INTEGRATION OF MOBILE TECHNOLOGY INTO EVIDENCE-BASED PRACTICES FOR STUDENTS WITH EMOTIONAL AND CONDUCT DISORDERS IN CLASSROOM

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Abstract

Mobile technology (MT) may create new opportunities for teachers to enhance the implementation of evidence-based practices (EBPs) for students with emotional and conduct disorders (ECD) in United States. However, there remains a relative paucity of research reviewing the effectiveness of integrating MT into EBPs, also referred to as emerging practices (EPs). This integrative review provides a synthesis of the research on the effectiveness of EPs for students with ECD in the K-12 classroom environment. A total of 11 empirical studies, published from 2008 to 2018, were reviewed. Results suggest that EPs may increase academic engagement for students with ECD during academic situations. Yet, drawing conclusions remains challenging due to limitations in relation to: (a) the unique power of EPs in isolation from some interfering variables, (b) generalizability of documented findings to various settings. Future research studies should ideally further address the areas of limitation toward conclusive claims concerning the effectiveness of EPs for students with ECD.
Keywords: *conduct disorders, educational setting, emerging practices, emotional disorders, evidence-based practices, mobile technology.*

Introduction

It is every teacher's belief and responsibility to maintain successful academic and behavioral engagements within the classroom setting. Meanwhile, students with emotional and conduct disorders (ECD) are more likely to experience difficulties in coping with academic and behavioral demands in school (Lane, Wehby, Little, & Cooley, 2005; Parette, Crowley, & Wojcik, 2007; Sutherland & Oswald, 2005). Their academic performance tends to fall two to three grade levels below that of their typically developing peers (Mattison, 2015). Some authorities have reported that students with ECD display disruptive behaviors in educational settings (Nelson & Robert, 2000) and lack foundational skills (e.g., self-regulation skills; Butler & Monda-Amaya, 2015) necessary for them to engage in the classroom. Considering this, students with ECD often become frustrated and less motivated to participate in academic activities (Haydon et al., 2017), placing them at risk for academic failure.

In order to reduce their achievement gap (Bruhn, Hirsch, & Vogelgesang, 2017), students with ECD need access to ongoing support and best practices (Haydon et al., 2017). Particularly, teachers are encouraged to use evidence-based practices (EBPs), which are practices that have been supported by multiple high-quality experimental research studies (Cook, Cook, & Collins, 2016), to address students' academic and behavioral needs. However, the robust research base supporting EBPs does not necessarily mean they translate easily into everyday classrooms. With mobile technology (MT; i.e., new handheld electronic devices, such as tablets and smart phones, and their corresponding educational applications) expanding rapidly in today's

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schools, it could be harnessed as a medium for facilitating EBPs (Bedesem & Dieker, 2014; Bruhn, Hirsch et al., 2017) and meeting a diverse array of students' needs (DuPaul & Weyandt, 2006).

Integrating MT into EBPs, sometimes identified as emerging practices (EPs; Cuming, 2013; Stephenson & Limerick, 2015), has recently received attention in special education literature for several reasons. First, looking at the overall educational trends, initiated by school districts and individual teachers, there appears to be a shift toward the use of new technologies for sound educational purposes (Falloon, 2013; Macsuga-Gage, Schmidt, Mcniff, Gage, & Schmidt, 2015). Second, with an increase in popularity and ubiquity of MT in households and schools (Maich & Hall, 2016; McClanahan, Williams, Kennedy, & Tate, 2012; Stephenson & Limbrick, 2015), not to mention many of which are students' personally-owned cell phones and tablets (Bedesem & Dieker, 2014), MT may offer new potential as a non-stigmatizing instructional and learning tool (Cumming, 2013; Maich & Hall, 2016; Stephenson & Limbrick, 2015). Third, researchers have reported positive school-related outcomes when MT has been used with diverse populations of students with disabilities (e.g., autism spectrum disorder; Rivera, Mason, Jabeen, & Johnson, 2015).

While MT is growing in prevalence in today's schools, it is relatively new, particularly in the area of teaching students with ECD. Scientific evidence supporting the overall efficacy of integrating MT into EBPs on academic or behavioral performance has not been established (Cumming, 2013). To date, there remains a relative dearth of recent integrative reviews synthesizing outcomes and issues associated with the current and future use of EPs for students with ECD during academic situations, thus warranting a review of the empirical literature in this area.

The aim of this integrative review was: (a) to synthesize the empirical literature on the effectiveness of incorporating MT into EBPs for students with ECD in educational settings. In an effort to synthesize a larger literature base on EPs, all class-wide or individual practices provided for students with ECD were included. In this review, EPs were to define the integration of MT into all or parts of EBP components (Cumming, 2013; Stephenson & Limbrick, 2015). Given the identified aim the specific research questions were: What are the information sources used to select MT for EPs? What extent are the EPs effective and beneficial for students with ECD in the K-12 school environment?

Research Methodology

Research Procedure

In order to locate relevant peer-reviewed studies for systematic and narrative review, an electronic search of educational databases, using ERIC, Education Research Complete, Psychology and Behavioral Sciences Collection, EBSCOhost, SCOPUS, and Web of Science was conducted. The following keywords, along with their derivations and synonyms, were included in the literature search: *emotional and behavioral disorders, emotional and conduct disorders, attention-deficit/hyperactivity disorder (ADHD), emotional disturbance,* or *behavioral problems* in combination with *mobile technology, iPad, tablet, smart phone, educational practices,* or *evidence-based practices*. The initial search produced 67 articles. Since the use of EPs is a rather new approach in Education, the search was limited to a sample of studies published in the US as a one knowledge society. Using their local contexts, other knowledge societies across the globe may find this review functional to add to the application of EPs for students with ECD, leading to broader understanding of the effects EPs in the classroom environment.

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Next, the title, abstract, research question(s), and method of each article were screened for eligibility. To be included in this review, a study had to meet the following inclusion criteria: (a) the study was published in a peer-reviewed journal and employed empirical methods; (b) participants were in grades K-12 and identified with or at risk for ECD or ADHD; (c) studies were published in the years spanning 2008, when the first study on EPs for students with ECD was published (Gulchak, 2008), through 2018 and conducted in the United States; (d) participants displayed problem behaviors and/or poor academic performance; (e) independent variables in the study included the use of MT to deliver or supplement EBPs or any other individual or classroom-based practices; (f) studies focused on academic and/or behavioral outcomes during academic situations; and (g) MT used in the study featured device portability, wireless connectivity, and advanced functionality (i.e., downloadable applications; McClanahan et al., 2012). A hand search of the reference lists of the articles yielded additional publications for inclusion. Finally, a study was excluded if: (a) participants were identified with a primary diagnosis of pervasive developmental disabilities (e.g., autism spectrum disorder), (b) MT used in the study was no more than a simple electronic device to only vibrate or ring at fixed intervals (e.g., Motivaider; Amato-Zech, Hoff, & Doepke, 2006), or (c) a study was more anecdotal than empirically-based. As a result, 11 studies qualified for the review.

Data Analysis

For data analysis, information extracted from the 11 studies was included in a researcher-developed coding form. Articles were analyzed by: the independent variables, targeted activities (i.e., academic or behavioral), participant(s) and setting, research design and effect(s) of EPs, and EP-related capabilities and limitations. Next, data extracted from the coding form were narratively analyzed and grouped, emerging the conceptually-grounded results.

Research Results

Analysis of the studies revealed three themes: (a) identification of MT for EPs, (b) effectiveness of EPs throughout levels of MT integration, and (c) the capabilities of MT in EPs.

Identification of MT for EPs

The reviewed studies revealed that the decision to select MT for EPs was made using one of the three information sources. First, Haydon and colleagues (2012) performed an informal assessment that asked teachers for their own judgments of the available consumer experiences. The teachers suggested iPad applications that were easy-to-use, financially affordable, and generally appropriate for students' academic skills. Another study added the functionality of the device (e.g., text message capability), and the consistency of size and appearance with popular models to the considerations (Bedesem, 2012). Second, Flower (2014) put forth a procedure that considered an individualized educational plan (IEP) for a more formal assessment. The assessment considered students' IEPs in matching the content of academic iPad applications and independent work practices. Last, MT was researcher-selected or created across the remaining seven studies (Blood, Johnson, Ridenour, Simmons, & Crouch, 2011; Bruhn, Vogelgesang, Fernando, & Lugo, 2016; Bruhn, Vogelgesang, Schabilion, Waller, & Fernando, 2015; Bruhn, Woods-Groves, Fernando, Taehoon, & Troughton, 2017; Gulchak, 2008; Szwed & Bouck, 2013; Vogelgesang, Bruhn, Coghill-Behrends, Kern, & Troughton, 2016; Wills & Mason, 2014).

Overall, regarding the three ways of selecting or developing MT for EPs, the reviewed literature directed the features of MT to the intervention demands without affecting the fidelity of implementation. In simpler terms, no changes were made in the core procedural stages of

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the typical practices. The difference was that the same specific components of the traditional practices were adjusted to be accessed, partially or fully, through MT as is discussed below.

Effectiveness of EPs throughout Levels of MT Integration

Across the literature reviewed, MT was integrated into EBPs within partial, full, or comparative levels.

Partial integration. This level of integration reflects the use of MT to supplement one or more components of EBPs in combination with the typical format. Of the literature reviewed, three studies applied the partial method (Blood et al., 2011; Gulchak, 2008; Szwed & Bouck, 2013). Starting from the seminal work on EPs for students with ECD, Gulchak (2008) examined the use of Palm Zire 72 (i.e., personal digital assistant) to record the self-monitored behaviors of a third-grade student with ECD. As an alternative to paper-based self-recording, a device provided prompting to the student(s). The students were prompted by scheduled ringing signals to record if the student was on-task during ten-minute intervals throughout a one-hour reading session. The MT-based prompting and recording processes were paired with a paper-pencil self-graphing. In this case, the student transferred the total number of on-task behaviors, summarized on the device, to a self-graphing sheet to view the progress. The data demonstrated a significant increase of on-task behavior from a baseline mean of 64% to an intervention mean of 98% in the ABAB design.

Other partial integration involved three elementary-aged students with ECD or ADHD answering the question, "Am I listening to my teacher and following class expectations?" on a handheld student response system. The students recorded if they were on or off-task every five minutes during 50-minute math sessions and after a typical visual prompt (i.e., teacher hand signal) was given. All three students demonstrated a significant decrease in off-task behaviors during intervention phase in the ABAB design. Yet, they did not maintain the lower off-task behavior when the intervention was not in effect during maintenance sessions (Szwed & Bouck, 2013). Last, Blood and associates (2011) taught a ten-year old student with ECD to use iPod-delivered video modeling in conjunction with traditional self-monitoring procedures. Before each math session, the student observed a four-minute video of on-task behaviors performed by two peers. When the teacher began math instructional activities, the student used a designated sheet to record self-monitored behaviors at two-minute intervals. Results of an A-B-BC design indicated that the combination of iPod-delivered video modeling and typical self-recording was associated with higher rates of time on-task and lower rates of disruptive behaviors.

All-inclusive MT. Full integration or all-inclusive MT occurs when the components of EBPs are fully delivered through MT. The largest number of studies examining EPs (*n* = 6) utilized the full integration method (Bedesem, 2012; Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves, et al., 2017; Vogelgesang et al., 2016; Wills & Mason, 2014). CellF-Monitoring was the first all-inclusive MT used to cue two high-school students engaging in distracting behaviors, to self-monitor their on-task behaviors in language arts class. The students received and replied to automated text messages via private Twitter accounts on cell phones. Four questions served as cues for target behaviors (e.g., Are you on-task?) at five-minute intervals prompting students to reply with "yes" or "no". In a multiple baseline across participants design, the average of students' on-task behaviors increased from 45% in the baseline phase to 71% in the intervention phase (Bedesem, 2012).

More recently, after the release of Apple's touch-screen iPads in 2010 (Falloon, 2014; McClanahan et al., 2012), four studies examined the innovations in the cuing and recording procedures of self-monitoring. Similar to CellF-Monitoring, Wills and Mason (2014) used the *I-Connect* application to send text cues to two high-school students with ADHD at predetermined

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time intervals, so they would then mark on-task behaviors with a yes/no response. Using an ABAB design, the percentage of on-task behavior was higher when *I-Connect* was in use compared to baseline phases. Likewise, Bruhn and colleagues (2015) examined an author-created iPad application, named *SCORE IT*, for self-monitoring purposes. The application was used to prompt academic engagement of two middle-school students with low academic and behavioral performances. Throughout the use of *SCORE IT*, the students rated their adherences to three school-wide expectations (Be Respectful, Be Responsible, Be Ready) on a five-point Likert scale presented on the iPad screen. The teacher also rated the students' behaviors within the teacher section of the application. Next, the percentages of positive behavior based on student and teacher ratings, were calculated separately but could be viewed simultaneously as bar graphs. The rating procedures occurred consistently after every structured instructional rotation (e.g., whole-group instruction) in a READ 180 classroom. Afterwards, the teacher provided students with specific praise or corrective feedback. The teacher also reinforced the student if the predetermined goal was achieved. During the intervention conditions of ABAB design, both students demonstrated substantial increases in their academic engagement with a decrease in disruptive behavior.

Three studies sought to improve and validate the use of *SCORE IT* (Bruhn et al., 2015), placing it in a research-based arena. With two similarly situated students and in a comparable setting, Bruhn and colleagues (2016) incorporated the data-based individualization (DBI) model by which teachers could gradually modify the criterion goal. Teachers and researchers could discuss the patterns of data collected within *SCORE IT*, make decisions, set achievable goals for positive behavior, and program the goal(s) into the application. In order to sustain success, the researchers raised the goal (e.g., from 70% to 85%) when the initial goal was achieved consistently. As a result of using *SCORE IT* with the DBI model, both students demonstrated an improvement in academic engagement and a reduction in disruptive behavior. The students also sustained the treatment effects after the intervention was faded during the maintenance phases. Vogelgesang and associates (2016) also tested the effects of *SCORE IT* for three elementary–aged students with ADHD, but in a less structured classroom setting. Unlike the original work (Bruhn et al., 2015), the teacher did not provide students with feedback of student and teacher ratings. The procedures of goal setting and reinforcement were controlled as well. Nonetheless, the findings underscored the unique contribution of *SCORE IT* in improving academic engagement. Last, with three middle-school students demonstrating off-task behaviors and at risk for academic failure and in a less structured classroom, Bruhn, Woods-Groves et al. (2017) used *SCORE IT* as a tier two intervention of Positive Behavior Interventions and Supports (PBIS) multi-tiered proactive system. Considering multiple baseline design across settings (e.g., social studies, reading, and math classes) and pre-post measures of behaviors (i.e., Strengths and Difficulties Questionnaire and Human Behavior Rating Scale–Brief), one student demonstrated high effect and another demonstrated moderate effect of the intervention on academic engagement and disruptive behavior. Due to the severity and complexity of the behavioral and mental issues of the third student, the use of *SCORE IT* alone was insufficient to produce positive outcomes.

Comparative level. In this level, two studies examined the effects of EPs versus typically-delivered practices using an alternating treatments design. First, Haydon and colleagues (2012) measured the effects of iPad and worksheet instructional conditions on the academic and behavioral performance of three high-school students diagnosed with ECD. Following the teacher's instruction and depending on the instructional condition of the day, the students completed independently the iPad or worksheet-based math problems. In comparison with traditional worksheet conditions, all three students answered significantly higher numbers of correct math responses per minute and demonstrated higher levels of active engagement intervals with EPs. Second, Flower (2014) extended the previous work with a more controlled

number of minutes allocated for each condition (i.e., ten minutes of independent practice time), and individualized practices (i.e., selected from each student's IEP folder). Three elementary-aged students with ECD were asked to complete independent reading and math practices in both worksheet and iPad conditions. The results revealed that the use of iPads prompted a higher level of on-task behaviors for all three students, comparable to their typically developing peers.

In sum, the reviewed studies reported a consistent increase of on-task behavior and/or decrease of off-task behaviors when MT was integrated fully or partially into self-monitoring (Bedesem, 2012; Bruhn et al., 2016; Bruhn et al., 2015; Gulchak, 2008; Szwed & Bouck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014) and video-modeling practices (Blood et al., 2011). The provision of EPs seemed to have advantages over the traditional paper-pencil formats in that they prompted higher levels of active academic responding (Haydon et al., 2012) and on-task behavior (Flower, 2014; Haydon et al., 2012). Further, EPs appeared to improve academic engagement for elementary (Blood et al., 2011; Flower, 2014; Gulchak, 2008; Szwed & Bouck, 2013; Vogelgesang et al., 2016), middle (Bedesem, 2012; Bruhn et al., 2016; Bruhn et al., 2015) and high school students with ECD (Haydon et al., 2012; Wills & Mason, 2014).

Likewise, the majority of the reviewed studies ($n = 9$) assessed social validity and indicated that EPs were well-received by teachers and/or students with ECD (Bedesem, 2012; Blood et al., 2011; Bruhn et al., 2016; Bruhn et al., 2015; Flower, 2014; Haydon et al., 2012; Szwed & Buck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014). Teachers expressed a high degree of satisfaction about the feasibility of using EPs in supplementing instructional activities and behavioral management (Bruhn et al., 2016; Flower, 2014; Haydon et al., 2012; Szwed & Bouck, 2013; Vogelgesang et al., 2016) and saving teaching time (Flower, 2014), thus making EPs much simpler than the typical format (Bruhn et al., 2015). Similarly, students with ECD enjoyed how they were viewed positively (e.g., as technology expert) by peers (Szwed & Bouck, 2013). Not only did the students show a sense of excitement concerning EPs (Bedesem, 2012; Flower, 2014; Szwed & Bouck, 2013), but also stated that EPs were engaging and preferred over traditional instruction (Flower, 2014; Haydon et al., 2012).

The Capabilities of MT in EPs

Noting the effectiveness of EPs, it is plausible to assume that MT offered a number of capabilities that made EPs unique or superior to traditional practices. First, unlike the traditional worksheet conditions, EPs by nature hold motivational variables and prompt opportunities to respond. As such, iPad academic applications provided students with: (a) immediate corrective feedback when a student answered incorrectly during independent practices, (b) opportunities to answer the problem again after a suggestion to revise (e.g., clue) was given, and (c) immediate rewarding feedback including summative scores (Flower, 2014; Haydon et al., 2012). Second, providing students with ECD frequent opportunities to respond (e.g., obtaining clues; Flower, 2014) and frequent feedback during instructional practices can increase learning motivation and decrease disruptive behaviors (Cavanaugh, 2013; Kern & Clemens, 2007). Given these benefits, MT allowed students to receive the two instructional components with minimal teacher assistance (Flower, 2014; Haydon et al., 2012). This would have otherwise been difficult to do in inclusive or multi-level classrooms (Flower, 2014). The opportunities for students to be autonomous learners while participating in instructional practices (Bruhn, Hirsch et al., 2017; Flower, 2014; Stephenson & Limbrick, 2015) could save teachers' time (Maich & Hall, 2016) and permit other forms of ongoing support (Haydon et al., 2017).

Third, the use of MT allowed students to engage unobtrusively in EPs. Stated differently, students with ECD were able to receive individualized EBPs without disrupting the flow of natural instructional routines or calling attention to themselves (Blood et al., 2011). Fourth, MT enabled EBPs to be individually tailored (Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-

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Groves et al., 2017; Gulchak, 2008; Szwed & Bouck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014). For instance, depending on each student's pace, the teacher determined and then programmed the self-monitoring intervals and criterion goals (Bruhn et al., 2016; Bruhn, Woods-Groves et al., 2017).

Last, the MT used in the reviewed literature had the capacity to document and assess students' data during several sessions at a time (Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Gulchak, 2008; Vogelgesang et al., 2016; Wills & Mason, 2014). Wireless capability enabled data to be sent to a password-protected database and be available for later access for progress monitoring over time (Wills & Mason, 2014). The documentation and information-sharing features (Maich & Hall, 2016) could help the teacher establish initial criterion goals, assess learning outcomes, and initiate weekly or daily problem-solving meetings on student performance (Bruhn et al., 2016; Bruhn et al., 2015; Vogelgesang et al., 2016; Wills & Mason, 2014). Viewed collectively, the previously reported EP-affected outcomes appeared to be especially relevant in view of the five MT capabilities.

Discussion

The purpose of the present review was to determine the effectiveness of EPs for students with ECD in school settings. The 11 articles that met the inclusion criteria suggested three main findings. First, MT was identified for the EPs based on an informal assessment of the MT features (Bedesem, 2012; Haydon et al., 2012), IEP-guided assessment of the appropriateness of MT for students' levels of performance and needs (Flower, 2014), or author-created/selected MT (Blood et al., 2011; Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Gulchak, 2008; Szwed & Bouck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014).

Second, EPs appeared to be overwhelmingly effective in improving overall academic engagement and/or decreasing disruptive behaviors for students with ECD. The findings were promising when MT was integrated partially (Blood et al., 2011; Gulchak, 2008; Szwed & Bouck, 2013), fully (Bedesem, 2012; Bruhn et al., 2016; Bruhn et al., 2015; Vogelgesang et al., 2016; Wills & Mason, 2014), or comparatively (Flower, 2014; Haydon et al., 2012). Not only might the EPs be a successful alternative to typical instructional interventions, but they also were reported to be more socially appealing to teachers and/or students with ECD in the majority of the literature reviewed (Bedesem, 2012; Blood et al., 2011; Bruhn et al., 2016; Bruhn et al., 2015; Flower, 2014; Haydon et al., 2012; Szwed & Buck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014).

Third, MT held capabilities to make EPs superior to typical practices in: (a) providing students with opportunities to respond and immediate feedback independent of teacher assistance (Flower, 2014; Haydon et al., 2012), (b) making the EBPs less intrusive in inclusive settings (Blood et al., 2011), (c) permitting individualized practices and tailored interventions with some programming features (Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Gulchak, 2008; Szwed & Buck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014), and (d) documenting data over several sessions for later access to make decisions on students' progress (Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Gulchak, 2008; Vogelgesang et al., 2016; Wills & Mason, 2014).

Potential EP-Related Empirical and Practical Limitations

Although this review has shown that EPs have the potential to be advantageous, concerns relating to the effectiveness of EPs could not be separated from the documented effects. The identified limitations mainly center on the unique power of EPs, generalizability-related issues, and additional demands/workload. This section provides detailed descriptions of the three

areas of limitations. Recommendations for future research and practice are offered within each aspect.

The unique power of EPs. Despite the fact that EPs produced positive outcomes for students with ECD, what remains unclear is the degree to which we could parse the unique contribution of the EPs alone to improve students' behavior. Several extraneous variables might have influenced the documented outcomes. First, Haydon and colleagues (2012) raised a concern that when comparing EPs and traditional practices, the novelty of MT might have induced higher responses. That is, novice learners showed excitement at the beginning of the study, but it was unknown whether the level of excitement would fade over time. The novelty effect could be greater due to the absence of baseline data in the alternating treatments design (i.e., when MT and worksheet conditions were counterbalanced across participants; Flower, 2014; Haydon et al., 2012; Wolery, Gast, & Ledford, 2014). The interpretation of how students' performances had improved in both conditions could be hindered accordingly (Flower, 2014; Haydon et al., 2012). By the same token, the baseline conditions in the majority of the reviewed studies excluded typical EBPs, while the intervention phases included the EPs (Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Gulchak, 2008; Szwed & Buck, 2013; Vogelgesang et al., 2016; Wills & Mason, 2014). The intervention data, thereby, were compared to non-comparative baseline conditions. There is no clear assurance whether the use of EBPs per se or the incorporation of MT into the EBPs was responsible for the behavioral improvements. Future research should attempt to minimize the novelty effects by involving students who are accustomed to using MT (i.e., routine access to MT within classroom activities; Vogelgesang et al., 2016) and collecting comparative baseline data (i.e., comparing the effects of EPs and traditional practices).

Second, the context by which EPs were presented was not adequately controlled in some studies. In part, the variance in the antecedents (e.g., choice-making) and consequences (e.g., reinforcement contingency; Bruhn et al., 2016; Bruhn et al., 2015; Flower, 2014; Haydon et al., 2012) during the MT conditions and their comparative conditions might tell a different story. For instance, Flower (2014) provided students with opportunities to choose a minimum of one reading application and one math application to complete during iPad sessions. This was unlike the corresponding worksheet sessions in which students were provided with one predetermined assignment sheet. Thus, a high rate of responding during iPad conditions might have been attributed to choice-making (e.g., Dunlap et al., 1994; Skerbetz & Kostewicz, 2013).

Last, MT design and content, including cognitive demands and sensory stimulation (Falloon, 2013; McClanahan et al., 2012), might influence the overall students' responses to the EPs. As an example, when it comes to MT design, game formatted applications would offer motivational stimulus (e.g., points for a game trophy after achieving a criterion level of accuracy; Flower, 2014) different than other formats. That is, students with ECD might enjoy the work without consciously feeling that they are being evaluated (Guía, Lozano, & Penichet, 2015). Overall, it is imperative to acknowledge and control for the aforementioned confounding factors when assessing the functional relations between EPs and students' outcomes in future inquiry.

Generalizability-related issues. It should be noted that the generalizability of the positive findings in the available literature was mostly limited to self-contained and residential settings (Blood et al., 2011; Gulchak, 2008; Flower, 2014; Haydon et al., 2012), and highly structured classroom routines (Bruhn et al., 2016; Bruhn et al., 2015). Further, only one study of the literature reviewed, examined the efficacy of EPs on academic outcomes (Haydon et al., 2012). Assessing learning effects, including proximal (e.g., task completion) and distal (e.g., final grades) levels of performance (Wills & Mason, 2014), in more standard and naturalistic settings warrants attention in future research. More importantly, EPs have been predominantly examined within self-monitoring literature, which is the only EBP for students with ECD mentioned in

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this review (Farley, Torres, Wailehua, & Cook, 2012). Limited studies thus far have explored the influence of EPs with other EBPs. Since students with ECD appeared to be more engaged in academic situations in the reviewed literature, this could push researchers to broaden the variety of EBPs in future research.

As for the reliability of the reported outcomes, few studies examined further than the acquisition of new behaviors (e.g., on-task behavior) to the maintenance of acquired behaviors. Given that the EPs are fairly new, and only three studies provided maintenance probes (Bruhn et al., 2016; Szwed & Bouck, 2013; Vogelgesang et al., 2016), it is incumbent on researchers to monitor student behavior rigorously over a longer period of time and across various situations. In addition, *SCORE IT* was the only research-based MT that was examined by four empirical studies (Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Vogelgesang et al., 2016). However, a potential source of bias could affect the quality of evidence as the three studies had been carried out by the same author and/or co-author. This contradicts the high-quality EBPs standards stated by Horner and colleagues (2005), in which the studies should be carried out by at least three different researchers.

A factor worth-mentioning that might affect the generalizability of the findings in real-world classrooms was the lack of teacher involvement in establishing EPs. The entire process of selecting or developing MT for EPs, making decisions, and programming or setting up MT was mostly researcher-mediated (Bedesem, 2012; Blood et al., 2011; Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Gulchak, 2008; Szwed & Bouck, 2013; Vogelgesang, 2016; Wills & Mason, 2014). None of the existing studies examined the capacity for teachers or school staff to use MT and lead related decisions independent of researcher support (Blood et al., 2011; Bruhn et al., 2016). This could raise a concern that delivering EBPs through MT would make the intervention cumbersome in the classroom. It seems necessary to develop and examine a problem-solving model to help teachers be better informed about the integration of MT into EBPs and enhance the feasibility of EPs in the everyday classroom. The model would define how to link MT to EBPs (i.e., without impacting the treatment fidelity) and students' needs, as well as describe MT-related features and conditions (e.g., Macsuga-Gage et al., 2015).

Additional workload. Previous studies have shown that the EPs might demand additional planning and work on the part of the teacher. Teachers had to establish rules and devise seating arrangements to control the degree to which MT was distracting to other students and/or inhibiting instruction, especially when placed visibly near the students at all times (Bedesem, 2012; Blood et al., 2011; Vogelgesang et al., 2016; Wills & Mason, 2014). One way involved handing students the iPad instead of asking them to leave their seats to walk to the iPad (Blood et al., 2011; Vogelgesang et al., 2016). Also, the implementation of EPs was preceded by some technical practice sessions until students became fluent in using MT (Bedesem, 2012; Gulchak, 2008; Szwed & Bouck, 2013; Wills & Mason, 2014). Planning to do so required preparing additional MT-based examples to familiarize the students with MT functions (e.g., text messaging; Wills & Mason, 2014).

Controlling the content fidelity could be another demanding issue when the functionality of MT did not thoroughly fit with the specific components of EBPs. Seemingly insurmountable technical challenges existed while programming or running EPs. Due to cellular transmission, it was hard to control the variation of the time - up to 30 seconds - between texting cues and receiving cues when self-monitoring was implemented via a cell phone. Also, as Twitter does not allow duplications in tweets (i.e., receiving live messages), the researcher had to send prompts for self-monitoring in different ways, which might affect the consistency of the intervention across the study phases (Bedesem, 2012). This suggests that when automating the procedures of EBPs within MT, teachers should ensure that the functionality of the MT does not conflict with the intervention procedural fidelity. Otherwise, a search for a third-party

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application (e.g., HootSuite social media dashboard or Picture Scheduler application) could be necessary to manage this automation and maintain fidelity (Bedesem, 2012; Blood et al., 2011). Having stated the potential demands, there is relatively little information on teachers' expertise and readiness to prepare and manage the context of EPs in the classroom (Macsuga-Gage et al., 2015). Future research may take into account qualitative data on the capabilities of teachers to run EPs in order to support teacher professional development programs.

In sum, the effectiveness of EPs obtained from this review was limited by three critical factors. First, the unique power of EPs, exclusive from extraneous variables (e.g., novelty effect Flower, 2014; Haydon et al., 2012), was not controlled constantly across study phases in some of the reviewed literature. Second, restrictions to the findings' generalizability included the non-naturalistic and self-contained settings in which the studies were conducted (e.g., Blood et al., 2011; Bruhn et al., 2016; Bruhn et al., 2015; Haydon et al., 2012), the lack of maintenance and generalizations probes, the absence of learning outcomes and teacher involvement in selecting or programming MT, the use of MT with a limited variety of EBPs, and the possible bias in meeting high-quality standards of evidence (e.g., Bruhn et al., 2016; Bruhn et al., 2015; Bruhn, Woods-Groves et al., 2017; Vogelgesang et al., 2016). Third, some literature asserted additional workload (e.g., additional training sessions; Bedesem, 2012; Gulchak, 2008; Szwed & Bouck, 2013; Wills & Mason, 2014) or technical challenges (e.g., the effects of cellular transmission; Bedesem, 2012) teachers might face when incorporating MT into instructional practices. Viewed together, for each limitation there should be corresponding avenues for future research and practice, as highlighted previously.

Limitations

This present review is subject to limitations. First, the aim of the adopted inclusion criteria was to encapsulate all relevant articles for review. Still, there is a possibility that some publications might have been inadvertently omitted. Further research in wider educational databases would be necessary. Second, the review included only single-subject research studies. Since EPs are relatively new in special education literature, including anecdotal and suggestive literature in future reviews may add to the knowledge base on EPs. Third, the type of MT varied across the EPs in the reviewed studies. That is, the features of iPads could be different from those of personally-owned cell phones. A clear definition of EPs within specific forms of MT could enable controlled observations in future research. Last, this review lacks statistical information toward conclusive claims about the effectiveness of EPs. This could be justified by the dearth of experimental studies found examining a wide variety of EPs for students with ECD, of which three studies were pilot studies (Blood et al., 2011; Gulchak, 2008; Wills & Mason, 2014). Future reviews should run robust statistical analyses and calculate standardized effect size, when an adequate number of well-controlled research studies on various EPs are available.

Implications for Future Research and Practice

Looking at the findings collectively, several implications for educational research and practice become evident. As for research value, it seems timely that this review analyzed the latest research on EPs. It might align with contemporary educational practices, where teachers look for new and better ways to complement classroom- or individual-based practices (Cumming, 2013; Heintzelman, 2016). Since there is still much to be learned about integrating MT into EBPs, this review lays the groundwork for further research by: (a) identifying issues in relation to the overall implementation and effectiveness of EPs for students with ECD, and (b) calling for future directions to examine the power of EPs and draw conclusive effects.

Nora A. ALTAWEEL. Integration of mobile technology into evidence-based practices for students with emotional and conduct disorders in classroom

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Strengthening the power of EPs for students with ECD in future research will add to the existing knowledge base.

From classroom practice point of view, teachers should be EP agents in future research, meaning that their judgments should play a key role in determining and programming MT based on the students' level of performance (Flower, 2014) and current response to intervention (Macsuga-Gage et al., 2015). Future research might obtain instrumental qualitative and quantitative information about teacher-guided implementation of EPs, barriers to MT integration (e.g., school restrictions; Bedesem, 2012; Bedesem & Dieker, 2014; Wills & Mason, 2014), and suggestions for improvements (e.g., tutorial programs that consider students' academic skills and cognitive demands; Haydon et al., 2012). Further, a problem-solving decision-making model and aligning MT guidelines (Maich & Hall, 2016) might enable teachers to keep pace with rapidly evolving MT (Cumming, 2013), without impacting treatment fidelity of EBPs (Macsuga-Gage et al., 2015). Along with this, professional development in the area of EPs may help teachers take full advantage of MT capabilities to supplement EBPs (Cumming, 2013; Heintzelman, 2016) and, thereby, improve academic and behavioral performance of students with ECD.

Educational stakeholders might also be prompted to develop powerful EPs to meet students' learning needs (Bedesem, 2012). For example, addressing the academic needs in the extant literature was rarely sufficient. A possible explanation for this is that the widespread existing MT could have been more promising for behavioral skills than academic content. Hence, stakeholders, along with practitioners, MT developers, and teachers (Heintzelman, 2016), should work cooperatively to provide insights into the students' academic needs and establish meaningful EPs. Finally, this literature focuses on a specific population of students with ECD across educational settings. When future research addresses the identified limitations, and EPs are scientifically supported as viable alternatives to traditional EBPs, teachers could extend the implementation of EBPs (Zhang, Trussell, Gallegos, & Asam, 2015). This is crucial, as successful inclusion of students with ECD demands training and support in a continuous manner (Haydon et al., 2017). As a result, students with ECD might display higher rates of positive academic and behavioral performance and, thereby, achieve their actual potential.

Conclusions

Within the era of EBPs and rapid uptake of MT in today's schools, this review is one of the first to synthesize the recent empirical literature on the effectiveness of EPs for students with ECD in academic situations. Results of this review suggest that EPs may be effective for increasing academic engagement and decreasing off-task behavior for students with ECD. However, the present review makes clear that further research is needed to verify and explore the potential of EPs to improve academic and behavioral attainment for students with ECD. This can be done by: (a) controlling for the interfering variables (e.g., antecedents) to examine the unique power of EPs, (b) assessing the generalizability of the documented findings (e.g., considering various EBPs), and (c) understanding the additional demands that might be involved in instructional routines when EPs are in place. Taking these issues into consideration, teachers of students with ECD might be provided with a promising alternative to typical EBPs, which could lead ultimately to enhancements in student learning and improvements in teaching effectiveness. With the focus put on evidence-based practices and media pedagogy, this literature review summarizes the results of hitherto research in the area of ECD and offers recommendations for future research and practice. Although the research sample was limited to American publications, it seems meaningful to present the results at the international level to promote more next-step synthesis and experimental considerations in the field of using mobile technology to support evidence-based practices for students with ECD.

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