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Effects of Individualized Coaching on Teacher Implementation Fidelity of Systematic Instruction with Students with Developmental Disabilities

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Abstract: *Research has established that implementing evidence-based practices with a high procedural fidelity is integral in promoting positive outcomes for students with moderate-to-severe disabilities and more significant support needs. However, special education teachers who teach students with moderate-to-severe developmental disabilities often lack training in adopting and implementing evidence-based practices. This study used a multiple-baseline single-case experimental design to investigate the effects of job-embedded, individualized coaching on a special education teacher's implementation fidelity of systematic instruction for students with disabilities within natural teaching routines. Immediate and maintained increases in the implementation fidelity were found across all systematic instruction components, demonstrating the effectiveness of the individualized coaching intervention. Additionally, a brief social validity assessment at the completion of the study suggested that the coaching procedures were highly acceptable and useful for enhancing the implementation of an evidence-based practice in a natural setting.*

Prior research has established that students with moderate-to-severe developmental disabilities (MSDD) have complex educational needs and the use of evidence-based practices (EBPs) is critical in addressing these needs (Browder et al., 2014; Thompson et al., 2018). In order to engage in EBPs to teach academic content to students with MSDD, educators need to be well-versed in both acquiring knowledge of and implementing EBPs (Hume et al., 2021; Odom et al., 2013). However, current literature suggests that teachers of students with MSDD often adopt and implement instructional practices that are not evidence-based (Brock et al., 2020; Knight et al., 2019; Morrier et al., 2011; Wong et al., 2015). Rather than relying on research evidence, teachers often rely on their own professional judgment and the judgment of their peers when making instructional decisions for their students (Knight et al., 2019). In addition, prior research suggests that teachers generally lack confidence in their ability to effectively use EBPs (Brock et al., 2020; Brock et al., 2014). This is a concern as research has repeatedly demonstrated that providing evidence-based and individualized instruction for students with MSDD is critical for ensuring meaningful access to education and promoting positive academic outcomes (Kurth et al., 2015; Thompson et al., 2018).

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Systematic Instruction

Systematic instruction is an instructional framework based on the principles of applied behavior analysis and has been demonstrated to be

effective for teaching academic skills to students with severe developmental disabilities (Barnett et al., 2018; Browder et al., 2009; Knight et al., 2010; Smith et al., 2013; Spooner et al., 2011; Spooner et al., 2012). Key features of systematic instruction include teaching socially relevant and meaningful outcomes, targeting observable and measurable skills, promoting the transfer of stimulus control, using data to determine the effects of instruction, and producing positive changes in behavior that are generalizable across instructional content, materials, people, or contexts (Smith et al., 2013; Spooner et al., 2011). To promote the transfer of stimulus control (i.e., teach students to engage in correct responses or positive behaviors as independently as possible across contexts), it is typical to include procedures such as systematic delivery of instructional tasks, a hierarchy of prompts to promote correct responses, correction or reduction of opportunities for errors, and differential reinforcement of student responses or behaviors. However, as an instructional framework, the specific procedures included in systematic instruction may vary based on instructional goals, student needs, and instructional setting.

Implementation Fidelity

As with other EBPs, systematic instruction should be implemented with a high degree of implementation fidelity in order to effectively improve academic, behavioral, and social communication outcomes in students with disabilities (Browder et al., 2014; Rispoli et al., 2011). Implementation fidelity is the extent to which the delivery of a practice adheres with the original protocol and a high degree of implementation fidelity is more likely to ensure that the practice produces its intended outcomes (Carroll et al., 2007; Fixsen et al., 2013). Studies have shown that school-based interventions with higher implementation fidelity produce significantly stronger effects on the intended outcomes such as improved academic achievement (Scott et al., 2019), lower rates of truancy (Pas et al., 2019), and reduced conduct problems (Fernández-Martínez et al., 2021). Yet, despite the importance and known benefits of high implementation fidelity in the instruction of students with disabilities, in practice there are barriers to implementing EBPs with high fidelity. Notably, major barriers include limited access to effective training or professional development opportunities, as well as long gaps between available trainings (Knight et al., 2019).

The implementation fidelity of EBPs, including systematic instruction, can be increased through training and professional development (Brock et al., 2020; Odom et al., 2013). However, it should be noted that while standalone professional development workshops are typically more accessible, they are often insufficient for educators' mastery and maintenance of EBPs in the classroom setting beyond the initial acquisition of knowledge (Hemmeter et al., 2016; Kretlow & Bartholmew, 2010). As such, there is a need for the development of a feasible professional development program that increases teachers' implementation of EBPs with fidelity and can be embedded into ongoing routines.

Effective Coaching for Educators

Job-embedded coaching has been defined as a practice that involves a coach-coachee relationship that is maintained across multiple sessions over time (Desimone & Pak, 2017) and has been demonstrated to be an effective professional development for educators to implement EBPs with students with MSDD (Coogle et al., 2017; Gregori et al., 2021; Hemmeter et al., 2016; Mason et al., 2019). Specifically, coaching that targets specific instructional skills or strategies has been shown to result in positive effects on teachers' delivery of instruction that improves student outcomes (Desimone & Pak, 2017; Dudek et al., 2019). Through the coaching sessions, the coachee engages in reflective practices to acquire new instructional practices or improve the implementation of current instructional practices (McLeod et al., 2019). Throughout the coaching process, there are multiple opportunities for the coach to observe the coachee and provide ongoing feedback to increase the implementation fidelity of the instructional practices (Dudek et al., 2019). The continuous feedback provided in coaching supports the learning, continued improvement, and mastery of an EBP in a manner that a workshop cannot provide.

Among various job-embedded coaching models, practice-based coaching (PBC) is a coaching model that involves a cyclical process of

building a partnership between the coach and the coachee, shared goal identification and action planning, observations and data collection on the implementation of the target practice, and feedback based on both data and the coachee's reflection on their implementation of the target practice (Snyder et al., 2015). Several studies have shown that PBC is an effective coaching model for improving the implementation of EBPs in educational settings (Donegan-Ritter & van Meeteren, 2018; Mason et al., 2017; Snyder et al., 2015; Sutherland et al., 2015). For example, Sutherland et al. (2015) conducted a randomized controlled trial to evaluate the effects of PBC on teachers' implementation of interventions for children at risk for emotional behavioral disorders in preschool settings and found that PBC resulted in significantly higher implementation fidelity. This study also concluded that the quality of teaching was improved based on measures of when and how a teaching practice was delivered. The specific feedback offered based on observations of specific practices within PBC allows the coachee to work on and enhance the specific teaching practices. In another study, Mason et al. (2017) conducted a single-case design study to investigate the effects of PBC on paraeducators' implementation of an EBP with students with MSDD during one-on-one instruction and found a positive functional relation between PBC and the paraeducators' implementation of the EBP. However, the literature surrounding the evaluation of PBC as a coaching model to effectively support the implementation of EBPs in classrooms have primarily focused on either early childhood settings or one-on-one instructional context.

Given this, the current study aims to further evaluate the effects of PBC on a special education teacher's implementation fidelity of systematic instruction particularly for students with MSDD in a more natural instructional setting (i.e., group instructional setting). Specifically, we addressed the following research questions:

(a) Is there a functional relation between individualized coaching based on the PBC framework and teacher implementation fidelity of systematic instruction?
(b) What is the effect of individualized coaching on teacher implementation fidelity of systematic instruction?

Method

Participants and Setting

All recruitment, consent, and data collection procedures were approved by the Institutional Review Board prior to the start of the study. A recruitment flyer was distributed to three school districts around a midwestern public university where the research study was based. The only inclusion criterion was that the participant had to be a special education teacher who worked directly with students with MSDD. A public elementary school special education teacher, Aaron (pseudonym), signed up to participate in the study. Aaron taught full time in a suburban school district in the midwestern United States. He was a 30-year-old White male with a bachelor's degree and four years of teaching experience. He had no prior experience implementing systematic instruction and had not received coaching related to the implementation of instructional practices. His classroom was a special education resource classroom that included 22 students in grade levels K-5 (ages 5-9 years old) who received services under one or more the following disability categories: (a) autism spectrum disorder (n = 4), (b) intellectual disability (n = 5), (c) language or speech impairment (n = 15), (d) other health impairment (n = 12), and (e) specific learning disability (n = 2). This classroom included students with both mild and intensive support needs. Some of the students in this classroom had multiple disability diagnoses and needed both intensive academic and behavioral supports. Fifty-nine percent (n = 13) of the students identified as White and 41% (n = 9) of the students identified as Black. Aaron delivered instruction in small groups most of the time, with group size ranging from 3 to 6 students. Students from different grade levels were grouped together when individualized education plans indicated similar academic goals. The students that Aaron taught during study sessions varied based on the schedule of study observation. Aaron also worked with two paraeducators, who delivered one-on-one or small group instruction simultaneously in the same classroom. However, the paraeducators did not participate in the study. The coach who delivered the intervention was a doctoral student in special education and

had prior experience in using PBC to support in-service teachers to implement EBPs.

There were three clusters of tables and chairs that allowed students to receive instruction in three separate groups. Students were typically seated in a U-shape facing the teacher or a paraeducator. The classroom also included a stationery area where students could borrow pencils and erasers, and a homework tray area where students turned in their daily homework. Occasionally, related service personnel such as a behavior specialist or a speech and language pathologist entered the resource classroom to observe a specific student. However, they did not interrupt ongoing instruction or routines and interacted minimally with students.

Materials

Documents used for coaching included: (a) *Strengths and Needs Assessment*, (b) *Focused Observation Form*, (c) *Goal Planning Form*, and (d) *Action Planning Form*. These materials were adapted from Snyder et al. (2015) and were individualized for this study (available from the first author upon request). The *Strengths and Needs Assessment* outlined the general procedure of each systematic instruction component. Aaron was asked to rate his knowledge and confidence in implementing each component, and then identify areas that he would like to prioritize on learning or enhancing. The *Focused Observation Form* was used by the coach to gather relevant information during observations and to guide reflection and feedback during coaching meetings. The *Goal Planning Form* was used by the coach and teacher to develop a specific implementation goal prior to targeting each new component of systematic instruction. The *Action Planning Form* was used by the coach and teacher during every coaching meeting to outline steps needed to achieve the goal they set.

Experimental Design

A single-subject concurrent multiple-baseline design across skills (Kennedy, 2005; Ledford & Gast, 2018) was used to evaluate the effect of PBC on the teacher's implementation fidelity of systematic instruction. This design was selected to allow for experimental control while also allowing for an applied application of PBC. The design allowed the coachee, the teacher, to choose the skill and goal for fidelity of implementation. The teacher was systematically introduced to coaching for each skill (i.e., systematic instruction component) when stable baseline data were demonstrated across untargeted skills and improved implementation fidelity was demonstrated for the targeted skill. The study was conducted over 13 school weeks, with an average of two direct observation sessions (range = 1–5 sessions per week, $SD = 1$) and one coaching meeting per week.

Dependent Variable and Data Collection Procedures

The dependent variable was the percentage of systematic instruction steps implemented correctly. A researcher-developed 26-item implementation fidelity checklist (see Table 1) was used to assess the accuracy of implementation of systematic instruction components. The systematic instruction components included: (1) setting up the instructional environment, (2) prompting, (3) error correction, and (4) reinforcement. The number of steps for the implementation of each systematic instruction component varied from 5 to 9 steps. Each step was scored with either a 0, 1, 2, or "not applicable (N/A)." A score of "0" was given if a step was not implemented at all or implemented incorrectly throughout the observation session. A score of "1" was given if the teacher implemented the step correctly at least once but not across all of the opportunities during an observation session. If the teacher implemented the step correctly across all opportunities in an observation session, a score of "2" was given. If there was no opportunity to implement a step, the step was scored as "N/A." For the first component, setting up the instructional environment, the teacher received either a score of "0" or "2" for correct implementation of the steps as the teacher was only expected to implement this component once at the beginning of a lesson. For the prompting component, the prompting hierarchy (i.e., least-to-most or most-to-least) was determined by the teacher and the observers would score the teacher's implementation of the prompts based on the predetermined hierarchy. For the error

TABLE 1

Systematic Instruction Fidelity Checklist

Systematic Instruction Components and Procedures	*Score*
Setting up the instructional environment	0 or 2
1. Teacher obtains all relevant instructional materials	
2. Teacher sits or stands within 3 ft. of the student	
3. Teacher removes distractions or move the student to an appropriate workspace	
4. Teacher obtains the attention of the student	
5. Teacher tells the student what they will be doing	
6. Teacher tells the student why the lesson is important	
7. Teacher states expectations of the student for the lesson	
Prompting	0, 1, or 2
1. Teacher provides the relevant instructional demand/cue	
2. Teacher provides 5-10 s for the student to respond	
3. If student responds correctly, the teacher provides brief specific praise	
4. If student does not respond at all, teacher provides a prompt with appropriate prompt level	
5. Teacher implements prompting hierarchy in correct sequence	
Error correction	0, 1, 2, or N/A
1. If student responds incorrectly, teacher indicates the response is incorrect and asks student to try again	
2. Teacher represents the instructional demand/cue	
3. Teacher prompts student to evoke correct response	
4. Teacher provides brief specific praise for correct response	
5. Teacher presents easy task	
6. Teacher provides brief specific praise for correct response	
7. Teacher returns to the initial instructional demand/cue	
8. Teacher reduces prompt level to evoke correct responding	
9. If student responds correctly, teacher provides brief specific praise	
Reinforcement	0, 1, or 2
1. After each correct student response, teacher provides access to reinforcer	
2. Teacher pairs access to reinforcer with brief specific praise	
3. Teacher provides reinforcer and/or praise immediately after the correct response	
4. Teacher provides stimulus that has been determined to be highly preferred for the student	
5. Teacher withholds access to reinforcer and praise if student response is incorrect	

Note. The steps of error correction should be implemented in the sequence they are listed.

correction component, "N/A" was scored if no errors occurred across all opportunities for student response during the observation session. Implementation fidelity was calculated by dividing the total score received by the total possible score and multiplying by 100.

Observation sessions were conducted in an identical manner across baseline, intervention, and maintenance phases. All observations took place in the classroom during typical instruction (e.g., reading, writing, mathematics) without any adjustment to scheduling, activities, or student group size. Each observation session lasted between 5 to 12 min, with an average of 8 min. The termination criteria for each observation session was at least 5 min of session duration and three or more opportunities for the teacher to demonstrate each targeted systematic instruction component. The coach and another observer conducted observations of the teacher in real time and collected data on paper. Observers were positioned at least 6 feet away from the teacher and the group of students he was teaching. The teacher was informed that the observations were focused on his implementation of systematic instruction. The coach did not provide additional instructions or feedback immediately prior to

or during observation sessions. The students were not informed of the intention of the observers.

Interobserver agreement (IOA) of the dependent variable measurement was obtained across at least 25% of sessions for each systematic instruction component and within each study phase (i.e., baseline, intervention, maintenance). The primary observer was the coach and the secondary observers were graduate students in special education who received training on single-case research designs and direct observations. Agreement was defined by both observers indicating the same score (i.e., 0, 1, 2, or N/A) on an item in the fidelity checklist. IOA was calculated by dividing the total number of items with agreement by the total number of items (i.e., 26) and multiplying by 100. The mean IOA across all 26 steps of systematic instruction was 92% (range = 84-100). The mean IOA calculated across components was 98% for setting up the instructional environment, 89% for prompting, 85% for error correction, and 91% for reinforcement. The mean IOA calculated across study phases was 89% for baseline, 92% for intervention, and 92% for maintenance.

Intervention Procedures

Baseline. In baseline, Aaron taught as usual and did not receive coaching on untargeted systematic instruction components. However, the teacher received a paper copy of the systematic instruction fidelity checklist, which included the steps of all systematic instruction components. Aaron taught reading, writing, mathematics, or social skills to students in small groups (3-6 students). A clip-up board and a token board with stickers was available on one side of the classroom. Students earned clip-ups when they exhibited appropriate learning behaviors, such as following directions throughout a class period, and the clips were reset at the beginning of each day. In addition, students earned tokens when they demonstrated appropriate academic behaviors, such as turning in homework on time, and the tokens could be accumulated over days until the board was filled with stickers. Daily, consistent use was not observed for either clip-ups or token system.

Intervention

Coaching Overview. Based on the PBC model (Snyder et al., 2015), the coach implemented a cyclical process of coaching that included shared goal setting and action planning with the teacher, conducting focused observations of the teacher's implementation of systematic instruction, having a reflective conversation with the teacher, and providing feedback to help the teacher achieve each goal. This coaching process involved weekly coaching meetings with duration ranging from 15 to 30 minutes. Coaching meetings took place during Aaron's lunch hour in his classroom per his request, as this was the most convenient window of time for one-on-one conversations. The coach conducted coaching meetings in adherence with a 15-item checklist, as shown in Table 2. Each coaching meeting included the following four components: (a) opening, (b) reflection and feedback, (c) shared goal setting and action planning, and (d) general items. As PBC has an emphasis on forming a collaborative partnership between the coach and the coachee (Snyder et al., 2015), the positive greeting at the beginning of each coaching session (i.e., the opening) was meant to help the coach build rapport with the teacher.

In the first coaching meeting, Aaron completed a *Strengths and Needs Assessment* to determine his knowledge and confidence with implementing each component of systematic instruction. After he completed the assessment, he selected the component he wanted to target first during intervention based on a combination of his knowledge, confidence, and preference self-ratings. In each of the subsequent coaching meetings, the coach and Aaron focused on discussing one or two instructional components. The sequence of the targeted components was determined jointly by the teacher and the coach as follows: (a) setting up the instructional environment, (b) prompting, (c) error correction, and (d) reinforcement. When Aaron achieved his goal for one instructional component, coaching was withdrawn for that component.

Goal Setting and Action Planning. In the shared goal setting and action planning component

TABLE 2

Coaching Fidelity Checklist

Coaching Components and Procedures	*Possible Score*
Opening	
• Coach opened with a positive greeting	+ or –
• Coach reviewed the purpose of the session	+ or –
Reflection and Feedback	
• Coach facilitated teacher reflection on target instructional practice using open-ended questions	+ or –
• Coach shared specific examples of implementation of the instructional practice	+ or –
• Coach shared data and checked for teacher understanding	+ or –
• Coach provided supportive feedback on relevant instructional practice based on teacher reflection	+ or –
• Coach provided constructive feedback on relevant instructional practice based on teacher reflection	+, –, or N/A
• Coach used leveling statements to reach common ground when teacher had different views	+, –, or N/A
Shared goal setting and action planning	
• Coach facilitated discussion to jointly identify a measurable goal	+, –, or N/A
• Coach facilitated discussion to identify action steps to help teacher achieve goal	+, –
• Coach facilitated discussion to identify supports or resources to help teacher achieve goal	+, –
General items	
• Coach asked teacher if they had questions or concerns	+ or –
• Coach addressed teacher questions or concerns	+, –, or N/A
• Coach and teacher determined time to conduct subsequent coaching session	+, –
• Coach kept discussion focused on target instructional practice	+, –

of coaching, the coach and the teacher identified a measurable goal on the implementation fidelity of a specific instructional component (e.g., implementing error correction with 80% fidelity or higher across three observed lessons in a row). Through a discussion and joint decision-making, the coach and the teacher outlined actionable steps to achieve the goal. Additionally, the coach offered to provide additional resources that might help the teacher achieve the goal, such as video examples of implementation, opportunities to obtain in-vivo feedback while practicing an instructional skill, and visual reminders of key steps in an instructional component.

Focused Observations. The coach conducted focused observations to collect data on the teacher's progress towards his goal. During focused observations, the coach scored the teacher's implementation fidelity of systematic instruction based on the fidelity checklist. In addition, the coach took descriptive notes on relevant events that occurred during the implementation of systematic instruction (e.g., effective use of visual reminders, students' responses). Implementation fidelity data were displayed on a line graph and shown to the teacher during coaching meetings to promote data-based decision making in the coaching process. Descriptive notes were used to facilitate the reflection and feedback component of coaching.

Reflection and Feedback. During each coaching meeting, the coach asked open-ended questions to facilitate the teacher's reflection of the implementation of systematic instruction. Examples of open-ended questions were: "What went well with the implementation of this strategy?", "How do you feel about implementing this component?", and "What did you notice about student responses?" The coach acknowledged the teacher's reflection and guided the teacher to reflect on any

changes or the lack of changes in the implementation fidelity of systematic instruction and the effects on student behavior. As part of providing feedback, specific examples of implementation were shared by the coach based on the notes and data taken during focused observations of the teacher prior to the coaching meeting. Supportive feedback was provided by describing what Aaron implemented well and how it led to enhanced student learning or outcomes (e.g., number of students who completed assigned classwork, quality of classwork submitted by the students). Constructive feedback was provided through suggesting strategies to enhance the implementation of an instructional component and providing Aaron with a choice in strategy selection, based on his reflection of what was challenging for him to implement or an area of implementation that he wanted to work on. If the coach and teacher had different viewpoints during a coaching meeting, the coach used leveling statements (e.g., acknowledged the teacher's view, affirmed the teacher's instructional skills, and suggested options for approaching the disagreed point) to reach a shared view or decision with the teacher.

After the reflection and feedback component of the coaching meeting, the teacher and the coach repeated the coaching cycle by engaging in goal setting and action planning to either continue working on the same goal or set a new goal. Throughout the coaching meeting, the coach offered opportunities for the teacher to voice concerns and addressed them, if any. The meeting ended with the coach and the teacher scheduling the subsequent coaching meeting.

Maintenance

The maintenance phase was introduced after intervention was withdrawn for each systematic instruction component. The implementation of the components in maintenance continued to be observed and scored for fidelity. However, these components were not discussed during coaching meetings and the coach did not provide any feedback or support related to these components outside of coaching meetings.

Coaching Fidelity

Coaching fidelity was assessed for all 11 coaching meetings (excluding the first coaching meeting which focused on identifying the teacher's strengths, needs, and priorities in implementing systematic instruction) based on a researcher-developed checklist (Table 2). Each item on the checklist was scored on a dichotomous scale (i.e., "+" or "-"). The coach had to implement an item correctly throughout a coaching meeting in order to receive a "+". If the coach implemented an item incorrectly at any point in time during the coaching meeting, the item was rated a "-". If there was no opportunity to implement an item, the item was scored as "N/A". Coaching fidelity was calculated by dividing the number of "+" by the total number of applicable items and multiplying by 100. All coaching meetings were video recorded and coaching fidelity was scored through videos by special education faculty and graduate students. IOA of the coaching fidelity data was assessed across 9 out of 11 (82%) coaching meetings. Primary and secondary observers watched the coaching meeting videos independently and evaluated the coaching fidelity using the checklist. Agreement was defined by both observers indicating the same rating for a given item. IOA was calculated by dividing the total number of items with agreement by the total number of items and multiplying by 100. The mean IOA for coaching fidelity was 97% (range = 86-100).

Social Validity

Social validity of the study was assessed using a brief written survey and a debrief session between the coach and the teacher after study completion. The survey included 24 Likert scale items on the acceptability, usability, effectiveness, and feasibility of the systematic instruction and coaching procedures and four open-ended prompts on features of the coaching procedures (available from first author upon request). The 24 Likert scale items could be rated as *strongly disagree* (1 point), *disagree* (2 points), *neutral* (3 points), *agree* (4 points), or *strongly agree* (5 points), and included eight items related to systematic instruction and 16 items related to coaching.

These items included descriptive statements such as "students benefitted from my enhanced implementation of systematic instruction" and "the duration of each coaching session was manageable with my other work demands." The open-ended prompts in the survey included statements such as "What I liked least about coaching …" and "Coaching would be better if …" In the debrief session after the completion of the study, the coach obtained verbal, descriptive feedback from the teacher regarding the coaching procedures using open-ended prompts such as "What do you think about …" and "How do you feel about using …"

Results

The implementation fidelity of systematic instruction is displayed in Figure 1. A percentage score was calculated for each of the four systematic instruction components during each observation session, as indicated by the closed circles. The grey horizontal lines indicate the implementation fidelity mastery goal set by the teacher and the coach. The percentage goals were 80% for setting up the instructional environment, 85% for prompting, 80% for error correction, and 80% for reinforcement. Each asterisk indicates the occurrence of a coaching meeting related to each systematic instruction component. The study demonstrates strong experimental control with establishment of a stable pattern of behavior, more than 5 data points per phase, and four demonstrations of experimental effect (three replications of effect across tiers). The study data suggest there is a functional relation between the individualized coaching intervention and the teacher's implementation fidelity of systematic instruction. Visual analysis of graphed data was used as the method of data analysis, which is appropriate for determining the presence or absence of a functional relation between independent and dependent variables, given the single-case experimental design of this study (Maggin et al., 2021).

In baseline, Aaron demonstrated a moderate and stable level of implementation fidelity in setting up the instructional environment. Slight variability and an increasing trend were observed in prompting during the first three baseline sessions which then stabilized at 40% fidelity. A slight increasing trend was initially observed in the implementation fidelity of error correction, however, this stabilized towards the end of the baseline phase, remaining below 40% implementation fidelity. Implementation fidelity of reinforcement remained low and stable across all baseline sessions with minimal variability, as Aaron implemented items 24 and 26 correctly (see Table 1 for a checklist of items) before intervention.

When the coaching intervention was introduced, an immediate increase in implementation fidelity was observed across all systematic instruction components. For setting up the instructional environment, a small but immediate increase in level was observed (from 68 to 86%) with the improved implementation of item 7 (i.e., stating expectations). When Aaron reached his goal for setting up the instructional environment in session 9, coaching was introduced for prompting in the subsequent coaching meeting. However, as Aaron was not able to maintain a stable implementation fidelity above his 90% goal for setting up the instructional environment (step 6, on stating the importance of the lesson, remained incorrect), this component remained a focus of coaching, along with the prompting component. The goal for setting up the instructional environment was eventually adjusted from 90% to 80% based on the conclusion that it was not entirely feasible to implement this component at 90% within natural instructional routines in his classroom. Aaron required a total of six coaching meetings to achieve his goal for setting up the instructional environment.

For prompting, an immediate increase in level (from 40 to 64%) and an increasing trend (from 63 to 100%) was observed when intervention was implemented, with the level remaining high and stable (at 100%) after three coaching meetings. In baseline, the items that were most commonly missed were items 10–12 (i.e., praising correct responses, providing appropriate prompt, using least-to-most prompting). In intervention, Aaron began implementing items 10–12 more frequently and eventually reached 100% consistently.

For error correction, a slight but immediate increase in level (from 22 to 44%) was observed when Aaron received coaching on this instructional component. Some variability (between 44% and 94%) was observed throughout the

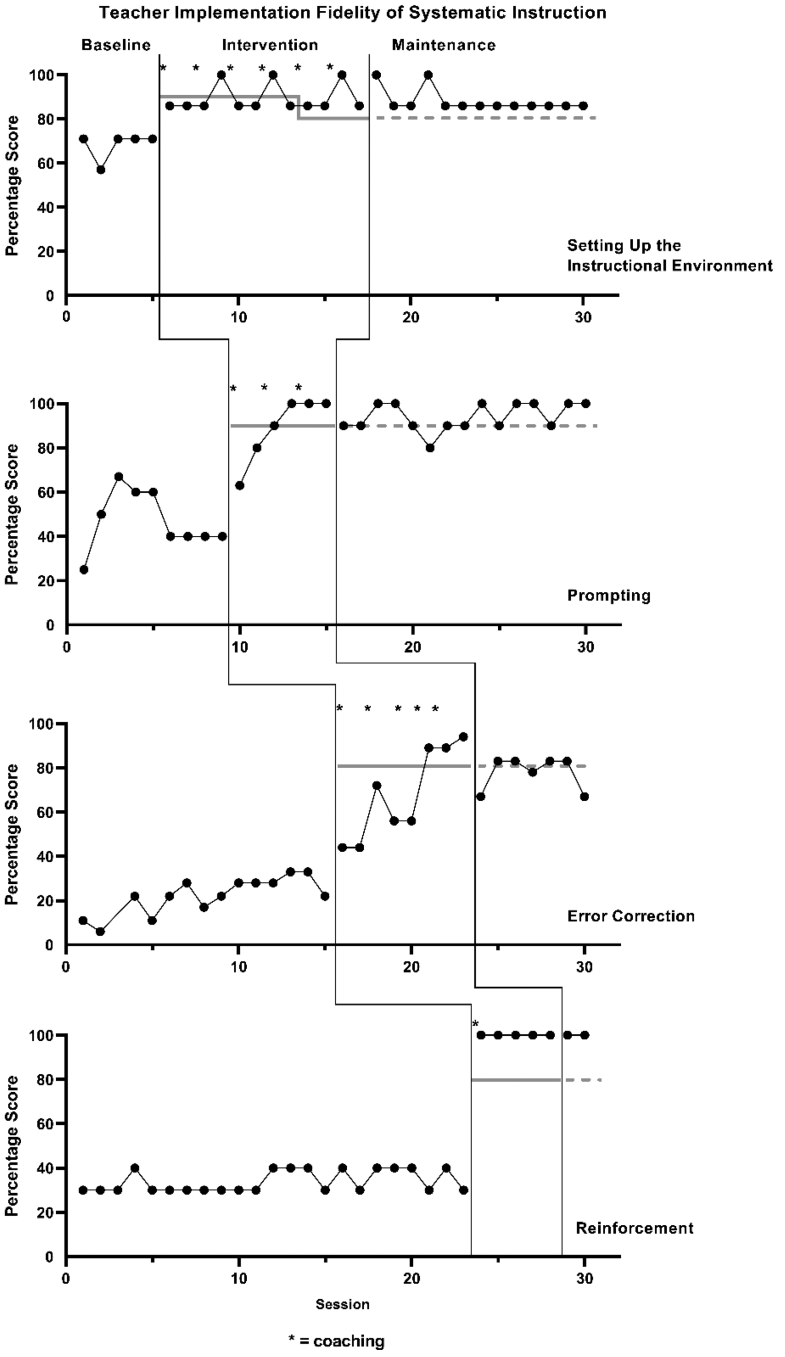

Figure 1. Teacher's implementation fidelity of systematic instruction. Each asterisk denotes a coaching meeting. Each gray horizontal line indicates the teacher's implementation fidelity goal determined during practice-based coaching.

intervention phase. Before intervention, Aaron sometimes implemented items 13–16 correctly. During intervention, Aaron gradually acquired items 17 to 21, but had more difficulty on items 19–21 and needed more coaching meetings to implement these items correctly. Overall, implementation fidelity increased during intervention and Aaron reached his goal after five coaching meetings.

When coaching was introduced for reinforcement, Aaron achieved 100% fidelity (immediate increase from 30%) after one coaching meeting and the level remained stable for the remaining sessions in intervention.

In the maintenance phase, setting up the instructional environment and reinforcement were implemented above his goal throughout maintenance, prompting was implemented at or above his goal except for one session, and error correction was implemented with some variability and decrease in fidelity, specifically on items 17–21. Overall, Aaron's implementation fidelity was high and stable across three out of four components in the maintenance phase.

Across 24 items on the survey, 23 items were given ratings of 5 (*strongly agree*) and one item, "my enhanced implementation of systematic instruction led to a noticeable increase in students' academic skills," was given a rating of 4 (*agree*). The mean rating was 4.96 across all items. Based on the open-ended prompts on the survey, the teacher indicated that what he liked best about coaching was the opportunity to learn new techniques in the classroom to help him be more successful in keeping students engaged in learning. On the other hand, the teacher also indicated that the overall coaching process took longer than he anticipated and would prefer spending less time on the process.

Based on the information gathered through the debrief session, the teacher commented positively about several features of the coaching procedures, including the systematic process, focus on implementation, guided discussions during coaching meetings, usefulness of specific, data-based feedback from the coach, and frequency of coaching meetings (i.e., once per week). In addition, the teacher described some areas for improvement including shortening the total duration of the study and more quickly identifying multiple areas of instructional practices to work on. The teacher also indicated that he would be willing to implement similar coaching procedures with paraeducators in his classroom to support their implementation of effective instructional practices.

Discussion

The purpose of this study was to evaluate the effects of a teacher training intervention based on the PBC model developed by Snyder et al. (2015) on a special educator's implementation fidelity of systematic instruction with students with MSDD. A multiple-baseline single-case experimental design across skills was used to demonstrate the intervention effects. Visual analysis of implementation fidelity data indicated a clear demonstration of functional relation between PBC and increases in implementation fidelity of systematic instruction. In view of the research-to-practice gap on adopting and implementing EBPs with high fidelity, as well as the critical need for job-embedded coaching for teachers, the current study provided some evidence that the PBC model can be applied for individualized coaching for special educators to implement an EBP for students with MSDD.

The findings of this study align with prior studies that demonstrated the efficacy of PBC in enhancing the implementation fidelity of EBPs in classroom settings (Conroy et al., 2014; Hemmeter et al., 2016; Snyder et al., 2015). Within the PBC model, each implementation goal was individualized based on the teacher's needs, priorities, as well as the contextual factors in his classroom (e.g., lesson duration, classroom expectations). In addition, the action plans that facilitated the teacher's progress towards each goal were developed with substantial input from the teacher. These could have increased teacher buy-in and motivation to enhance the implementation fidelity of systematic instruction.

While systematic instruction has been shown to be highly effective for supporting the academic needs of students with MSDD (Barnett et al., 2018; Knight et al., 2010; Smith et al., 2013; Spooner et al., 2011; Spooner et al., 2012), little research has been conducted to develop or examine the effects of job-embedded, individualized coaching on special educators' implementation of systematic instruction.

This study extends the research on these areas and provides empirical evidence that immediate and maintained positive effects can be achieved in the implementation of systematic instruction when a special educator is coached weekly using the PBC model.

It is also worth noting that the implementation fidelity data were collected through focused observations that were conducted during natural instructional routines across multiple subject areas (e.g., mathematics, reading, writing), as well as students across grades K-5 with a range of MSDD (e.g., autism spectrum disorder, intellectual disability, other health impairment) and learning disabilities. This highlights the generalizability of coaching effects on the teacher's delivery of systematic instruction across subject areas, grade levels, and diverse student needs. It is possible that delivering systematic instruction across students with a range of grade levels and academic support needs, rather than one-on-one with a specific student, promoted generalization within natural instructional routines.

Furthermore, after the teacher mastered each component of systematic instruction, his implementation fidelity remained high across most components without coaching. When coaching was withdrawn for a component, the coach and coachee no longer engaged in reflection and feedback for that component. However, the coach continued to collect data on the component during focused observations and provided graphical displays of data for the teacher during coaching meetings. It is possible that the visual data display of high implementation fidelity reinforced the teacher's maintenance of each acquired instructional component.

Implications for Research

While the behavior of collecting data was not explicitly assessed through items on the implementation checklist of systematic instruction, the teacher had to collect data and monitor student progress frequently throughout instruction to correctly implement systematic instruction. For example, monitoring the accuracy of student response was necessary for determining the need for providing a praise, delivering a prompt, or correcting an error. In an effort to make reinforcement more efficient and feasible in the context of his classroom, Aaron tallied correct student responses using a point system and delivered rewards at the end of the lesson based on the points earned by each student. While this data collection system was not explicitly included in the systematic instruction procedures, this practice aligns with the notion that data-based decision making is central to systematic instruction (Spooner et al., 2011; Spooner et al., 2012). Future research should explore how data collection behaviors may be assessed more directly, with consideration for the data collection method, accuracy, and reliability.

During coaching meetings, resources that the teacher requested to enhance implementation fidelity included viewing video exemplars of systematic instruction components and visual reminders of specific procedures that he often missed. In the context of this study, these requested resources were typically provided by the coach before the subsequent focused observation. However, it may be worth examining what the commonly requested and acceptable resources are for teachers who are learning to implement systematic instruction, and develop web-based learning modules or downloadable teaching resources as readily accessible resources to enhance the efficiency of coaching. A potential benefit of web-based learning modules is that the teacher, or coachee, may access learning modules at any time that is convenient for them to strengthen the implementation of specific instructional procedures.

Implications for Practice

Social validity findings of this study indicate that the teacher participant considered the coaching process highly acceptable and systematic instruction useful and feasible within natural instructional routines. While student outcomes were not directly assessed in this study, the teacher indicated that his students engaged in more meaningful academic responses during systematic instruction. For example, students were more likely to have correct responses to a question when he established clear expectations about rules for raising hands and responding to a question as part of setting up the instructional environment component; students were also more engaged in academic tasks when he

implemented the reinforcement component consistently.

On the other hand, the teacher also expressed that the coaching procedures could be streamlined to shorten the total coaching meetings needed to learn systematic instruction, such as by targeting systematic instruction as one instructional practice during coaching rather than breaking it down into multiple components. He also suggested that reduced paperwork for coaching meetings (e.g., goal setting form, action planning form) may enhance the feasibility of coaching. Taken together, we would recommend that professionals who provide individualized coaching for educators should limit the amount of additional time and paperwork needed to support their implementation of new instructional practices.

Limitations and Future Directions

This study demonstrates strong experimental control as evidenced by systematic introduction of the intervention, a minimum of five data points per phase, and more than three demonstrations of change at different points in time (What Works Clearinghouse, 2020). However, this study only included one teacher in a single classroom. Thus, replication with more teachers is needed to demonstrate the generalizability of findings from this study and determine the efficacy of the practice. Additionally, this study did not include the paraeducators working in the classroom. Based on a national report of the 2018-2019 school year, paraeducators who serve school-age students with disabilities (between 6 and 21 years old) make up over half of the special education workforce, outnumbering the number of special education teachers (U.S. Department of Education, 2020). Paraeducators are often expected to provide instructional and behavioral supports to students with MSDD (Brock & Carter; 2013; Carter et al., 2009). Yet, little to no training in instructional and behavioral strategies for paraeducators is usually provided (Brock & Carter, 2016). Therefore, training in implementing EBPs is needed for these professionals to meet the needs of students in special education (Mason et al., 2020). Future research should consider evaluating the effects of coaching on the instructional practices of paraeducators, using a teacher-as-coach model (Gregori et al., 2021; Mason et al., 2017; Mason et al., 2019).

Although the study discusses the implementation of systematic instruction across subject areas, no student outcomes were measured. Measuring academic outcomes can be challenging when the subject area is not held consistent. Thus, future research may consider measuring student engagement (e.g., on-task behavior, responses to opportunities to respond) to determine the indirect effects of PBC on student outcomes.

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