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Using Connected Technologies in a Continuous Quality Improvement Approach in After-school Settings: The PAX Good Behavior Game

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Abstract

This demonstration study explored the use of connected technologies in a continuous quality improvement (CQI) approach to implementing evidence-based practices in after-school. Focus-group with staff indicated enjoyment of technology and offered feedback for future development. Ecological momentary assessments (EMA) were gathered daily. Three randomized conditions were compared among 4 programs and 12 staff implementing PAX Good Behavior Game (PAX GBG). ANOVA, Post-Hoc Tukey and Chi-square analyses indicated that the tech-enhanced condition showed better implementation using scoreboards than the in-person, while similar in game length. Both were superior to the control in behavioral strategies; highlighting the promise of technology in capacity-building.

Keywords

after-school; coaching; mobile-technology; ecological momentary assessment; continuous quality improvement; technical assistance; implementation; prevention; children; staff

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The Significance of After-school

After-school is a critical time for youth because the majority of all illegal behavior by minors happens between 3 pm to 7 pm in the United States (OJJDP Statistical Briefing, 2018; Snyder & Sickmund 2006). An important issue facing families is the supervision of their children after-school. According to the Bureau of Labor Statistics (2018), over 71% of all mothers, and 62% of married parents have children under age 18, and both work outside the home. After-school programs have blossomed in the United States (U.S.) since they provide important support for students and families, often helping to connect them to critical sources within the community (Maynard, Peters, Vaughn & Sarteschi, 2013; E. Smith & Bradshaw, 2017a).

Over the past 2 decades, research has demonstrated the benefits of after-school programs on youth development (Hillman et al., 2014; Huang, Gribbons, Kim, Lee, and Baker, 2000; Newell, Zientek, Tharp, Vogt & Moreno, 2015; Posner & Vandell, 1994, 1999; E. Smith, Witherspoon, & Osgood, 2017b; Zarrett, Abraczinskas, Skiles Cook, Wilson & Ragaban, 2018). However, evaluating the effectiveness of after-school programs is difficult due to limited reports of intervention fidelity data and inadequate training and support (Maynard et al., 2013). The recent study by E. Smith, Osgood, Oh & Caldwell, (2018), emphasized the importance of implementation fidelity in fostering quality after-school programs that promote positive youth development.

Using Evidence-Based Practices in Quality After-School Programs

After-school is a significant context in which fostering the professional development of adult staff can lead to higher quality after-school programs (Akiva, Li, Martin, Horner, & McNamara, 2017; C. Smith et al, 2012; E. Smith, Osgood, Oh & Caldwell 2018). Quality in after-school programs has been defined often operationalized as supportive relationships, intentional programming, and strong partnerships by a body of qualitative and quantitative studies (Eccles & Gootman, 2002; Katoaka & Vandell, 2013; Palmer, Anderson, & Sabatelli, 2009; Yohalem & Wilson-Ahlstrom, 2010). Moreover, researchers have found that after-school programs (ASP) that implement evidence-based practices are found to be most beneficial in terms of youth outcomes (Durlak, Weissberg & Pachan, 2010; Gottfredson et al., 2004; Pierce, Bolt & Vandell, 2010; Tebes et al., 2007).

Unfortunately, there are challenges to implementing evidence-based practices and fostering adult staff professional development in order to establish quality programs. The training and turnover among staff members, and lack of interest in organized activities can make implementation difficult (Kennedy, Wilson, Valladares & Bronte-Tinkew, 2007; Lauver, Little, & Weiss, 2004). Luckily, there are technology-based approaches in the field that are being developed to foster a process of continuous quality improvement (CQI), that is assessment, training, coaching, and data feedback, approaches that have evidenced effects upon adult staff (Browne, 2015; Fixsen, Blase, Metz & Van Dyke, 2013; Sheldon, Arbretton, Hopkins and Grossman, 2010). Scholars surmise that initiatives that build the capacity of youth program leaders and staff to engage in data-informed processes result in increased

staff program monitoring and improved practices (Halgunseth et al., 2012; Wandersman et al., 2008). The value of these approaches is that they go beyond single workshops to investigate how to implement and sustain quality evidence-based practices in after-school settings. As such connected technologies, e.g. web-based training, /text prompts and messages, and rapid data input and feedback, could be helpful, convenient tools in continuous staff training and support.

Technology and After-school Learning Settings

Today, the vast majority of people have access to technological devices. While 70% of young adults and 14% of seniors were using the internet in 2000, current estimates show that now 96% of young adults and 58% of older adults reported using the internet in 2015 (Serrano et al., 2017). Broadband Internet access shows a 12% decrease, while internet access via mobile devices has increased 53% from 2008 to 2014 (Serrano et al., 2017). The current study is focused on understanding how technology can be applied in implementing evidence-based practice for after-school programs. This topic is under-researched, and could provide more convenient and economical solutions for the field (Branscum, Housley, Bhochhibhoya & Hayes, 2016).

Mobile technology supplies novel approaches to learning (Boticki, Baksa, Seow & Looi, 2015; Zhang, Wang, de Pablos, Tang & Yan, 2015). It fosters more collaborative and flexible learning environments in terms of when and where learning can occur (Boticki et al., 2015; Crompton, Burke, Gregory & Grabe, 2016; Peña-Ayala & Cárdenas, 2016; Shuib, Shamshirband & Ismail, 2015; Wu et al., 2012; Zydney & Warner, 2016). Connected technologies, such as online learning, video conferencing, and text messages allow learners to connect to each other and to experts (Hew & Brush, 2007) and have been used effectively in the fields of education and prevention to provide training and technical assistance and to promote beneficial practices (Downer, Kraft-Sayre, & Pianta, 2009; Vernon-Feagans, Kainz, Hedrick, Ginsberg & Amendum, 2013; Warren, et al., 2006). Mobile learning makes information and online resources more accessible to learners, and fosters greater social interaction (Suanpang, 2012).

According to the study about both higher-quality and lower-quality after-school sites, although the majority of staff and managers at the lowest-performing programs reported having inadequate access to technology (e.g., internet and computers), the staff and managers at the highest-performing programs reported satisfactory access to technology (Khashu & Dougherty, 2007). Even when staff members have access to technology, they do not routinely use technology due to the lack of sufficient time for its proper use (Clark, 2001). However, when staff members receive training on how to use technology, they tended to integrate technology into their routine practices (Adada, 2007).

Technology might also be beneficial in improving the effectiveness of youth-serving after-school programs. In fact, some research has already been done showing improved academic performance, and reduced substance use in after-school via technology-assisted or based programs (Craig et al., 2013; Hu et al., 2012; Schinke, Schwinn, & Ozanian, 2005). Schinke et al., (2005) used a 10-session CD-ROM prevention program that provided awareness of the

harmful effects of alcohol with games, videos or graphics. Results of this study demonstrated that the tech-enhanced program helped to reduced substance use and increase awareness of the maleficent impact of alcohol use (Schinke et al., 2005). However, adults in youth-serving organizations require support and technical assistance in order to build their capacity to integrate evidence-based practices into after-school settings (Junge & Manglallan, 2001).

The PAX Good Behavior Game: Fostering Settings Change in After-School

One example of an evidence-based practice tested in after-school is the Good Behavior Game, a universal prevention program designed 40 years ago to increase academic performance and to decrease disruptive behaviors for elementary school-aged children (Barrish, Saunders, & Wolf, 1969; Kellam et al., 2008; E. Smith et al., 2017b; Weis, Osborne, & Dean, 2015). Pax Institute has developed a pre-packaged, manualized, commercialized version called PAX Good Behavior Game (PAX GBG, “pax” means peace in Latin). Referred to as a “behavioral vaccine” (Embry, 2002; Embry, 2004), PAX GBG is a peer-assisted intervention (Kohler & Strain, 1990) that relies on interdependent group contingencies to improve children’s behavior and selfregulation (Maggin, Johnson, Chafouleas, Ruberto, & Berggren, 2012; Wright & McCurdy, 2012). The strategy is based on social learning theory (Bandura, 1977), in which desirable behaviors are reinforced, encouraged and maintained by modelling appropriate behaviors, and by providing contingent group activity rewards for self-regulation and peer group co-regulation. Moreover, in addition to adults providing appropriate structure and support, “positive peer pressure” or “peer co-regulation” also plays a key role (Embry, 2002) because the children can encourage their teammates to engage in pro-social behaviors that benefit both themselves and the group.

In previous research, when PAX GBG was properly implemented in ASP, the programs improved in quality (i.e. less adult harshness, increased appropriate structure, adult support, and engagement) and participating youth reported more prosocial behavior (i.e., sharing, caring, and listening), and less hyperactivity (E. Smith et al., 2018; E. Smith, et al., 2017b). Overall, proper implementation of the evidence-based PAX GBG in the after-school context improved program quality and youth developmental outcomes.

Even an evidence-based intervention, however, can yield diminished returns if poorly run (Durlak & DuPre, 2008). Technology may be a way to combat the barriers to effectively implementing evidence-based programs during after-school. In terms of approaches to implementing evidence-based practices effectively and efficiently, the Interactive System Framework is a conceptual model that suggests that the prevention support system (PSS) (technical assistance to staff) and the prevention delivery system (PDS) (staff implementing prevention programming) are critical to effective implementation (ISF; Wandersman et al., 2008). Moreover, Sheldon, Arbreton, Hopkins and Grossman’s (2010) model for continuous quality improvement (CQI) demonstrates the value of consistent training, on-site observation and coaching (i.e. the prevention support system), as well as ongoing program data collection, analysis, and feedback in fostering optimal levels of implementation. In traditional models of training and implementation, experts provide face-to-face training to

staff in order to foster their use of evidence-based practices (Bertram, Blase, & Fixsen, 2015; Flaspohler, Lesesne, Puddy, Smith & Wandersman, 2012). However, it can be challenging to ensure proper implementation due to the physical distance between the ASP sites and the trainers, and the limited money and time available for additional support personnel. Ecological momentary assessments (EMA) in which staff provide more “in the moment, real time” data on implementation, receiving regular feedback into their practice, might prove to be helpful in fostering implementation of evidence-based practices (Smyth & Stone, 2003). Thus, using mobile technology to implement evidence-based practices may be an effective strategy in that mobile technology might be less expensive and equally or more effective than face-to-face training, at least in some settings (Foster & Jones, 2006; Fullard, Fowler, & Gray, 1987; Walters, Wright, & Shegog, 2006).

In this pilot demonstration study, we test the effectiveness of using technology to support after-school program staff in implementing evidence-based practices. In doing so, we build upon the ISF prevention support system conceptual model to test whether training using connected technologies (i.e. online training videos, text message reminders and feedback) can be as effective as face-to-face approaches in fostering quality implementation of evidence-based practices (the prevention delivery system). The conceptual model guiding this study is shown in Figure 1.

In our conceptual model of utilizing technology for effective implementation of PAX GBG in ASP, the training (the Prevention Support System) is delivered via mobile devices provided to staff on which staff provide brief ecological momentary assessment data (Smyth & Stone, 2003) on the frequency and duration of their implementation immediately following the conclusion of daily programming. Coaches examine staff data and observe staff practice using onsite videos (PSS); within one week interval coaches provide feedback to staff to further improve practice (Prevention Delivery System). In essence, our model suggests that effective training and continuous quality improvement can be achieved via mobile technology without the training experts being on site. This model is compared to traditional in-person modalities and to program sites with no additional technical assistance, comprising a treatment-as-usual control group.

Research Questions

With the increasing popularity of and access to mobile technology, this study is intended to explore effectiveness in fostering implementation of evidence-based practices by training after-school program staff. We were specifically interested in:

1. The degree to which technology could be used to enhance the training and technical assistance provided to after-school caregivers using PAX GBG. We provide both descriptive qualitative information and quantitative data to address this question.
2. Whether technological approaches could be as effective as in-person training and technical assistance in fostering implementation of PAX GBG and superior to a treatment-as-usual control condition. We conduct multiple statistical tests to examine initial efficacy of technological support.

Given that our previous research has demonstrated the benefits of PAX GBG both for the after-school setting and the youth developmental outcomes with quality implementation, our research questions concern the degree to which technology can foster implementation of PAX GBG. In our previous work, training and technical assistance was provided in-person, which allowed our coaches to develop considerable trust and sensitivity to the issues facing staff. In this study, we were curious to learn whether technology, which might be perceived as slightly less personal, although more accessible in terms of using videos for training and boosters, more instantaneous provision of data on implementation, might be as effective as our in-person approaches. We provide qualitative and quantitative descriptive information on staff perceptions of the use of PaxGBG and the support delivered via connected technologies. We also explore whether both tech-enhanced and in-person implementation of PAX GBG were superior to the normal routines of after-school programs (e.g. control condition) potentially using evidence-based practices.

Methods

This study is part of the LEGACY Together After-school Research Project. LEGACY Together was a multi-site randomized control trial examining the PAX Good Behavior Game. Subsequent to our randomized trial, the aims of this smaller pilot demonstration study were to test the feasibility and implementation of a technological approach to training and coaching in PAX GBG, which was found to be effective in the randomized trial.

We partnered with a small, community-based foundation within a 30-mile radius of the university that we identified providing free after-school programming to children living in three different housing projects and one in a local church. The program provider was in a small city with a population of 46,320, 18% of the residents were living below the poverty level. Approximately 93% of the city was demographically White/European American, 3% Black or African American, and the remaining 4% Hispanic or Latino, Mixed Race, Asian, or Other. Having a site proximal to the university allowed us to deliver both the in-person and technological components. There were total of 123 children enrolled in the programs. The programs ran from approximately 3–6 pm every weekday.

Design

An experimental design was used in which programs were randomly assigned to condition by participating staff from each program who participated in a coin toss. To gather information on the smartphone app prototype and more fully test the innovative technological approach in this pilot project, two sites were assigned to the tech-enhanced coaching experimental sites, one assigned to the in-person coaching site, and the other to the business-as-usual control site. All staff in the tech and in-person coaching sites received two trainings in PAX GBG; once in the beginning of December after pre-data collection, and another refresher in January.

The in-person model included multiple interactive 3-hour training sessions and 8 weekly coaching sessions that occurred onsite at the program. Because after-school staff are often part-time with other job or educational demands, the coach was flexible in meeting staff before or after the program, often providing some assistance with routine activities and

modeling of PAX GBG during programming. The in-person site received a coach visit once a week over 8 weeks for an entire program day. The coach provided the staff with a calendar upon which the staff could indicate how many strategies were used, the number of games played, the number of teams that “won,” and the prizes given to winners as ways of verifying and monitoring implementation. The coach would discuss with the staff their progress or any issues that arose.

The tech-enhanced sites were involved in testing the use of a prototype of a smartphone application and website designed to assist after-school staff in their implementation of PAX GBG. The training model was similar to the in-person sites in that training was provided in person in order to assist staff with the future use of the technology. The distinction was that coaching was provided via a process in which staff used project-provided smartphones to view online videos of programmatic strategies, and to videotape their use of the PAX GBG strategies (using only consenting children). These videos were then uploaded to a secure, password-protected project coaching website where the PAX GBG coach at the university could see the videos and provide brief weekly feedback on the site’s progress. Additionally, the tech-enhanced sites entered daily data on mobile devices provided, regarding their implementation of the PAX GBG strategies and game. Staff in tech-enhanced sites also received an online weekly Feedback Report every Monday morning summarizing both their personal progress and the site’s overall progress. The template form for entering daily data was called the Staff Daily Data Entry Log (Daily Data Log for short). The Tech-Enhanced sites entered their daily data into the Staff Daily Data Entry Log on a smartphone application which stored the data on a secure, password-protected website (i.e., for security, data was not stored on the smartphones). Both of the logs were the same, just one in print and the other electronic. The Daily Data log was comprised of 7 questions related to PAX GBG implementation such as which strategies they used, if they played a game, and if so, for how long, with how many teams, and whether they won a prize. Staff were entered into a weekly, random drawing for a gift-card, but only if they had entered daily data for every day of program operations during the week.

Staff at the Business as Usual site, along with staff of the other sites, received a 1–2 day training in PAX GBG by another source a year prior to this pilot study; thus, some staff might have recalled the strategies and used them, though the probability of this may have been low (Fixsen et al., 2013). Thus, we assess the degree to which the business-as-usual control site was using PAX GBG strategies without additional coaching or technical assistance.

Participants

Staff were engaged in the decision for their sites to participate in this novel community-engaged research study (E. Smith et al., 2014). The program director and staff agreed for their programs to participate and signed consent forms. The total number of staff members who were enrolled in the study was 12. During the course of the pilot two staff left the program (one at a tech-enhanced site and the other at the business-as-usual site) and one joined (at the business-as-usual site). Table 1 describes the demographic characteristics of program staff. The majority of the staff members reported their level of educational

attainment as four year of college. The staff members were overwhelmingly female (91.7 %), and white (91.7 %). With regard to age, half of the staff members self-reported their age to be older than 45 years. Staff were initially assessed and trained in December of one academic year and implementation was conducted during the spring semester of the following year, for approximately 12 weeks. Even though the group sizes are unequal, each of the four sites had 2–3 staff members who served 25 – 35 children in kindergarten through 6th grade.

Procedures and Measures

PAX GBG is a cooperative game played among teams of children who earn group-based activity rewards by minimizing off-task behavior. Teams are comprised of 4–5 children who vary in age, gender, and other behavioral characteristics to maximize the potential for each team to succeed. Teams displaying 3 or less misbehaviors within the given time period (usually 3–30 minutes) “win” the game. PAX GBG is a manualized, pre-packaged, user-friendly version developed by the Paxis Institute with additional components, including a common language and symbolism that adults and children use to encourage on-task and socially sanction off-task behaviors (Embry et al., 2010). PAX GBG also includes a number of strategies or “kernels” that are used to promote positive behavior (Table 2). Staff reported either on paper or on mobile technologies the number of strategies they utilized daily. Across the pilot period, the number of kernels were summed across the staff in the sites to examine overall use of the behavioral strategies.

The use of PAX GBG scoreboard was reported daily by each staff member and coded as “yes/no”. Staff were expected to record the score of the PAX GBG on the calendar-like scoreboard each day throughout the week. This indicator was measured by staff self-report of whether they used the scoreboard each day. The use of the scoreboard is important in that it contains the team names and members, and tracks the number of wins for each team; an indicator of implementation fidelity. PAX GBG typically begins with shorter games and gradually increases in length as youth begin to better self-regulate. However, games longer than 30 minutes are more difficult to monitor and less likely to be contingently rewarded. The minutes of PAX GBG play per game was reported by each staff member and coded as “3–5 minutes”, “6–9 minutes”, “10–15 minutes”, “16–25 minutes”, “26–30 minutes” and “over 30 minutes”.

Following implementation, a focus group was held with all of the sites to learn about their perceptions of staff implementing PaxGBG using the connected technologies. Nine afterschool staff participated with differing levels of access to the technology component. Staff talked with a faculty member and staff who were not involved in the pilot for almost 2 hours about their experiences with PaxGBG and the tech enhancement. The group members were candid and honest about their thoughts regarding PaxGBG overall and the technology component. Some of the findings of the focus group are reported in this paper.

Analyses

The focus group data provided insight into the experiences of the staff receiving various modes of technical assistance, invaluable insight for future refinement of the technological

protocols. In addition to this more descriptive data, Statistical analyses were conducted comparing the three conditions (tech-enhanced, in-person, and control) on several implementation indicators: use of PAX GBG scoreboards, the number of PAX GBG's played per condition, the minutes of PAX GBG play per game, and the sum of use of PAX GBG kernels. Moreover, we conducted paired chi-square tests between each condition and corrected the alpha based on number of tests conducted to avoid type I error. Given that there were different numbers of staff in different conditions, the one-way ANOVA analyses were conducted by summing the number of games played by program staff throughout the pilot study and then conducting an analysis of variance to look for differences between conditions.

For categorical and ordinal variables, we used Chi-Square tests to test the differences between the conditions. For interval level data, (e.g. Number of Games played, the sum of PAX GBG kernels), the conditions were compared using one-way ANOVA, and Post-Hoc Tukey tests was used to compare the differences between each the conditions.

Results

The current study focused on the following research questions:

1. The degree to which technology could be used to enhance the training and technical assistance provided to after-school caregivers using PAX GBG, using both descriptive qualitative information and quantitative data to address this question.
2. Whether technological approaches could be as effective as in-person training and technical assistance in fostering implementation of PAX GBG and superior to a treatment-as-usual control condition. We conduct multiple statistical tests to examine initial efficacy of technological support.

Staff were amenable to using ecological momentary assessments (EMA) via connected technologies such as online-videos, and the use of text messages for data entry and feedback on weekly implementation. The following section describes their perceptions from the focus groups.

Description of Staff Perceptions of Connected Technologies in Fostering CQI

Overall, the staff overall liked the app developed for entering data and receiving feedback. They responded that the ease of inputting the information for the daily implementation logs was great. The afterschool staff recognized that the technology did foster more accountability by having to enter information in daily texts at the end of the daily programming that was automatically uploaded to the database. Staff also indicated that they enjoyed recoding their activities on video and that "the kids liked it too."

However, in some ways the technology was cumbersome in that the lack of wireless signals in some of their buildings limited their ability to upload videos of their implementation. They were concerned that they wanted to be "in the moment" with children and not distracted by the phones and technology (staff were given the option to upload videos at the

end of the day's programming). They were also concerned that parents might enter and not understand the role of the cellphones and in general would have preferred tablets that would be larger and easier to read. While some staff saw the value of learning collectively via sharing videos, others did not, particularly when few children were consented and could not be included in the videos. Sites doing well in implementation began to find the text messages with feedback on implementation redundant and impersonal. In general, staff desire personalized feedback and thought about having a "virtual coach." Staff inquired "Could we set the coach up on a tripod?" Though the initial response to using technology indicated great accountability and opportunity for learning, they highlighted the value of personalized feedback and personal coaching using technology. Importantly, staff emphasized that the in-person training on the technology in which the coach was introduced, was critical to bonding and affinity with the coach, whom they perceived as quite supportive. Even with these areas for future product and training development, the following statistical analyses examine implementation across the tech-enhanced, in-person, and control conditions.

Overall, the statistical analysis revealed that both the in-person condition and the tech-enhanced condition outperformed the treatment-as-usual control condition in the use of PAX GBG scoreboards, the number of games played, the minutes of PAX GBG play per game, and the sum of use of PAX GBG kernels.

Use of Scoreboard

The first indicator of implementation to be analyzed was whether staff used the PAX GBG scoreboard; these results are shown in Table 3. The chi-square test revealed that there was a significant difference in the use of the scoreboard among the different conditions ($\chi^2 = 15.44$, $p < .001$). Paired Chi-square tests of each two conditions were also conducted. Alpha was corrected ($\alpha = .05/3 = .017$) based on the number of tests conducted in order to avoid type I error. The in-person condition did not differ in the use of Scoreboard from control condition ($\chi^2 = 2.14$, $p = .14$). Tech-enhanced condition which required daily data entry, outperformed both the in-person condition ($\chi^2 = 9.30$, $p < .017$) as well as the control condition ($\chi^2 = 17.95$, $p < .017$).

Number of Games Played

Given that there were two sites in the tech-enhanced condition but only one site in the in-person condition and one site in the control condition, there were different numbers of staff members in each condition and analyses were conducted by summing the number of games played by each staff member and then conducting an analysis of variance to look for mean differences between conditions. The descriptive results and comparison results are shown in Table 4. One-way ANOVA analysis revealed that there was *marginally* significant difference in the mean number of games played across conditions ($F_{2,7} = 4.60$, $p = .074$). A post-hoc Tukey test showed that the trend was driven by a marginally significant difference between the mean number of games played in the control versus tech-enhanced condition ($p = .064$). All other pairwise comparisons were non-significant, suggesting that the number of games played did not differ significantly between the in-person and tech-enhanced conditions (Table 4).

Minutes of PAX GBG Play Per Game

Ideally, when children are learning to play the game, shorter periods of 3–5 or 6–9 minutes are preferred, allowing for more immediate positive reinforcing activities, gradually increasing the minutes of play. The descriptive results are shown in Table 5. Chi-square test revealed that time spent playing games differed across conditions ($\chi^2 = 61.84, p < .001$). Paired chi-square tests of each two conditions were also conducted. Alpha was corrected ($\alpha = .05/3 = .017$) based on the number of tests conducted in order to avoid type I error. The majority of tech-enhanced and in-person sites played the game for 3–5 minutes (39.4% for in-person condition & 34.4% for tech-enhanced condition) and 6–9 minutes (57.6% for in-person condition & 47.9% for tech-enhanced condition). At these levels of play, there was no statistically significant difference between these two conditions ($\chi^2 = 4.42, p = .11$). When a game was played at the control sites, it was played for 10–15 minutes almost 67% of the time and 16–25 minutes 33% of the time. The length of the game in the control condition was significantly different from both the in-person ($\chi^2 = 32.86, p < .017$) and tech-enhanced conditions ($\chi^2 = 43.51, p < .017$).

Use of PAX GBG Kernels

The sum of the use of kernels (i.e. Peer Tootle Notes, Staff Tootle Notes, Go Pax/Stop Spleems, Beat the Time, PAX Quiet, PAX Voices, PAX Language, PAX Hands & PAX Feet) per staff member per day was compared across conditions. The descriptive and comparison results are shown in Table 6. One-way ANOVA revealed that there were statistically significant differences in the mean use of PAX GBG Kernels across conditions ($F_{2,226} = 12.44, p < .001$). Post-hoc tests further revealed that both in-person condition ($p < .001$) and tech-enhanced conditions ($p < .001$) outperformed the control condition in how many helpful kernels being used to promote self-regulation. However, there was no significant difference between the in-person and tech-enhanced conditions ($p = .165$).

Summary and Discussion

Our work demonstrates that connected technologies can be used to foster implementation of PAX GBG, providing prompts and gathering real-time data on implementation of after-school programming for both the staff and youth in these community-based organizations. Ecological momentary assessments through the use of a smartphone application, an SMS (text message) reminder system and website feedback, tech-enhanced implementation of PAX GBG were observed similar or better compared with in-person condition and superior to the control condition.

The use of a scoreboard is a clear indicator that sites are using PAX GBG and tracking student behavior. There was a significant difference in the use of the scoreboard among the different conditions. The tech-enhanced condition with daily and weekly mobile data prompts and reminders demonstrated better implementation results than both the in-person and control conditions regarding use of the scoreboard. The staff in the in-person and tech-enhanced conditions also reported a larger mean number of games per staff member; however, the differences were marginally statistically significant. Lastly, we examined the minutes of game play in which smaller, gradual increases in length are indicated while

longer games are usually less focused, unrewarded play. The control condition was significantly different from both the in-person and tech-enhanced conditions, evidencing longer games of 10–25 minutes while both the tech-enhanced and in-person conditions most frequently reported shorter games of 3–5 and 6–9 minutes in length. There were no statistically significant differences between the in-person and tech-enhanced conditions on game length. Additionally, both the in-person and tech-enhanced conditions outperformed the control condition in using helpful kernels or strategies like verbal cues for walking softly, using soft voices and visual symbols of praise and encouragement for good behavior. The in-person and tech-enhanced condition sites were similar in their use of these helpful behavioral management strategies that promote youth self-regulation.

In terms of staff perceptions of the use of technology, they were open to using technology when they have adequate internet access, but do not want it to distract from their important job of supporting children in afterschool. Though they were open to using technology, staff made suggestions for improving the technological protocol that would allow a “virtual coach,” who could be present via the use of technology and facilitate more personalized feedback on their implementation.

In this small pilot study in after-school programs, we built integrated systems of online training and technical assistance coupled with real-time data for rapid monitoring and adaptation of best practices in community-based organizations. Although there is not much prevention research about technology-based training versus online training, a few previous evidence-based studies suggested that online training can be as effective as in-person training (Becker, Bohnenkamp, Domitrovich, Keperling & Ialongo, 2014) or better than in-person training (Gold, 2001). With appropriate training and technical assistance, we also found these connected technologies could promote accountability and implementation and the mobile prompts might have facilitated superior performance. However, the feedback and assistance should be interesting, novel, personalized, and helpful. The goal of this phase of the project was to begin to test alternative, hopefully less resource-intensive approaches to training and technical assistance using technology, particularly for mobile, often part-time, paraprofessional yet caring after-school staff. Considering the costs of staff resources, space, and potential travel to sites that may be local or more distant, technology, with some personalization, has the promise of being more cost-effective in implementing evidence-based practices.

As the model implies with the multi-directional arrows between the PSS and the PDS, providing support is best provided when informed by real-time observed or staff-shared examples and data. Also, the mere act of data collection might attune staff to the strategies being used or not being used. Mobile technology with data prompts and feedbacks, and sharing hold promise for fostering implementation of evidence-based practices.

Limitations and Directions for Future Research

Based upon some of the staff feedback in the focus groups, in the future, afterschool programs that provide video/photo consenting for families during the enrollment process could facilitate adequate numbers of children included in the video-observational, technical assistance process. Also, to use technology effectively, afterschool programs would need

consistent and effective internet access. Importantly, as promising as technology is, it is important that the CQI process still help staff feel that they are being personally supported.

In our statistical analyses, there were limitations as well. There were some differences based on the participants for each condition site. The tech-enhanced site had a greater proportion of 6th grade and Caucasian students, and the staff members were overwhelmingly female and White. Also, this study focused upon a small number of purposively selected sites, thus, limiting the potential generalizability of these findings to other sites or cities. However, this was a pilot study, utilizing random assignment to condition to demonstrate the acceptability and effectiveness of mobile applications in fostering the implementation of evidence-based practices. With randomization, even in this small context, differences in implementation are less likely due to uncontrolled variables and more attributable to the experimental design (Shadish, Cook, & Campbell, 2002). This tech-enhanced method of training and coaching could be potentially more accessible and affordable for after-school programs that often struggle to find the time, funding and trained staff members to effectively implement evidence-based programs.

As this was a pilot study with only one after-school organization, further research will be needed to further study this tech-enhanced training and continuous improvement system in additional, larger after-school programs with more staff. Despite this, this work demonstrates that the future use of technology in after-school settings to promote positive youth development is well worth further exploration.

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Figure 1.
Conceptual model of CQI approach

Table 1

Demographic Characteristics of the Staff Members

Variable	Total		Tech-based		In-person		Control	
	N	% or M(SD)	N	% or M(SD)	N	% or M(SD)	N	% or M(SD)
Staff characteristics								
<i>Gender</i>								
Female	11	94.4%	5	83.3%	2	100.0%	4	100.0%
Male	1	5.6%	1	16.7%				
<i>Ethnicity/Race</i>								
White	11	94.4%	5	83.3%	2	100.0%	4	100.0%
African-American	1	5.6%	1	16.7%				
<i>Education</i>								
Some college	1	8.3%					1	25.0%
Two-year college	2	11.1%	2	33.3%				
Four-year college	4	47.3%	1	16.7%	2	100.0%	1	25.0%
Some graduate	3	19.4%	2	33.3%			1	25.0%
Master's degree	2	13.9%	1	16.7%			1	25.0%
<i>Age</i>								
18–21	1	8.3%					1	25.0%
22–25	3	22.2%	1	16.7%			2	50.0%
26–35	2	22.2%	1	16.7%	1	50.0%		
36–45								
>45	6	47.3%	4	66.7%	1	50.0%	1	25.0%

Table 2**PAX GBG Strategies**

Strategy	Meaning
Peer Tootle Notes	Written note of behaviorally-oriented praise by peers
Staff Tootle Notes	Written note of behaviorally-oriented praise by adult staff
Go Pax/Stop Spleems Beat the Timer	Visual cues encouraging good behaviors and ceasing disruptive behaviors Timed transition period for wrap-up and cleanup
Pax Quiet	Visual and sound cues reminding youth to be quiet
Pax Language	Verbal cues reminding youth of positive languages
Pax Voices	Verbal cues reminding youth of appropriate speaking volume in different settings (e.g. varying times at which whispering, talking, or loud talking might be allowed contingent upon
Pax Hands	setting, for example, 10-foot voices would be allowed on playground) Verbal cues reminding youth to keep hands to themselves
Pax Feet	Verbal cues reminding youth to walk quietly

Table 3

Descriptive Results of Use of Scoreboard

Strategy	Control	In-Person	Tech-Enhanced
Scoreboard	18.6% ^b	31.6% ^a	55.8% ^{a, b}

Note. The descriptive number is the percentage of days that used the scoreboard. a, b, c indicate statistically significant differences between the designated conditions.

a, b, c indicate statistically significant differences between the designated conditions.

Table 4

The Mean Number of Games and Range Played Per Staff Member across Conditions

Condition	Number of Staff Members	M (SD)	Range	F
Control	2	1.00 (.00)	1 – 1	4.60 [†]
In-person	2	16.50 (9.19)	10 – 23	
Tech-enhanced	4	26.00 (11.11)	15 – 37	

[†]Note. $p < .1$ *
 $p < .05$ **
 $p < .01$ ***
 $p < .001$

Table 5

Distribution of Minutes of Games Played across Conditions

Strategy	Control	In-Person	Tech-Enhanced
3–5 min	0%	39.4% ^a	34.4% ^a
6–9 min	0%	57.6% ^a	47.9% ^a
10–15 min	66.7% ^{b, c}	3.0% ^b	17.7% ^c
16–25 min	33.3% ^{b, c}	0% ^b	0% ^c
26+ min	0%	0%	0%

^aNote. ($\chi^2 = 4.42, p = .11$), no statistically significant differences between in-person and tech-enhanced.

^b($\chi^2 = 32.86, p < .017$), statistically significant differences between inperson and control.

^c($\chi^2 = 43.51, p < .017$), statistically significant differences between tech-enhanced and control.

Table 6

Sum of Use of Kernels across Conditions

Condition	<i>M</i>	<i>SD</i>	<i>F</i>
Control	4.07 ^{a, b}	2.00	12.44 ^{***}
In-person	5.79 ^a	1.84	
Tech-enhanced	5.8 ^b	1.60	

[†] *Note.* $p < .1$

* $p < .05$

** $p < .01$

*** $p < .001$

When two conditions have the same alphabetic letter, it means the two measures are significantly different.