “parent-teacher communication app recommendation” was also conducted, so that mobile apps that appeared in recommendation lists were also included in the study. Those mobile apps that have not met the inclusion and exclusion criteria were excluded. Finally, apps were reviewed and rated on quality using the MARS subscales on engagement, functionality, visual aesthetics, information quality, and subjective quality.

Results: A total of 339 apps were identified upon removing the duplicates, screening using inclusion and exclusion criteria, and including top 15 apps from the 21 editorial recommendation lists from Google search result. The final selection of apps consists of 10 that appeared in all three sources/platforms (i.e. Apple App Store, Google Play Store, and the recommendation list found via Google search). The median overall MARS score on the quality measure was 4.08 (out of 5.0), which exceeded the minimum acceptable score (3.0). The ClassDojo app had the highest average score (4.75) followed by Remind (4.41). Only two apps, Bloomz(2.95), and
Freshgrade(2.83), fall below the minimum acceptable score (3.0). Subjective subscales of MARS ratings are excluded from the overall MARS ratings.

Conclusions: Despite the wealth of apps targeting parent and teacher communication, only a few passed the identified screening criteria. Many of the excluded apps also require a school wide implementation and a specific access code provided by the school to use, making them somehow inaccessible for some teachers and parents to try out. Of the final 10 apps selected from the systematic search, some demonstrate a diverse offering of features aimed towards information sharing, while others have a narrower scope, including only features related to direct messaging between parents and teachers and class announcements. Furthermore, some apps that are frequently recommended in recommendation lists (i.e. in blogs, etc.) scored the lowest scores in the app quality evaluation, and only few of the 10 selected apps address communication between parents and teachers for children with special needs. Finally, the ways in which these apps measure the effectiveness of parent-teacher communication remains unknown and requires further research.

Introduction

Background

Parents and teachers play an important role in students’ educational success. Existing research has documented that students’ engagement in school is continuously formed by their relationships with adults and their schooling environment (Connell, 1990; Finn & Rock, 1997). Frequent parent-teacher communication can increase student motivation, efficacy, engagement, and academic achievement (Kraft & Dougherty, 2013). It is crucial to understand parent-teacher communication because of the importance placed on parental engagement with students’ learning which is accompanied by difficulties for teachers in supporting this engagement.

Common challenges in parent-teacher communication

Communication between parents and teachers is not always effective and efficient. Both parents and teachers face unique challenges in their perspective. One common challenge is that they do not usually have obvious opportunities for interaction (Pearson’s Research and Innovation Network & Wardlow, n.d.). As a result, one party usually needs to intentionally reach out to the other for communication to take place. A study by Baker, Wise, Kelley, & Skiba(2016) indicated that parent engagement usually involves teachers making intentional efforts to communicate with parents on strategies to improve student success. Therefore, teachers seem to take more initiative when it comes to parent-teacher interaction and communication.

Communication challenge in teacher’s perspective
Yet teachers may struggle to regularly communicate and connect with all families in a meaningful way. For instance, teachers report feeling unprepared to communicate effectively with families especially those from cultural and linguistic backgrounds that are different from their own (Sewell, 2012). Epstein (1995) also pointed out that this purported lack of confidence has been in part facilitated by the failure of both preservice and in-service programs to provide teachers with the needed knowledge, cultural understandings and skills to foster support from parents. A 2012 nationwide survey found that beginning teachers were most likely to report parent communication and involvement to be their biggest challenge (Markow, Macia, & Lee, 2013). Furthermore, studies have also shown that teachers’ overloaded and hectic schedules and shortage of time interacting with parents also contributes to communication challenges (Flynn & Nolan, 2008).

**Communication challenge in parents’ perspective**

Parents, on the other hand, also face challenges with effective communication with teachers. Some of the leading factors include 1. economic pressures, 2. time constraints 3. cultural barriers, and 4. pre-existing negative experiences or feelings about school (Graham-Clay, 2005). Economic pressure, defined as the inability to meet basic necessities and having to cut back on necessary expenses, increases the likelihood of parental distress. Studies have shown that children growing up under conditions of economic hardship are at increased risk of behavioral problems (Evans, 2002), a decrease in social competence (Bolger, Patterson, Thompson, & Kupersmidt, 1995), and lower cognitive abilities (Gershoff, Aber, Raver, & Lennon, 2007). Unfortunately, the reality is that parents who face economic hardship tend to prioritize working to cover basic daily needs for their children rather than devoting time to communicate with teachers. In addition, working parents’ lack of flexibility in their work schedule and the overwhelmingness from day-to-day responsibilities can also be attributed to challenges like time constraints. Cultural differences is another significant factor for this communication challenge. For families whose home language is not english, making conversations with teachers can be challenging. Moreover, parents’ own negative school experiences can also create a negative impact on the relationships with teachers. Sometimes these pre-existing negative experiences are results of parents not understanding how to effectively interact with the educational system.

**Communication modes: One-way and two-way communication**

There are existing modes for parent-teacher communication. To understand the current communication modes between parents and teachers, Graham-Clay(2005) categorized two communication modes for parent-teacher communication: one-way communication and two-way communication. One-way communication involves teachers sending out information to parents, such as newsletters, introductory letters, school-to-home notebooks, report cards, etc. Two-way communication includes dialogue between two parties via telephone calls, home visits, parent-teacher conferences, open houses, school-based community activities, etc. Some of these communication modes are made possible with a more traditional medium such as paper
letters/cards or direct face-to-face interaction between parents and teachers; others use technologies such as a medium such as emails, text messages, websites, video recordings, mobile/web apps.

However, whether the communication challenges mentioned above were addressed or not in these existing modes is unknown. Furthermore, the effectiveness of the communication remains hard to measure. Understanding the ideal communication strategy works the best for the two parties and establishing that communication strategy early on to form a trusting relationship between teachers and parents (Powers, 2016) remains the most crucial goal in parent-teacher communication.

**Emerging technology in parent-teacher communication**

Advances in technology over the past decade have improved the tools, accessibility, and affordability of various devices for individuals, families, and schools. Technologies such as tablets, smartphones, and laptops are commonly used as teaching tools and supported in schools nationwide. Parents with technology access are beginning to rely more on these online sites for daily updates about their child’s grades, attendance, and homework (Fusco, 2004; Meyer, 2000; Weinstein, 2005) because these online communication mechanisms are more convenient for parents, as they do not have to interrupt their workday to phone a teacher or attend a conference (Beverly, 2003). One of the primary devices for parents to access this information is through smartphones. An increase in smartphone usage also made it easier for parents and teachers to access such information. With smartphone usage growing rapidly in the past decades, mobile accounts constitute approximately half of the web traffic worldwide. In the third quarter of 2020, mobile devices (excluding tablets) generated 50.81% of global website traffic (Statista & Clement, 2021). This broad acceptance of mobile devices implies that it offers a medium to access communication technology and potentially improves parent-teacher communication.

**Lack of communication technology quality evaluation**

However, to date, the field lacks empirical support for using web resources or mobile devices to increase parent-teacher communication (Beecher, 2016). However, studies of technology in other areas have demonstrated success in improving communication and targeted outcomes. Free (2013) 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 the impact on health outcomes. In this study, I conducted a systematic search to describe the commercially available parent-teacher communication apps and use MARS (Stoyanov et al., 2015) evaluation to evaluate app quality.
Methods

Systematic Search

I identified available apps by emulating common search behaviors of end-users. A recent study of teachers, parents, and therapists who had children with autism in their care found that the most common method of discovering new apps was searching app stores and the Internet, followed second by recommendations from their social networks and social media, and third by professional recommendations (Putnam et al., 2019).

A systematic search of parent-teacher mobile apps accessible from the United States was conducted in December 2020. The search was conducted using the iOS app store, the search feature in the Google Play store, “education communication,” “home school communication,” “parent communication,” “parent school,” “parent-school communication,” “parent-teacher,” “parents communication.” I also performed a more general search online using the Google search engine for app recommendations, for example, from prominent organizations, editorials, or bloggers. “Parent-teacher communication recommendation” was the only search term used in Google search. With both search strategies, I prioritize search results in the order in which they appear to understand likely results a typical user will see.

Comparative Analysis

I then performed a comparative analysis of the features and functionality of the selected apps, focused on identifying the common features among these apps and any unique features for each app. I created a comparison matrix based on the one made by Jessica Meacham in her Parent Communication App Review (Meacham, 2021). My matrix included the app name, version number, latest update dates, cost, platforms, brief description, main features, unique features, companion apps available, types of accounts within the app, and the number of times mentioned in editorial recommendations.

App Quality Evaluation

The Mobile Application Rating Scale (MARS) was used to rate app quality (Terhorst et al., 2020). The MARS evaluation method contains 23 items in 3 sections: classification, app quality, and satisfaction. Each MARS item uses a 5-point scale (1-Inadequate, 2-Poor, 3-Acceptable, 4-Good, 5-Excellent). The classification section is only for descriptive purposes. The 19-item MARS scale rates apps on four subscales: engagement, functionality, aesthetics, and information quality. The subjective quality section contains four items evaluating the user’s overall satisfaction. The MARS is scored by calculating the mean scores of the app quality subscales and the total mean score. The subjective quality items are scored separately as individual items. The MARS has demonstrated excellent internal consistency ($\alpha=0.92$) and interrater reliability ($ICC=.85$) (Stoyanov et al., 2015). After training, I evaluated the quality of each of the ten apps using the MARS as a sole rater.
Finally, I combined the comparative analysis and MARS rating results to identify gaps, areas for improvement and highlight good design features and practices.

**Results**

**Systematic Search**

As Figure 1 shows, I collect the top 10 app store search results from each of these seven keyword pairs I identified. This selection of top 10 is based on the assumption that users are not likely to browse more than 10 apps in each search queries. In addition, according to the apps stores algorithm, apps after the first 10 apps tend to be less relevant to the search keywords user inputted. In addition to app store searches, I also conducted a Google search by searching “mobile app recommendation for parent and teacher communication” as my search term. Combining results from both app store search and Google search, I identified 32 unique apps from the Apple App Store, 41 unique apps from Google Play Store, and 90 unique apps from the Google search results from these recommendation lists. In order to ensure ubiquity, I combined the unique app from Apple App Store and Google Play Stores and only included the apps that are available on both the IOS and Android devices. The combination of these two sets of unique apps leads to a total of 47 unique apps from app store searches. From the Google search, I identified a total of 94 unique apps. In the final corpus, I decided to include only the top 15 apps from the Google search recommendation lists. The top 15 apps are determined based on the
frequency of the occurrences in each editorial list. These top 15 apps are ranked based on frequency, I only took the apps that appear at least three times in the 21 lists searched. The assumption is that, if the app has been seen more than 3 times as a recommendation, people are likely wanting to download it. I then screen these unique apps again by applying the following screening criteria I came up with:

**Inclusion and exclusion criteria**

- Excluded the apps that require unique code from a specific school to access
- Excluded apps that do not have a free trial to access
- Excluded apps that are irrelevant to parent-teacher communication
- Excluded apps that need to pay to download
- Exclude apps that are not available on both iOS and Android platforms.
- Exclude apps that have not been updated since 2020
- Included search results only in United States app stores
- Included only English language apps
- Included the teacher app when the searched app requires a teacher app to create invitation code

This preliminary screening criterion removed irrelevant apps (game apps, nonEnglish apps, parent-parent communication apps, student-student communication apps, sports-related apps, etc.). I then downloaded the remaining apps from the corpus to see if they were usable/accessible. If an app required a unique access code from an enrolled school district that I could not register for as a teacher, I excluded it from this study. I also excluded apps that didn't have a free trial to access. I also included the teacher app for some apps that required a teacher-side app to create an invitation code. I also excluded any app that hadn't been updated since 2020 (an indicator of being inactive). After screening the 47 unique apps from the Apple app store and Google play store, only 8 apps in total passed the screening criteria.

For the Google search on the editorial recommendation list apps, due to the 94 unique apps volume, I started by sorting the apps based on their occurrence frequency in the recommendation lists and collected the only top 15 apps. I then compared these 15 unique apps with the 8 unique apps from the app store searches and saw high consistency. 7 out of 8 apps collected from app store searches appeared in the top 15 editorial recommendation app lists. I then removed the 7 duplicate apps (from app store searches) and screened the remaining unique 8 apps with our inclusion and exclusion criteria again. This led to the 2 additional unique apps to add to the final app list.

Systematic search results showed that only roughly about 17% of the unique apps passed the screening criteria. This percentage indicates that only a small portion of apps from the initial app corpus satisfy the screening criteria. The results from the systematic search also suggest that even though there is a wealth of results from both app stores search and editorial recommendations related to the search keywords "parent-teacher communication," there is only a
small portion of these apps that serve as communication tools. Especially for the app store search, many of the apps may include "communication," "parent," or "teacher" in their app name or descriptions, but the actual app functionality is unrelated to Parent-teacher communication. The inaccuracy of the result may be due to the app store's search algorithm design or what keywords the software company chooses to put in the app description or the app category.

Furthermore, in the search result, many apps' registration process requires a "school access code" or "teacher's invitation." This pattern emphasizes the importance of the school district's and teachers' role when it comes to the selection of communication mechanisms. This can imply that having school administrators and teachers take the initiative to select an app for parent-teacher communication and then distribute it to students' parents might be a more effective and realistic approach rather than having parents search and download those apps on their own and try to recommend to their child's teacher to use it.

The search results can also enlighten App developers and software companies to make their products more accessible to the public. By making the app easy to access and free for users can potentially improve product quality. User experience is critical to a usable and high-quality product. By inviting users to try out the app for free or offering a free trial, developers can collect meaningful feedback from the user and improve their app and services. For example, apps like ParentSquare can benefit from this change. ParentSquare ranked very high in the occurrences of each search query in both the Apple App Store, Google Play Store. It also was mentioned 8 times in the 21 lists of the Google search editorial recommendation. These numbers can show that when a parent or teacher searches for a parent-teacher communication app, they are likely to encounter ParentSquare. However, that app is not available for access for individual users. A user can download ParentSquare on their devices but can not access it due to the school's requirement of a unique access code. Based on ParentSquare's website, it does not offer free trials, and it does not allow individual users to sign up for their service. Instead, it requires a school-district-wide implementation with roughly about $3000 a year or more based on feature complexity. If apps like ParentSquare change their pricing strategy by offering a free trial or a free version, it can potentially reach more potential users and impact more families and schools.
Figure 2 shows the overall and subscale of apps rated with MARS. The MARS is a simple, objective, and reliable tool for classifying and assessing the quality of mobile health apps. There are five broad categories of criteria in MARS: Engagement(A), Functionality(B), Aesthetics(C), Information(D) and Satisfaction(E).

According to the creator of MARS (Stoyanov et al., 2015), for an app to qualify for a perfect score in Engagement(A), the app has to be fun, interesting, customizable, interactive, with prompts, well-targeted. For a perfect Functionality(B) score, the app has to function with no noticeable errors, easy to learn, clean and straightforward navigation, easy to follow flow logic, and intuitive gestural design. For a perfect score in Aesthetics(C), the app has to excel in graphic design, overall visual appeal, color scheme and remain stylistic consistent. For a perfect score in Information(D), the app has to have readable text, provide proper feedback, present measures to evaluate health outcomes, and provide references to related sources.
Each category includes several items/prompts with 5 point scale options with detailed descriptions. The 5 point scale is listed as 1- Inadequate, 2-Poor, 3-Acceptable, 4-Good, 5-excellent. The mean score for each category is calculated and presented in the corresponding column in Table 2. And the overall MARS for each app is calculated based on the mean score from Section Engagement(A), Functionality(B), Aesthetics(C), Information(D).

I adapted the MARS to evaluate non-mobile health-related apps and accommodate the context. I used the MARS as an expert evaluator rather than an end-user evaluator (i.e., parent or teacher). Because MARS was originally designed for rating mobile health apps that provide health information, it was impossible to rate item 18 and item 19 in the Information(D) category. Item 18 focuses on evaluating app credibility; it checks whether the app comes from a legitimate source (specified in-app store description or within the app itself). Credibility is not relevant given that the apps collected from the systematic search were about facilitating communication rather than providing information. Item 19 focuses on whether the app is evidence-based. It evaluates whether the app has been trialed/tested, or must be verified by evidence (in published scientific literature). Item 19 is challenging to evaluate. It is hard to define which aspects of the app need to be evidence-based, given that facilitating parent-teacher communication does not need expert guidance. Furthermore, whether an app has been tested or verified by evidence is unknown since this piece of information is not available.

Figure 2 shows the quality score ranging from the top quality app to the lowest quality app. The ClassDojo app had the highest overall MARS total(4.75) and subscale scores. Followed by Remind(4.42) and Teacher | Talking Point(4.36). The median MARS was 4.08, and all but two of the apps, Bloomz(2.95) Freshgrade(2.83), met or beat the minimum acceptability score of 3.0.

**High quality apps**

High quality apps demonstrate a high overall score (excluding subjective score). Any app that has a score above 4 is considered a good app. Engagement(A), the high quality apps appear to be fun, interesting, customizable, interactive (e.g., sends alerts, messages, reminders, feedback, enables sharing), and well-targeted to the audience. For the functionality(B) category, the apps have perfect/timely response; no technical bugs found/contains a 'loading time left' indicator, users can use the app intuitively and immediately, the navigation of the app presents a logical and clear flow, and the gestural design in the apps are perfectly consistent and intuitive. For the Aesthetics(C), apps have outstanding graphic design, overall attractive visual appeal, and consistent color scheme. For Information(D) high quality apps usually contain high quality information (e.g. text, feedback, measures, references) from a credible source.

**High information quality: Social and emotional learning with credible sources**

Apps with higher information quality tend to have evidence-based content focused on social and emotional learning. According to CASEL(Collaborative for Academic, Social,
and Emotional Learning), Social and Emotional Learning (SEL) is defined as "the process through which all young people and adults acquire and apply the knowledge, skills, and attitudes to develop healthy identities, manage emotions and achieve personal and collective goals, feel and show empathy for others, establish and maintain supportive relationships, and make responsible and caring decisions". ClassDojo is the only app in the corpus that contains such type of evidence-based information. Figure 3a is an example of a Social and Emotional component in ClassDojo. Under the “Big Ideas” and “Dojo Challenges”, teachers can access the social and emotional learning materials on the teacher app, parents can also access these curated contents to interact with their kids beyond school. These Social and Emotional Learning (SEL) components are videos made by educational experts and academic researchers from research institutes and universities for teachers aiming to address essential topics in students/children's social and emotional learning. For example, ClassDojo made a partnership with Stanford PERTS (figure 3b), a center at Stanford University that helps educators apply insights from the psychological sciences to improve student's educational experiences and outcomes and create a series of Big Ideas original content on "Growth Mindset." Their recent Big Idea module "Heart of a Champion" invites Olympic and Paralympic athletes to share their stories of diversity, courage, perseverance etc. These original curated contents give teachers and parents access to educational and engaging original content to help students/children to learn about essential characteristics and develop social-emotional skills. The research partnerships with credible sources also made ClassDojo's information more persuasive and trustworthy.
High quality apps, especially with a higher information quality MARS sub score tend to have clear app store descriptions and measurable goals that accurately reflect the product function. For example, TalkingPoints is an app that focuses on direct messaging, group messaging, and class announcements between teachers and parents. One of the highlighted features is the message translation feature (figure 3c). This feature enables the teacher and parents to translate messages into their preferred language. This translation feature is a solution that can potentially address the cultural barrier challenges parents and teachers face when communicating with each other. In addition, with its “Read Receipt” notice and message engagement status report (figure 3d), teachers can gain insights into the messaging trends.

![Figure 3c. Message translation feature(parent and teacher account)](image)
![Figure 3d. Engagement data measurement(teacher account)](image)

**High engagement quality: Customization, gamification and token economy**

Apps with high quality tended to have engaging avatar customization, gamification elements and point systems. Klassly (figure 3e) and ClassDojo (figure 3f) offer customizable avatar selection and creation. Klassly allows users to select premade Unicorn avatars for parents and teachers and ClassDojo Beyond School premium allows children/students to create their monster by redeeming monster parts by using points earned. These customizable avatar and gamification concepts can potentially increase app engagement and spark creativity.

ClassDojo, also utilizes a Token Economy for positive reinforcement for students/children’s behavior. A Token Economy is a contingency management strategy in which students are
awarded tokens for displaying appropriate behaviors (Robacker et al., 2016). The point system in ClassDojo allows teachers and parents to give points for their students/children based on their goals, skills and behaviors. The points students received will appear under students’/children’s profile. This point system (figure 3g, 3h, 3i) keeps students motivated and allows teachers and parents to share a holistic understanding about their students/children’s performance in home and school environments.

Figure 3e. Klassly’s customizable avatar selection (teacher and parents account)

Figure 3f. ClassDojo allows parent and child to customize their avatar monster. Beyond school feature
High quality apps: behavioral management & daily routine tracking

High quality apps include well designed behavioral management and routine/activity tracking features. For example, in Brightwheel, teachers can track any activity (figure 3g, 3h) including naps, meals, incidents, potty, and kudos, etc. and share detailed notes with parents. Parents can access these daily activities reports to gain insights on their child’s behavior at school.
ClassDojo being the highest quality rated app in the corpus also supports behavioral management in both home and school and routine development and tracking at home. The app also allows parents and teachers to set goals/behaviors/skills for their children/students. And also allow parents to build a daily routine for their kids (Figure 3k).
To conclude, the reason why these apps have higher quality ratings is because not only do these apps offer a wealth of useful features tackling parent-teacher communication and information exchange challenges, but also these apps contain no obvious usability issues.

**App with lower quality**

According to the rating score, two apps scored below the minimum acceptability score of 3.0 (1-Inadequate, 2-Poor, 3-Acceptable, 4-Good, 5-Excellent). Bloomz scored 2.95 overall. Freshgrade scored the lowest overall, 2.82. Areas to target across both of these two apps are mainly caused by major and noticeable usability issues, unengaging interaction and content, low-quality graphic resolution, and inconsistent design.

**Major and noticeable usability issues**

As shown below as an example, Bloomz has some major noticeable usability issues and system glitches. Some of these usability issues and technical glitches are more serious than others. Some of the system design, layout, and elements are so confusing that they can confuse the user and hinder the user from accomplishing their tasks. Some of the more minor issues, including visual design consistency, can lead to decreased trust with the system due to unprofessionalism and no attention to detail. *In figure 4, in this screen alone, I identified 5 usability issues.*
Figure 4 Bloom's student behavioral report screenshot

Note: The usability issues are marked as red dots by the evaluator, and the reasoning is provided below.

Issue 1: This screenshot is a student’s behavioral report on Bloomz. However, the system failed to indicate to the user what this page is about, it only listed student names on the top. This is a violation of Nielsen’s 10 Usability Heuristics for User Interface Design rules (Nielsen, 1994). It failed to make system status available to users, in other word, the system failed to inform the user on what is happening on this screen. This violation can hinder the user's understanding.

Issue 2: If looking closely at the page’s profile picture placeholder design, one of the profile picture’s corner radius is different from the other three (the others are rounded corners, only one is a straight corner). This is likely to be an error in the UI design. This error is a violation of the
consistency and standards in the heuristic evaluation rules. This error presents an unprofessional image to the user, and hinders the user’s experience.

**Issue 3:** This profile picture placeholder has a different graphic style than No.2. This inconsistency in Bloomz graphic design violates not only the consistency and standards rule, but also the aesthetic and minimalist. The reason why a second profile placeholder is present is unknown. Neither No.2 nor No.3’s profile picture is clickable or editable.

**Issue 4:** This “Message Lisa” button contains a chat icon, however, the button “Message Parents” above doesn’t contain a graphic icon. This is another violation of consistency and standards.

**Issue 5:** One of the items in the sub menu is written as “Assi...ents” even though the user might guess that it means “Assignments” it is still not a good practice to include only part of the spelling of a critical menu item.

**Features of parent-teacher communication apps**

The 10 apps in the final corpus are downloaded and used by the evaluator each for 40 min and more carefully researched by the evaluator. Below is a features chart and a general description of each app. The information from this chart is collected from app store description, app’s official website and by the evaluator’s experience using the apps.

<table>
<thead>
<tr>
<th>Apps</th>
<th>App Version</th>
<th>Roles/ stakeholders</th>
<th>Direct in-app messaging</th>
<th>School/class-wide announcement</th>
<th>Calendar</th>
<th>Student Assignment/Portfolio</th>
<th>Events planning</th>
<th>Behavioral Tracking/recording</th>
<th>Engagement stats report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seesaw (class, family)</td>
<td>Apr 15, 2021 Version 7.6.5</td>
<td>Teachers, Students, Family Member, Schools Administrator</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Remind</td>
<td>Apr 13, 2021 Version 12.10</td>
<td>Teachers, Students, Parents, administrator (premium)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ClassTag</td>
<td>Feb 10, 2021 Version 1.27.4</td>
<td>Teachers, school leaders, parents</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Application</td>
<td>Release Date</td>
<td>Features</td>
<td>Teachers, school and district, parents and family</td>
<td>Parents, students, school leaders</td>
<td>Students, teachers, parents</td>
<td>Teachers, parents, staff</td>
<td>Premium</td>
<td>Parents</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------</td>
<td>----------------------------</td>
<td>--------------------------</td>
<td>---------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>Talking Points</td>
<td>Apr 7, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>ClassDojo</td>
<td>Apr 16, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Bloomz</td>
<td>Apr 21, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Edmodo</td>
<td>Apr 19, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Brightwheel</td>
<td>Apr 19, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔ premium</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Freshgrade</td>
<td>Apr 17, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Klassly</td>
<td>Apr 15, 2021</td>
<td>✓</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5a App features
<table>
<thead>
<tr>
<th>Apps</th>
<th>Unique features</th>
<th>How teacher sent information</th>
<th>How parents receive information</th>
<th>Ubiquity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seesaw (class, family)</td>
<td>Parents can browse child's work, view post on calendar or sort by folders, translate content to 50+ languages, export zip archive of child's work</td>
<td>Direct messaging, post student work, Assign activities, Send Class announcements</td>
<td>Through the app, email</td>
<td>iOS, Android, Web</td>
<td>Free, with the premium subscription: Seesaw Plus $12.99/months</td>
</tr>
<tr>
<td>Remind</td>
<td>SMS available if parent choose to sign in with phone numbers, export message history</td>
<td>Send class announcements, direct messaging</td>
<td>Text, Through the app, email</td>
<td>iOS, Android, Web</td>
<td>Free</td>
</tr>
<tr>
<td>ClassTag</td>
<td>Parent-parent communication, backpack for each student, parents can access file within the backpack, sync with google class</td>
<td>Direct messages, send a class announcement, post in student backpack, create events, volunteer request, schedule parent-teacher conference</td>
<td>Text, Through the app, email</td>
<td>iOS, Android, Web</td>
<td>Free</td>
</tr>
<tr>
<td>Talking Points (teacher, parent)</td>
<td>In-app message translation to preferred language(direct message and announcement)</td>
<td>Direct messaging, send class announcements</td>
<td>Text, through the app</td>
<td>iOS, Android, Web</td>
<td>Free</td>
</tr>
<tr>
<td>ClassDojo</td>
<td>Teachers can award students with points, and take points off with behaviors that need work, a class toolkit for teachers. Parents can engage in ClassDojobeyond School to track daily routines and engage their kid in Family Fun activities</td>
<td>Class announcements(stories) direct messaging, group messaging, Track behavior with a points system</td>
<td>Through the app, email</td>
<td>iOS, Android, Web</td>
<td>Free, with premium additional features for parents: ClassDojo Beyond School $7.99 Memories $24.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Bloomz</td>
<td>All in one solution, daily activity reports, photo &amp; video sharing, parent messaging, student assignment, portfolios</td>
<td>Send announcements, create events, request volunteers, direct messaging, send alerts notifications for urgent matters, capture &amp; share student portfolios, track behavior with a points system</td>
<td>SMS/TEXT messaging, push and email notifications, read posts in preferred language with one-click translations (80 languages available), communicate with other parents</td>
<td>iOS, Android, Web</td>
<td>Free, experimenting with different premium experiences</td>
</tr>
<tr>
<td>Edmodo (teacher, student, parent)</td>
<td>A home stream for following and discovering resources from teachers across the globe.</td>
<td>Share resources with fellow teachers across the globe, organize and publish class assignments, send direct messages to students and parents.</td>
<td>View homework status, get notified when assignments are turned in, view teacher announcements, view lesson, quiz, and event schedules, Link all children's Edmodo accounts</td>
<td>iOS, Android, Web</td>
<td>Free</td>
</tr>
<tr>
<td>Brightwheel</td>
<td>Assess learning milestone, generate custom daily routine/reports for individuals</td>
<td>Track attendance, scheduling, share photos, and videos, assess learning milestones, communicate with parents, send paperless invoices and payments</td>
<td>Engage in your child’s day with a real-time feed of photos, videos, schedules, reminders, and updates.</td>
<td>iOS, Android, Web</td>
<td>Free with a premium plan and free trial</td>
</tr>
<tr>
<td>Freshgrade (teacher, student, parent)</td>
<td>Student portfolios, integrated with Google Drive and OneDrive, Teachers, students, and parents can upload media and comment</td>
<td>Student learning portfolios direct messaging and class announcements</td>
<td>View student’s portfolio, Receive direct messages and class-wide announcements</td>
<td>iOS, Android, Web</td>
<td>Free</td>
</tr>
</tbody>
</table>
### Features of reviewed apps are summarized in tables 5a and 5b. All of the apps contained direct in-app messaging and school/class-wide announcement features. Some also contain some of the following features as a communication/information sharing method: Calendar, Student assignment/portfolio/backpack, Events Planning, Behavioral management, Parents engagement stats report, Community feed/discovery Attendance/Check-in.

1. **Direct in-app messaging**: teachers can send messages directly to parents, parent groups. These messages can contain rich media ranging from photos, videos, voice messages, files, etc. parents can get notified via email, SMS, push notifications. Some apps offer in-app translation to many languages.

2. **School/class-wide announcements**: teachers and administrators can send messages to the whole school/class. This feature allows teachers to send important updates and notices to the entire audience.

3. **Calendar**: Teachers can plan events, activities, and homework assignments under the calendar.
4. **Student assignment/portfolio/backpack**: This is a place for teachers/parents to review and access students’ academic work and other forms of educational evidence.

5. **Events Planning**: Teachers can organize and plan events like PTC and field trips and notify the parents.

6. **Behavioral management**: Teachers can take attendance, document students’ good behaviors and behaviors that need improvement in a point-based system, or in some cases, document the observed behavior within a classroom setting.

7. **Engagement stats report**: The app collects parent engagement data and visually presents that data in the app.

**Principal Findings**

**The state of commercially available parent-teacher communication apps**

I screened through a systematic search through 339 search results from Apple App Store, Google Play Store, and Google search. After removing the duplicates from the search results from each source, I identified 32 unique apps from Apple App Store, 41 unique apps from Google Play Store, and 90 unique apps from the Google search for editorial recommendation lists. However, only 10 unique apps passed the preliminary screening using my inclusion and exclusion criteria.

There is a big gap between the number of unique apps identified in each app store and the final selected corpus. This gap indicates that even though an app appears as a result when related search query keywords are searched in the app store, it does not necessarily mean that the app is related to parent-teacher communication. This gap also suggests that even the app's app store description mentions keywords like "parent-teacher communication" and is downloadable, which does not mean that the app is accessible. For example, some apps do not allow users to access or create an account without a unique access code provided by the school district. This example shows that many commercially available parent-teacher apps require a school-wide decision for implementation. Another major factor that prevents the app from being included in the search corpus is whether it allows users to register the app for free or provides a free trial. Apps that do not offer free registration and a free trial discourage parents and teachers with communication interest from downloading and testing the app. Without easy access, parents, teachers, and schools will have difficulty evaluating and comparing the apps, making the app implementation challenge. I see an opportunity for app developers or companies to make their apps accessible by offering free service or a free trial from this state. Recruit parents, teachers, and school administration and invite more parents and teachers to test the app and provide feedback.

**App feature complexity**

The selected corpus of apps presents a variety of feature scopes. Some apps are more complex in their design and goals than others. ClassDojo, Edmodo, Klassly, ClassTag, Seesaw, Bloomz, and Freshgrade offer numerous features targeting different needs from parents and teachers. These
features allow parents and teachers to communicate with each other via direct message and class announcement and offer opportunities for increasing parent's participation and engagement in their child's learning. For example, in these apps, teachers can share students' work/learning moments, and parents can react and comment on the post of their child's work. Furthermore, some apps like Edmodo also allow teachers to schedule homework, quizzes, and events on calendars in the app. Parents can also access these assignments and events information and be in sync with children's performance. Apps like Brightwheel allow teachers to record children's daily routine, take notes on their milestones and behaviors, etc.

In contrast to apps with complex features, TalkingPoints and Remind are the two apps that offer simple features that only focus on direct messaging and class announcements. They strive to make the messaging app tailored towards parents and teacher communication needs; therefore, Their quality rating is also higher because of their focused and straightforward feature set and good overall usability: Remind (4.41) Talking Points (4.35).

Looking at the data, it seems that apps with more straightforward and more focused feature sets tend to get a reasonably consistent rating in quality. The more features the app offers, the more challenging it is to manage app quality and user experience.

Future research needs to look into evaluating these features based on parent and teacher communication needs. These insights could improve mobile app design and development based on these insights and allow developers and companies to develop well-targeted apps with meaningful features that their primary users(parents and teachers) can find helpful.

**App’s target audience**

Majority of the 10 apps in the search corpus target K-12 teachers, students and parents. ClassDojo on their website mentions that 90% of users are in K-8 school settings. The app Brightwheel mentioned on their website that they target a different audience group. BrightWheel focuses on early childhood education communication and serves teachers and parents at preschools, daycares, camps, after-school programs, etc. This app sets itself apart by targeting a smaller audience, but it tailored its features and content to tackle the communication challenges among these parents and teachers with young children. For example, the apps provide features for teachers to record children's daily activity, such as children's nap time, potty time, food, incident, health check, meds, etc. Brightwheel also offers a custom field in the activities for the teacher to document notes related to developmental milestones observed and other specific incidents related to the child. These daily activities and notes can be generated as reports and shared with parents.

**Lack of focus in special education**

Even though all the apps in the 10 apps corpus seemed to cover a wide audience, not many of them tend to target the Special Education community. Apps with customizable components and
behavioral tracking features like ClassDojo, Bloomz, and Brightwheel might have more significant potential for the Special Education community. For Example, ClassDojo's and Bloomz's point-based token economy and the positive reinforcement might empower Children with behavioral needs. Brightwheel's daily activities report can be utilized to share notes and information with the parents and track children's developmental milestones; Teachers also use digital portfolio tools like Seesaw to create customized sticker books to award and encourage students for positive behaviors.

The current app market as of May 2021 does not have many apps that tend to focus on parent-teacher communication/information sharing about children/students with special needs. Most apps under the "apps for special education" tend to be apps that help students improve a certain skill, educational material, goal-setting apps. One app named Birdhouse is an organizational tool that gives special education teachers, parents, and other caregivers one place to share information about a student's behavior and progress. It's intended for caregivers of kids with developmental disabilities, but is accessible for everyone. Teachers can create a profile (that includes entries for diagnoses) for each student and invite parents and colleagues to share their experiences while working with the student. Birdhouse was not included in the final 10 app corpus because it did not show up in any search keywords. This implies that parent-teacher communication apps generally do not consider special education, and apps like Birdhouse do not include parent-teacher communication as their app description keywords. The app's quality, like Birdhouse, still needs to be evaluated by MARS in the future, and whether Birdhouse addresses parent-teacher communication needs in the particular education community is still unknown and requires further research and investigation.

**Parent might have trouble accessing the apps in general**

Some App developers create separate apps for parents and teachers; others allow one app with different account types to log in. Apps like Edmodo, SeeSaw, Talking Points, Freshgrade offer separate apps for teachers, parents, and students. For the apps that offer separate apps for teachers, parents, and students, the parent's app is usually underdeveloped and contains more issues. One typical common issue is that in order to use the app, parents have to receive a code or invitation from the teacher to join the app; sometimes, those invitations or codes were never received on the parents' end. Not being able to receive an invitation code or email can prevent parents from using these apps. The lack of development on the parent app might also suggest the lack of testing and feedback from parent users.

Unlike most teachers who have pre-service training with parent-teacher communication and a relevantly more extensive support community, parents might face more challenges navigating parent-teacher communication. App software companies, teachers, and parents should work together to build trust and empathy in the relationship and strategize how communication platforms should be designed, utilized, and maintained to ensure better parental involvement and engagement.
**Student's role in parent-teacher communication**

In this study, some apps in the corpus offer student accounts and student login; others eliminate student involvement and focus only on communication between Parent and teacher. Students play a unique role in parent-teacher communication. They are the primary subject of the conversations, and students tend to benefit from a healthy parent-teacher relationship. Studies have shown that students who know that both parties are invested in their development tend to work more intentionally to reach their academic and behavioral goals (American University Blog, 2020).

However, parental surveillance can be introduced in some of the apps in an unexpected way. For example, in Edmodo, under the parent account, parents can access Teacher-Student private communication in a read-only manner. How teachers and students react to such surveillance is unknown, and the outcome of such surveillance on parent-teacher communication requires further research.

**Some of the apps that I found were being recommended by other educators and scored low on app quality.**

When comparing the app quality ranking with the Google search editorial recommendation list, I found a mismatch. Bloomz was recommended 17 times out of the 22 lists screened. However, Bloomz scored 2.95 in the overall app quality using the MARS rating scale, and it was ranked the second-lowest in app quality. Although the Bloomz app offers a variety of features targeting a variety of needs in the education and communication context, the app's functionality quality is low. The app itself contains major usability issues and technical glitches that worsen the overall user experience. Some of the apps recommended in the app are not accessible and require the school district's access code which needs school-wide implementation (i.e. ParentSquare). This mismatch between app quality and recommendation indicates that the metrics used to evaluate apps are diverse and how these metrics are selected/created, and whether these recommendation lists are credible or trustworthy needs further investigation and assessment.

**Challenges in measuring parent-teacher engagement in mobile apps**

Almost all the apps provide a goal related to improving parent-teacher communication and engagement in their app description. However, only a few apps provide a form of a report to show parent engagement data. Engagement data in these apps are usually presented in various ways. For Example, ClassDojo presents the engagement data by showing a percentage of how many parents are connected to ClassDojo. TalkingPoint|Teachers present engagement data by showing the teacher's activity in the past 30 days, including the number of direct messages sent, number of announcements sent, and number of families responded. ClassTag provides a statistical report on parent engagement for each student. Their statistical report presents engagement data such as numbers of volunteer events, the number of times that answered Yes for RSVP, numbers of overdue, and the number of times that replied to class announcements. These
engagement data can help provide insights for teachers on parent engagement. However, the effectiveness of such measurement remains unknown.

**Strength and Limitations**

This study utilized a systematic search approach and applied quality metrics (MARS) from a different field of study (mobile health) to compare and evaluate parent-teacher communication mobile apps. It also simulates people’s typical app online searching behavior, which is app store and online recommendations. It is innovative, comprehensive but also comprises several limitations.

Because of the timeline constraints for this thesis, the app quality was only evaluated by one rater, interrater reliability is missing from this study. There is no other study to evaluate the appropriateness of using MARS to evaluate non-mobile health-related apps, therefore, the suitability of this method needs to be further assessed. Due to limited access to prototypes that are currently being developed, this study only focuses on only commercially available apps. Because the MARS rating scale is initially developed to assess mobile health app qualities, several items and changes have been made to adapt to the education communication context. Also MARS rating scale does not provide prompt or subscales to measure app accessibility, therefore accessibility aspect is not evaluated in this study.

**Future Research**

Collecting user needs by conducting qualitative research can be the next step for this project. By conducting user interviews with parents and teachers, I can better understand what are the challenges users face, and identify their communication needs. Inviting parents and teachers to use the apps, I can collect more feedback on what features are essential, and what is missing from the design and development of these apps. Including parents and teachers of children with special needs can also bring insights to how future parent-teacher communication apps can be designed. Spending more time on evaluating app usability using other metrics such as 10 Nielson’s Heuristic Evaluation Rules (Nielsen, 1994) and System Usability Scale (SUS) (Brooke, 2013) can also shed light on more interesting results.

**Conclusion**

The search of apps revealed that even though there are a wealth of apps targeting parent and teacher communication, only a few passed the identified screening criteria. This indicated that although a lot of the apps in the app market include “parent-teacher communication” as keywords but might not be relevant to serve the communication purpose. A big portion of the app is only available in one of the app platforms, which indicated that app developers might not
take ubiquity and diverse device types in mind when it comes to app design and development. Many of the excluded apps are not accessible because they request a school wide implementation (without free trial) and request specific access code provided by the school. Some of the apps are also outdated (not updated in the past year), or are serving users from other regions/countries. The final 10 apps selected from the systematic search demonstrated a diverse focus on their goals and features. Some have a broad scope of features for information sharing like behavior tracking, student portfolio, etc. Others have a narrower scope, including only features related to direct messaging between parents and teachers and class announcement. Some apps that are frequently recommended in recommendation lists (i.e. in blogs, etc.) scored lower scores in app quality evaluation. Few of the selected apps address communication between parents and teachers for children with special needs. Furthermore, the ways in which these apps measure the effectiveness of parent-teacher communication remains unknown and requires further research.

Acknowledgements

I would like to thank Dr. Gabriela Marcu and Dr. Eric Common who served as my advisor and committee members for this thesis and provided me with insightful advice and guidance that encouraged me to look at this study in different angles. I would also like to thank Amber Hardin for her help with revising, proofreading and making thoughtful suggestions. I like to thank Iris Lin, Chloe Kuc and Jade Shepherd for their assistance in app evaluations.

This material is based upon work supported by the National Science Foundation under Grant No. IIS 1816319.

References


17. Maisto, M. (2013, November). BTOD trends, millennials, have little use for desk phones. eWeek, p. 3.
