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Data-Driven Coaching Model to Support Teachers' Implementation of Opportunities to Respond

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Abstract

Promoting a high level of student engagement has been a goal for many teachers. Opportunities to respond (OTR) offer a low-cost instructional practice that allows teachers to improve student engagement in the classroom. In this study, we explored the potential effects of a data-driven coaching model on one elementary school teacher's implementation fidelity of OTR delivery and the teacher's delivery rate of OTR during teacher-directed instruction. We used a single-case, changing criterion design with two criterion changes. Results showed the teacher improved her OTR implementation fidelity from 69.79% to 93.77% and OTR delivery rates from 0.8 per minute to 2.5 per minute across two criterion changes with the data-driven coaching support. Additionally, the teacher improved her demonstration of OTR that included all essential delivery components. Consumer satisfaction survey data from the teacher supported the benefits of the data-driven coaching model. This study highlights the importance of measuring essential components of OTR delivery and using a coaching model to promote the teacher's use of high-quality OTR based on specific needs.

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Introduction

Improving student academic engagement has been a priority for teachers. Academic engagement encompasses activities directly related to learning, such as active participation in discussions, collaboration in group work, and completion of academic tasks (Saunders et al., 2021). Students who are engaged are more likely to experience academic success, persist through difficulties, exhibit stronger social skills, and remain in school (Freeman et al., 2019; Gage et al., 2017). Conversely, disengagement is associated with lower academic achievement, increased disruptive behavior, and higher rates of school absenteeism and dropout (Flannery et al., 2014; Freeman et al., 2019; Saunders et al., 2021).

To promote student academic engagement, teachers may use evidence-based practices (EBP). Evidence-based practices are techniques that have high quality research to support the effectiveness of the practices (Cook & Cook, 2013). Even though there are several EBP teachers can use in the classroom (e.g. explicit instruction, peer-assisted learning strategies, positive behavior interventions and supports), some EBP require less time and fewer resources to implement while still having a significant impact on student engagement and achievement (Kretlow et al., 2012). One such EBP that has a high level of feasibility and requires limited resources is opportunities to respond (OTR). OTR involves a cycle of teacher actions, including

providing content input, prompting responses, presenting questions or statements, monitoring accuracy, and delivering feedback (Greenwood et al., 1984; Simonsen & Myers, 2015). Research demonstrates that high-quality OTR, particularly at higher rates of opportunities per minute, significantly enhances student engagement and achievement (Haydon et al., 2012; Menzies et al., 2017).

Despite the proven benefits of EBP like OTR, their integration into teachers' daily practice is often less than desired. Specifically, teachers are not consistently trained in how to incorporate EBP or they may not know how to implement EBP effectively and with fidelity (Simonsen et al., 2008). When teachers need assistance learning how to implement a new technique, usually school districts require them to attend professional development (PD). According to Wood et al. (2016), PD alone is not adequate for teachers to be able to independently apply what they learned during training with high fidelity in the classroom. Traditional PD often consists of a one-time workshop that lacks follow-up support (Putnam & Borko, 2000), and teachers have reported these PD sessions rarely translate into improved classroom practices (Carmouche et al., 2018). To improve quality and implementation fidelity of EBP such as OTR in the classroom, PD with on-going support, modeling, and feedback (i.e., coaching) from instructional coaches is essential (Kretlow & Bartholomew, 2010; Kretlow et al., 2011).

Instructional coaching, grounded in the cognitive coaching model by Costa and Garmston (1985), offers a promising alternative to traditional PD. This model fosters the development of teachers' thinking skills, leading to more effective teaching practices and, consequently, increased student engagement and achievement. In this model, coaches provide personalized, ongoing support and feedback, collaborate with teachers to identify strengths and weaknesses in their instruction, and offer strategies and resources for improvement (Bethune & Wood, 2013; Sinclaire, 2020; Wood et al., 2016). In many cases, coaches use behavior skills training (BST) to support teachers in mastering targeted skills through four core components: instruction, modeling, rehearsal, and feedback (Parsons et al., 2012; Ward-Horner & Sturmey, 2012). One of the reasons BST is great to use during instructional coaching is its focus on active skills acquisition and performance rather than passive knowledge transfer. By incorporating opportunities for teachers to receive PD on a skill (instruction), observe correct practices (modeling), practice the skills in real context (rehearsal), and receive specific feedback (feedback), BST promotes sustained use of the skill with high fidelity. It also ensures the teacher not only understands the skills conceptually, but also masters its practical application (Gianoumis et al., 2012; Ward-Horner & Sturmey, 2012).

Another important aspect of instructional coaching is the Impact Cycle, which is a data-driven model that guides teachers through identifying, learning, and improving instructional strategies (Knight, 2021). Research highlights the importance of using instructional data to guide teaching and student learning (Boudett et al., 2005, 2006; Ertmer et al., 2005; Kerr et al., 2006; Mandinach, 2012). In this sense, data-driven decision making (DDDM) enables coaches and teachers to make informed decisions about the use of EBP such as OTR. This approach not only supports the individualization of instructional practices, but also ensures that coaching supports are aligned with actual classroom needs and student outcomes. It also advocates for a non-hierarchical, respectful relationship between teachers and coaches that addresses real classroom challenges, making instructional coaching directly applicable and relevant (Knight, 2021).

Despite the recognized importance of EBP in enhancing student engagement and achievement, there remains a notable gap in the literature regarding the combined effects of PD and instructional coaching on EBP such as OTR. This gap is particularly evident when considering the role of DDDM in these processes. DDDM can critically inform and optimize the implementation of EBP

by providing empirical evidence on their effectiveness in classroom settings. Additionally, studies on OTR implementation often did not include a measure of implementation fidelity. Therefore, the purpose of this study was to determine the effects of a data-driven coaching model, underpinned by DDDM, on one teacher's implementation fidelity of OTR delivery during teacher-directed instruction. The research questions were:

1. What were the effects of a data-driven coaching model on improving the teacher participant's implementation fidelity and delivery rate of OTR delivery?
2. What essential components of OTR were challenging for the teacher participant?
3. What were the teacher's perceptions about the data-driven coaching model?

Theoretical Framework

The theoretical framework used to guide the development of our study and selection of the research design consisted of two essential pillars: (a) OTR as an EBP to promote active student academic engagement and the need to measure implementation fidelity of OTR, and (b) multilevel PD and coaching models to support teachers' instructional implementation. Teachers' delivery of OTR involves a cycle where the teacher (a) directly provides input by presenting content, (b) explicitly states desired prompt for student responses, (c) provides a well-crafted statement/question, (d) actively monitors student responses, and (d) provides appropriate feedback (Greenwood et al., 1984; Simonsen & Myers, 2015). Different modalities of OTR, such as verbal, gestural, written, and technological response options, have been shown to improve student engagement and achievement (Haydon et al., 2012; Menzies et al., 2017; Rila et al., 2019). High rates of OTR delivery, measured as the number of opportunities provided per minute, ensures that students are consistently engaged with the material, providing more avenues for learning and assessment (Kretlow et al., 2012). Additionally, the fidelity of OTR implementation is important. Fidelity of OTR implementation refers to the degree to which teachers accurately and consistently deliver these essential components during instruction. A high OTR rate and high fidelity of implementation ensures these interactions not only are frequent, but also are of high quality that promote understanding and retention (Kretlow et al., 2012; McLeskey et al., 2019; Van Camp et al., 2020).

A second pillar of the theoretical framework that guided this study was the concept of multilevel PD and coaching models, which emphasize individualized, ongoing support to help teachers acquire and apply instructional skills (Bloomfield et al., 2024). Multilevel PD and coaching is a data-driven systematic model that uses intensifying levels of PD and coaching support tailored to teacher performance data to increase teachers' use of research- and evidence-based instructional practices (Grasley-Boy et al., 2019). BST provides a structured framework within these models, incorporating instruction, modeling, rehearsal, and feedback to promote mastery of teaching behaviors (Parsons et al., 2012; Ward-Horner & Sturmey, 2012). Such coaching models also leverage data-driven decision-making to align coaching efforts with measurable goals (Kretlow & Bartholomew, 2010; Mandinach, 2012; Wood et al., 2016). This study integrated the OTR and multilevel PD and coaching frameworks to provide the conceptual foundation for its design. The OTR framework guided the identification of essential instructional components and measurable outcomes, focusing on improving the implementation fidelity and rate of OTR implementation to enhance teacher practices and student engagement. The multilevel PD framework informed the coaching model, which included targeted and individualized coaching

supported by BST to ensure high-quality OTR implementation. Data-driven decision-making and performance thresholds were integral to adjusting coaching intensity and monitoring progress.

Literature Review

Prior research on PD and coaching interventions has demonstrated their effectiveness in improving teachers' use of OTR (e.g., Menzies et al., 2017; Randolph et al., 2019). For example, Randolph et al. (2019) examined the impact of iCoaching on teacher-delivered OTR and found that teachers who received sustained coaching support demonstrated significant improvements in both the frequency and quality of OTR implementation. Similarly, Cavanaugh et al. (2013) explored the role of performance feedback within coaching interventions, revealing that teachers who received ongoing feedback improved their use of OTR and instructional practices overall. These studies support the argument that coaching is a critical component in helping teachers apply and maintain implementation of OTR in classroom environments.

Currently, there are a limited number of studies that have examined the use of multilevel coaching models (e.g., Gage et al., 2017; Grasley-Boy et al., 2019; Thompson et al., 2012). Across these studies, researchers have examined the efficiency and effectiveness of multilevel coaching models, while also exploring its use in increasing teachers' implementation of evidence-based instructional practices. These studies support the use of multilevel coaching models to assist teachers in implementing increased rates of EBPs that promote positive student outcomes, with each study noting positive outcomes associated with participant social validity. However, research addressing the use of a multilevel coaching model to improve teachers' implementation of OTR is relatively limited and restricted to dissertations (Johnson, 2021; MacSuga-Gage, 2013). Johnson (2021) was the only study found to have explored teachers' delivery rate of OTR and implementation fidelity. Findings of Johnson's (2021) study are consistent with previous literature indicating that, although teachers may often present OTR throughout the instructional day, naturally occurring delivery rates fall well below the research-supported recommendations (Scott et al., 2017). Although there may be numerous reasons for this, it is hypothesized that many teachers potentially encounter four main barriers when delivering increased rates of OTR (Johnson et al., in press). These challenges include (a) achieving adequate OTR delivery rates to produce desired positive student outcomes, (b) delivering OTR that include all essential components, (c) incorporating a variety of OTR delivery types during instructional delivery, and (d) balancing student engagement strategies with other forms of instructional best practices. The current study has the potential to extend the literature base in the area of multilevel coaching and its impact on the delivery of evidence-based instructional practices while also providing further support for the need to explore effective ways not only to increase teachers' delivery rates of OTR, but also to improve their overall OTR implementation fidelity. By focusing on both delivery rate of OTR and teachers' OTR delivery of essential components, it may potentially help to increase active student response, provide students with additional opportunities for feedback, and increased opportunities for practice if formative data indicate a need to provide additional learning to master content.

Method

Contexts and Participant

The study took place in a lab school that was affiliated with a local university and was situated within one of the largest public school districts in the United States. As a lab school, one of the authors has been working with school staff to improve their adoption of effective instructional

practices to promote student engagement. This study represented part of that effort. This urban elementary Title 1 school included a diverse student population of 150 students in grades K–5. The demographic composition of the school predominantly included underrepresented groups, with 76% African American, 12% Hispanic, 6.7% Multiracial, and 1.4% Asian students. At the time of the study, 68% of the student population were identified as economically disadvantaged and 28% of the students were receiving special education services. The school specifically served students from underperforming schools within the district or those experiencing academic and social-behavioral challenges in their current educational setting.

The participant was Elaine, a White general education third grade teacher with 6 years of teaching experience. Elaine was selected to participate in this study based on principal recommendation regarding her potential to improve upon instructional practices, her reporting of students' low levels of active academic engagement, and her desire to strengthen her instructional delivery. She had a bachelor's degree in elementary education and K–6 teaching certification. At the start of the study, Elaine had been teaching at the participating elementary school for two years. Elaine's class included five males and five females (ages 8–9 years old), all Black students who were identified as performing below grade level on school-based academic assessments and were from families having a low socioeconomic status. At the start of the study, Elaine reported that she had used choral responding, answer cards, written responses, and other gestural prompts (e.g., thumbs up and thumbs down) to engage students in instruction.

Independent Variable

The independent variable was the data-driven coaching model, that included two fluid levels of support, targeted and individualized coaching. The development of the data-driven coaching model was based on the theoretical framework of multilevel PD and coaching model (Bloomfield et al., 2024) to provide a continuum of intensifying levels of support beyond a one-time PD session based on Elaine's instructional delivery performance. As an a-priori guideline, targeted coaching (less intensive level) was provided if post-PD data indicated Elaine's average delivery rate of OTR was between 1.6–2.9 OTR per minute with fidelity below 90%, whereas individualized coaching (most intensive level) was provided if her average rate was between 0.0–1.5 OTR per minute with fidelity below 90% (see Figure 1). Within each level of coaching, we made decisions to change a criterion (i.e., move to the next phase) to provide support for incremental performance changes, based on Elaine meeting a specific OTR criterion (i.e., implementation fidelity and OTR rate) for three out of four consecutive sessions. The first author delivered all coaching sessions in person during Elaine's instructional planning sessions or after school.

Individualized Coaching. Individualized coaching was designed using a gradual release model where the instructional coach first modeled a lesson in Elaine's class demonstrating proper implementation fidelity (i.e., delivery of essential components) and high rates of OTR. Following this session, the instructional coach engaged Elaine in one 30-minute debriefing session to discuss the modeled session, highlight examples of high-quality OTR, and co-plan the subsequent session. In the subsequent session, the instructional coach and Elaine co-taught the lesson where the coach began modeling the delivery of instruction during the teacher-directed instruction portion of the lesson that included high rates of OTR and Elaine took over and completed the session. Specifically, the instructional coach began the lesson by modeling the use of choral responding and response cards when engaging students in a review of key vocabulary, introducing new terms, and leading students through a picture walk of the text. After this introductory activity, Elaine used a variety of OTR types to engage students during a read-aloud activity. During the sessions that

followed, Elaine then independently delivered OTR focusing on previously identified target areas. The instructional coach provided a 10-15 minute consultation meeting at the end of Elaine's independent teaching using BST (Ward-Horner & Sturmey, 2012) to provide Elaine with (a) a confirmation of the number of OTR (total and type) provided and whether the current goal was met, (b) a graphic display of her implementation fidelity and delivery rate of OTR, (c) specific performance feedback (both positive and corrective) on overall implementation fidelity and rate, (d) an instructional opportunity where the coach gave a description of the focus skill and modeled how it could be implemented with fidelity, (e) a review of an upcoming lesson and intentionally planning OTR to be included during teacher-directed instruction, and (f) support in setting a realistic goal based on teacher performance data.

Targeted Coaching. Similar to the individualized coaching sessions, targeted coaching used BST principles, including instruction, modeling, rehearsal, and feedback; however, the frequency and intensity of support were reduced based on Elaine's progress. Targeted coaching supports included one 15–20 minute consultation coaching session using BST where the instructional coach and the teacher (a) identified the number of OTR (total and type) provided and noted if the current goal was met; (b) examined a graphic display of Elaine's implementation fidelity and delivery rate of OTR; (c) discussed a focus for the coaching session while providing performance feedback (both positive and corrective); (d) identified and described the targeted skill and modeled how it could be implemented with fidelity; (e) rehearsed identified skills while the coach provided behavior specific praise for correct demonstrations or corrective feedback when needed; (f) reviewed an upcoming lesson and intentionally planned OTR to be included during teacher-directed instruction; and (g) together used previous data to set a realistic goal based on Elaine's performance data.

Data Sources

To answer the research questions and to ensure the internal validity of the study, we used observations of Elaine's instructional delivery, observations of the coach's behavior, and a consumer satisfaction survey for Elaine as data sources. Data from the observations of Elaine's instructional deliveries allowed us to answer research questions 1 and 2, whereas data from the consumer satisfaction survey allowed us to answer research question 3. Data collected to answer research question 1 were quantitative in nature (i.e., frequency/percentage and rate), and data collected to answer research questions 2 and 3 were descriptive in nature. Observational data of Elaine's instructional deliveries and the coach's behavior also served as data sources for interobserver agreement and procedural fidelity.

Variable Construction and Data Collection

Dependent Variables. There were two primary dependent variables. Measures of these two dependent variables allowed us to answer research question 1. The first primary dependent variable was Elaine's implementation fidelity of OTR during teacher-directed instruction, defined as the percentage of steps/components implemented correctly when delivering OTR. We targeted the OTR implementation fidelity as the primary dependent variable because delivering each OTR with essential components ensures the quality of OTR to produce optimal student outcomes, and measuring implementation fidelity is crucial (Kretlow et al., 2012). The second primary dependent variable was Elaine's delivery rate of OTR, measured as the number of OTR per minute. When measuring Elaine's OTR rate, we also differentiated the overall OTR delivery rate from the OTR

delivery rate with all five essential components to highlight the essence of high level of implementation fidelity, a component that has been omitted in prior studies.

To capture the OTR delivery data, Elaine video recorded the first 10-minutes of her literacy block three times a week, which included teacher-directed instruction, using a school-issued iPad® and uploaded the videos to a password-protected Google Drive™. To measure Elaine's implementation fidelity, we reviewed her video recordings and completed a fidelity data collection form (Figure 2). The form consisted of ten 1-minute intervals, accompanied by space to record the type of OTR delivered (i.e., verbal, gestural, written, technology) and presence of the required OTR delivery components (i.e., *input* [providing a clear explanation of the content], *prompt* [clearly signaling how students will respond], *question/statement* [presenting a question or a statement for students to respond or repeat], *monitoring* [determining the accuracy of students' responses], and *feedback* [providing behavior specific praise or corrective feedback]) for each OTR. Although previous literature has emphasized the importance of eliciting frequent responses that require students' active participation, noting the importance of critical features such as monitoring and feedback (e.g., Archer & Hughes, 2011), we identified these five critical components based on research-supported components of effective instruction (Hattie, 2012). In addition to marking the presence of each OTR delivery component, we also recorded whether Elaine used two or more types of OTR in a session, as an additional essential component for implementation fidelity. Relying on one single type of OTR will likely create boredom for students and limit students' responses that may promote varying levels of learning (Johnson et al., in press). We counted an OTR if Elaine presented an opportunity for students to respond in a group format using verbal, gestural, written, or technology responding. Additionally, an opportunity to respond requested from a specific student (e.g., "Hannah, what is the answer to this question?") was not counted as an OTR. We focused on group OTR (i.e., all students respond to teacher prompts simultaneously) because such OTR likely result in greater student outcomes than individual OTR that involve one student responding at a time (Haydon et al., 2012). Table 1 presents the definitions and examples of different OTR types and the five essential OTR components.

To calculate the percent of implementation fidelity, we first added the total number of components implemented by Elaine (i.e., # of input + # of prompt + # of question/statement + # of monitoring + # of feedback + 1 if using two or more OTR types [or 0 if using fewer than two types]). We then divided that sum by the total number of required components based on her OTR delivery (i.e., 5 x the number of OTR delivered + 1 for using two or more types of OTR) and multiplied by 100. The formula was as below:

$$\text{Implementation Fidelity (\%)} = \left(\frac{\text{Number of Essential Components Completed}}{(5 \times \text{Number of OTR Delivered}) + 1 \text{ (if using two or more OTR types)}} \right) \times 100$$

For Elaine's OTR delivery rate, we calculated two rates: (a) overall OTR delivery rate, and (b) OTR delivery rate with all five essential components. To calculate the overall OTR delivery rate per minute, we divided the total number of OTR Elaine presented by the number of minutes of observed instruction (e.g., 10 minutes) regardless of whether Elaine completed all essential components of OTR delivery. To calculate the OTR delivery rate with all five essential components (i.e., *input*, *prompt*, *question/statement*, *monitoring*, and *feedback*), we divided the total number of OTR Elaine delivered that included all essential components by the number of minutes of observed instruction. The OTR rate with all components represented the delivery of high quality OTR.

To answer research question 2, we further analyzed Elaine's OTR delivery based on the data collected above to identify the percent of implementation for each of the five essential OTR components. This allowed us to determine essential component(s) that were challenging for Elaine to deliver (i.e., omitted during implementation).

Consumer Satisfaction. To answer research question 3 regarding the teacher's perceptions about the data-driven coaching model, Elaine was asked to complete a 10-item researcher-developed survey that was designed to assess her perceptions of both the use of high rates of OTR during instruction to increase student engagement and the data-driven coaching model. Specifically, at the conclusion of the study Elaine was asked to rate her agreement with the degree to which (a) high rates of OTR delivered during teacher-directed instruction increased student academic engagement and achievement, (b) she was able to deliver varied OTR at a high rate, (c) delivering high rates of OTR was worth the effort required, (d) the data-driven coaching model was beneficial, helpful, and meaningful, and (e) she would recommend OTR and the coaching model to other teachers, using a 5-point Likert scale (i.e., 1 = strongly disagree; 5 = strongly agree). Elaine also had an opportunity to provide comments about the usefulness of the intervention and suggestions for future implementation. Consumer satisfaction survey is a typical subjective measure of social validity in single-case research; it is used to gather information from stakeholders regarding their perspectives on the social importance of goals, procedures, and outcomes of an intervention (Ledford & Gast, 2018). Despite its subjectivity and the potential insensitivity to the actual intervention effects, subjective measures such as consumer satisfaction surveys offer researchers a means to learn about the participants' perspectives regarding their likes and dislikes.

Interobserver Agreement. Two members of the research team served as independent observers when gathering interobserver agreement (IOA) data for Elaine's OTR implementation fidelity and delivery rates, and for the procedural fidelity data of the coaching sessions. The purpose of IOA data collection was to ensure reliability and validity of data collection (Ledford & Gast, 2018). Prior to collecting IOA data, members of the research team discussed the operational definitions of OTR and the essential OTR delivery components to establish consensus and practiced data collection using four video-recorded sessions until achieving 90% agreement. Observers collected IOA data on Elaine's implementation fidelity and delivery rates of OTR for 37.5% (6 out of 16 sessions) of all observational sessions across the experimental conditions (i.e., 2/5 baseline sessions, 1/3 post-PD sessions, 3/8 intervention sessions). Using the point-by-point method, we calculated IOA data by comparing each OTR occurrence and dividing the number of agreements by the total number of agreements plus disagreements and multiplying that ratio by 100. The overall IOA for Elaine's implementation fidelity was 96.5% (range 96.2%–100%), with 98.5% (range 97.1%–100%) in baseline, 97.7% during post-PD, and 97.1% (range 96.2%–98.1%) during intervention. The overall IOA for Elaine's OTR delivery rates was 95.1% (range 81.8%–100%), with 100% in baseline, 82.0% during post-PD (no range), and 96.0% (range 89.0%–100%) during intervention. In addition, we obtained IOA for the procedural fidelity of the coaching sessions from one of the two sessions and the IOA was 93.3% with 14 out of 15 steps completed correctly.

Procedural Fidelity. To determine the extent to which procedures of the experimental conditions were implemented as intended, we measured the procedural fidelity. To monitor the instructional coach's implementation of the grade-level PD session on OTR, a member of the research team video-recorded the session and collected fidelity data using an 11-step Professional Development Fidelity Checklist. Procedural fidelity of the video-recorded coaching sessions was

also assessed using either the eight-step Targeted or eight-step Individualized Coaching Fidelity Checklist. The observer marked either "yes" or "no" on the form to indicate the completion of required procedural steps. The percent of procedural fidelity was determined by adding up the number of correctly delivered procedural steps on a checklist and dividing that number by the number of applicable steps and multiplying the quotient by 100. The procedural fidelity was 100% for the grade-level PD and 93.3% for the coaching sessions.

Research Design and Procedures

We used a single-case, changing criterion design (Cooper et al., 2019; Ledford & Gast, 2018) to assess Elaine's instructional behavior changes with data-driven coaching support. Different from a case study, single-case research methodology is a quantitative, experimental research approach in which participants serve as their own control and it involves repeated measures and manipulation of an independent variable to allow researchers to compare behavioral changes between the control and intervention conditions (Ledford & Gast, 2018). Majority of prior studies examining the effects of coaching on teachers' use of OTR (e.g., Johnson, 2021; MacSuga-Gage, 2013) also have used a single-case research design. Within the single-case designs, we selected the changing criterion design because it offers the use of a stepwise criterion for increasing or decreasing a dimension of a single behavior that is already present in the individual's skill set (Cooper et al., 2019). This design is most often used with behaviors where an immediate change may be difficult or unwanted; therefore, gradual movement towards the desired goal is applied (Ledford & Gast, 2018). In this study, each of the two criteria aimed to shape Elaine's instructional behavior to gradually increase the average number of OTR per minute delivered in a 10-minute interval of direct instruction and to improve the adoption of essential components of high-quality OTR implementation. The decision rule as a-priori to change a criterion (i.e., move to the next phase) was based on Elaine meeting current OTR criterion (i.e., implementation fidelity and OTR rate) for three out of four consecutive sessions. However, the specific criterion for each criterion phase was based on Elaine's performance during the previous phase, with a slight increase in both OTR implementation fidelity and OTR rate. We used the changing criterion design to answer research question 1.

Baseline. The baseline condition represented a "business as usual" assessment of Elaine's implementation fidelity of OTR prior to receiving grade-level PD training. During baseline, Elaine (a) provided an overview of goals and objectives for the instructional session, (b) presented students with their materials, and (c) delivered explicit instruction on daily essential standards and learning targets as outlined by the school's universal literacy curriculum, *Benchmark Advance* (Benchmark Education, 2022). *Benchmark Advance* is a comprehensive, semi-scripted literacy curriculum that is aligned to the Science of Reading. Each unit in the curriculum includes a knowledge strand with an essential question that guides instruction. Daily components of a unit include phonics instruction and word study, close reading, vocabulary, grammar, and writing lessons. Although this curriculum provides some structure and includes occasional prompts for OTR, it does not offer explicit guidance on the frequency or quality of OTR implementation. Based on her prior experience, Elaine embedded some forms of OTR such as choral responding, response cards, and written responses.

Grade-Level PD for Teachers. Both third grade teachers from the school, including Elaine, participated in a 30-minute in-person grade-level training session provided by the first author (i.e., instructional coach). This is because same grade level teachers often planned together. The primary goal of this PD was to provide initial training to teachers on delivering high rates and high quality

of OTR during teacher-directed instruction. During this session, the instructional coach (a) introduced background research on the use of OTR and its benefits to increase student engagement, (b) provided a definition and examples of each of the four types of OTR, (c) outlined the essential components of high-quality OTR delivery, (d) engaged teachers in providing examples of various types of OTR commonly used in their own practice, (e) presented opportunities for teachers to discuss how OTR could be incorporated into daily instruction, (f) offered chances for teachers to provide feedback on the PD session, and (g) encouraged teachers' use of OTR following the training session. During the training, teachers had electronic access to all presentation materials (e.g., PowerPoint, video examples, guided notes).

Post-PD. Following the grade-level PD, Elaine had one week to apply content learned during the training and intentionally deliver increased rates of OTR during teacher-directed instruction within her literacy block. Instructional sessions during post-PD followed the same procedures as those in the baseline condition. Data collection during post-PD aimed to provide an assessment on the effects of a traditional one-time PD workshop (Putnam & Borko, 2000) to separate its effects from the data-driven coaching support. We reviewed Elaine's video recordings to observe and record her level of implementation fidelity, overall delivery rate of OTR, and delivery rate of OTR with all essential components. According to predetermined data-decision rules, Elaine's baseline data indicated levels below that of mastery criterion (i.e., 90% of implementation fidelity and an overall rate of three or more OTR per minute across three consecutive sessions), confirming her eligibility to participate in the intervention condition (i.e., data-driven coaching). We set the goal of three OTR per minute based on recommendations from prior studies (MacSuga-Gage & Simonsen, 2015) for Elaine.

Data-driven Coaching. Following the post-PD, Elaine received coaching support based on the data-driven coaching model (Figure 1). Based on Elaine's post-PD data (i.e., implementation fidelity below 90%, OTR rate below 1.5), she initially received the individualized coaching support with a mastery criterion of 80% implementation fidelity and an overall OTR rate of 1.5 with at least 0.7 OTR per minute with all essential components present (i.e., coaching criterion 1). During the second phase of coaching, Elaine received the targeted coaching support with a mastery criterion of 85% implementation fidelity with an overall OTR rate of 2.0 and at least 1.5 OTR per minute with all essential components present (i.e., coaching criterion 2).

Data Analysis

As the cornerstone of the data analysis method for single-case research (Ledford & Gast, 2018), we conducted a visual analysis of Elaine's graphed data of OTR implementation fidelity and OTR rates to determine if her repeated behavioral changes coincided with presentation of the different conditions. Through the visual analysis, we examined the data level, trend, stability/variability, and consistency of behavioral changes based on criterion introduction. We also used simple descriptive analyses of reporting means and ranges to analyze Elaine's use of OTR essential components across the conditions, IOA data, consumer satisfaction survey results, and procedural fidelity data.

Results

Research Question 1: What were the effects of a data-driven coaching model on improving the teacher participant's implementation fidelity and delivery rate of OTR delivery?

Figure 3 displays Elaine's implementation fidelity data across the experimental conditions, whereas Figure 4 displays Elaine's OTR rates across the conditions. Elaine demonstrated a moderate level of OTR implementation fidelity (mean = 69.79%; range = 62.74%–80.95%) and a low to moderate level of overall OTR delivery rate (mean = 0.8; range 0.3–1.4) during the baseline condition, but her high-quality OTR delivery rate remained as 0. Upon receiving the PD, Elaine improved her OTR implementation fidelity (mean = 79.77%; range = 78.57%–81.96%), overall OTR delivery rate (mean = 1.2; range = 1.1–1.3), and high-quality OTR delivery rate (mean = 0.3; range = 0.1–0.5) with a high level of stability and consistency in data patterns; however, her performance continued to remain below the predetermined criteria (i.e., 90% implementation fidelity and an overall rate of three OTR per minute). After two criterion changes of data-driven coaching support that integrated BST, Elaine consistently improved her performance in all three areas, with an overall mean of 93.77% (range 91.83%–98.90%) implementation fidelity, 2.5 (range 1.8–3.9) OTR delivery rate, and 1.73 (range 1.4–2.4) high-quality OTR delivery rate per minute. Elaine consistently exceeded the mastery criterion for implementation fidelity during both criterion phases; but her delivery rates were less consistent, particularly during the coaching criterion 2 phase.

Research Question 2: What essential components of OTR were challenging for the teacher participant?

Table 2 shows the mean percentages of Elaine's implementation fidelity by each of the five essential components when delivering an OTR. Across conditions, Elaine consistently delivered the components of *input*, *question/statement*, and *two or more OTR types* with 100% accuracy. Her delivery of the component of *prompt* substantially improved post-PD, whereas her delivery of the *monitoring* and *feedback* components more markedly increased after she received the data-driven coaching support. The component of *monitoring* was most challenging for her with a mean of 72.6% accuracy at the end of the coaching sessions.

Research Question 3: What were the teacher's perceptions about the data-driven coaching model?

Elaine expressed strong agreement across all items (ratings of 5) that implementing higher rates of OTR resulted in increased student participation and academic performance, that delivering high rates of OTR was feasible and worth the effort, and the data-driven coaching model was beneficial and effective in supporting her instructional behavior. Elaine commented, "the opportunities to respond [OTR] study and PD opened my eyes to the importance of every student responding a certain amount of times during a lesson" and "I saw a[n] increase in my students' engagement and test scores as soon as I implemented the OTR practices in my classroom." Elaine also commented the coaching support helped her "foster a sense of ownership and accountability in my [her] implementation of OTR."

Discussion

This study had several limitations that require caution when interpreting the results. First, we adopted a single-case, experimental changing criterion design, which allowed us to tailor support according to Elaine's needs and foster a sense of control and meaning for her. However, the limited changes in criteria and/or varying magnitudes of changes used to measure success in this study prevented us from fully establishing an experimental control. As a result, the study findings should be viewed as preliminary and descriptive in nature. Similarly, because this study commenced later

in the school year, the limited timeframe restricted the depth of observable changes in Elaine's OTR instructional behavior, which contributed to the lack of her meeting the ultimate mastery criterion of three OTR per minute with 90% implementation fidelity consecutively. Second, the study involved only one teacher in a small-size class with the coach being a member of the research team. This limited the scope and ability to generalize the findings across different teachers and diverse settings (e.g., grade levels, content areas, sizes of class, types of school), as well as coaches (e.g., school-based instructional coaches). Third, the lack of anonymity due to having only one teacher participant may have influenced the consumer satisfaction survey data, as Elaine was aware that her responses would be known to the research team. This may have contributed to her perception and ratings, thus impacting the generalizability of the consumer satisfaction survey findings. Finally, we did not systematically collect data on key student outcomes such as engagement or achievement, which are critical for evaluating the effectiveness of high rates of OTR and the data-driven coaching model.

Results for Research Question 1

Results showed that Elaine demonstrated consistent improvement in her implementation fidelity of OTR after receiving two criterion changes of data-driven coaching support. Specifically, when receiving data-driven coaching support, Elaine's implementation fidelity of OTR (range 86.5–98.9%) exceeded any data point during baseline or post-PD. Similarly, her overall OTR delivery rates and OTR delivery rates of all essential components consistently exceeded any OTR rate during baseline and post-PD phases.

Our preliminary findings supported previous research (e.g., Loyalka et al., 2019; Popova et al., 2022; Wood et al., 2016) that has shown initial PD alone is insufficient to bring about marked changes in teacher behavior. Findings of the current study also align with prior research (Cavanaugh et al., 2013; Menzies et al., 2017; Randolph et al., 2019) demonstrating the effectiveness of coaching interventions in improving teachers' use of OTR. After Elaine received the data-driven coaching support across two different criterion levels, her OTR implementation fidelity and delivery rates increased, along with her demonstration of high-quality OTR that included all essential delivery components. Elaine's improvement in the overall OTR delivery rate from 0.8 per minute in baseline to 2.5 per minute during the final phase of the intervention offers practical significance. Even though Elaine has not consistently achieved the suggested rate of three OTR per minute (MacSuga-Gage & Simonsen, 2015), her improvement in the overall OTR rate at the end of the coaching phase has greatly surpassed the average rate of 0.823 OTR based on over 6,700 elementary school teachers (Scott et al., 2017). When applying the rate improvement to longer instructional periods (e.g., 30 minutes, 60 minutes) and across weeks, months, and the instructional days in a school year, increased rates of OTR may be translated into a much substantial increase in opportunities for student to respond and their active student engagement (see Table 3).

In comparison to prior studies that also involved PD and coaching to support teachers' use of OTR, similarities and differences exist. First, similar to Randolph et al. (2019) who found that iCoaching led to increased frequency and quality of OTR in classrooms, our study also demonstrated that continuous data-driven coaching enhanced Elaine's fidelity of OTR implementation. Whereas Randolph et al. focused on the use of iCoaching (a virtual coaching model), our study involved in-person coaching. Second, similar to Cavanaugh et al. (2013) who demonstrated the effectiveness of performance feedback in coaching models to improve OTR use, the coaching model we adopted included the use of BST to provide instruction, modeling,

rehearsal, and feedback to support Elaine's OTR implementation. Whereas Cavanaugh et al. primarily examined teacher efficacy as an outcome, our study placed greater emphasis on the specific measurable outcomes of OTR implementation fidelity and OTR delivery rate, with additional focus on high-quality OTR delivery. Our study also extends the findings from Johnson (2021) and MacSuga-Gage (2013) regarding the benefits of multilevel PD and coaching support. Finally, Menzies et al. (2017) highlighted the importance of structured coaching to increase student engagement through OTR; however, unlike Menzies et al., our study incorporated a data-driven coaching model that provided more individualized feedback based on ongoing performance data.

In light of limited criterion changes, future research addressing coaching of teachers in OTR implementation may examine multiple criterion changes within the coaching phase in a single-case, changing criterion design to strengthen the internal validity, or use other designs such as a multiple baseline across participants design. Additionally, future research should involve multiple teachers across different content areas, grade levels, and diverse classes to broaden the applicability of the results, and to include school personnel as coaches to increase sustainability of teachers' use of instructional practices for capacity building. With the potential adaptability of the same coaching model to support teachers' use of other instructional practices, researchers may extend the current study to include a similar data-driven coaching model to support teachers' implementation of other evidence-based instructional practices for promoting student engagement.

Results for Research Question 2

A review of Elaine's OTR implementation fidelity related to the five essential components showed that the components of *prompt* (58.3%), *monitoring* (26.4%), and *feedback* (59.3%) were most challenging during the baseline condition. The component of *prompt* improved to 97.2% post-PD and the component of *feedback* improved to 91.7% during the coaching criterion 1 phase; however, the component of *monitoring* continued to remain as most challenging despite that she improved the fidelity of this component to 72.6% by the end of coaching criterion 2 phase.

One aspect of potential contributions of this study is the inclusion of measuring the essential components of OTR, a dimension that has been largely overlooked in previous research. Historically, the focus of OTR research has been on the frequency or rate rather than on implementation fidelity of the essential components of OTR (Fitzgerald Leahy et al., 2019). Although increasing the OTR rates is undoubtedly important and there is a clear relationship between high rates of OTR and student engagement (Common et al., 2020; Haydon et al., 2013; MacSuga-Gage & Gage, 2015), exploring the quality of OTR delivery offers a critical perspective to understanding how the quality of OTR, as opposed to the quantity, can substantially influence the effectiveness of teachers' delivery of this instructional practice, classroom interactions, and student engagement. In this study, we documented Elaine's inclusion of the five essential delivery components of OTR. Without PD and coaching support, Elaine consistently provided input on academic content, presented a clear question/statement, and delivered at least two OTR types. However, she had the most difficulties with the components of monitoring and feedback. Omission of clear monitoring (e.g., "I see a majority of the class responded correctly…") could lead to students wondering how well they did, whereas omission of feedback such as behavior specific praise (e.g., "You all are correct! The answer is B, fiction) or corrective feedback (e.g., "I am noticing there are a variety of answers. To confirm, the correct answer is A, Nonfiction.") could inadvertently result in students mistaking their incorrect response as the correct answer. The clear presentation of feedback also allowed Elaine to provide additional OTR (e.g., "Let's try again. Everyone, say "Nonfiction.") in a brisk pace to ensure further learning of content for students.

Future research is warranted to further measure essential components of OTR as an important variable.

Results for Research Question 3

Elaine's perceptions reflected in the consumer satisfaction survey data supported that her improved OTR delivery rates had a positive effect on students' academic engagement and achievement, and the data-driven coaching support was beneficial in fostering her ownership and accountability in the OTR implementation. These results lend support to the importance of data-driven coaching in the classroom. Even though the broader concept of using data for decision making is well established (Bowers, 2010; Datnow & Hubbard, 2015; Sanetti & Collier-Meek, 2015; Schildkamp, 2019), there is limited research on how data can be specifically used to improve targeted coaching foci. This study preliminarily bridges the gap by showing how providing detailed, data-driven feedback might have helped Elaine deliver more focused and effective instruction using increased rates of OTR. Additionally, the data-driven coaching model in this study might possibly offer a fluid and efficient way to identify the teacher's need for additional coaching supports (i.e., data-based decision rules), select target areas of improvement (e.g., monitoring and feedback), and determine her responsiveness to various levels of coaching support (i.e., individualized and targeted).

The data-driven coaching model we used in the study to support Elaine consisted of several essential components, including BST (emphasizing the development of specific skills through modeling, practice, feedback, and reinforcement), intentional planning, and the use of a gradual release model (referring to the teacher initially receiving substantial support that gradually decreased as she become more proficient). By combining BST with the gradual release model, Elaine was able to observe a model, rehearse targeted skills with specific feedback, set a goal, co-teach a lesson with the instructional coach's support, and then independently deliver a lesson with follow-up feedback. Moreover, intentional planning of implementing OTR in lessons might have allowed Elaine to be thoughtful in how and where she could integrate OTR to reach targeted rates and ensure the inclusion of all essential components. Involving Elaine in the decision-making and goal-setting process also might have supported her positive behavior change. When teachers are part of the decision-making and goal-setting process, they are more likely to be invested in the outcomes and more committed to implementing the strategies and techniques they have learned with fidelity. In this study, Elaine specifically commented on how the coaching support helped her "foster a sense of ownership and accountability." Using these support strategies in tandem possibly allowed Elaine not only to acquire the necessary skills, but also develop the confidence and autonomy needed for long-term success in implementing effective OTR. Future studies may continue to explore the perceptions of teachers regarding data-driven coaching models through a qualitative approach to provide in-depth descriptions of what components of the data-driven coaching model are most or least effective.

Conclusions and Implications

In the field of education, PD and effective coaching plays a crucial role in enhancing teachers' skills and competencies. This study is significant in that it measured the implementation fidelity of a teacher's OTR delivery with an emphasis on exploring the presence or absence of essential components to produce high-quality OTR. For Elaine, the coaching support centered on improving her OTR delivery components of *monitoring* and *feedback* to increase her high-quality OTRs. The measurement of the essential components of OTR allowed us to pinpoint Elaine's specific needs

during coaching, which resulted in her improvement in these two components. However, Elaine continued to have difficulties with the *monitoring* components, which suggested that continuous support is needed. Such a personalized coaching model offers implications for practitioners in schools to measure implementation fidelity and use specific teacher data to support teachers using precise tools and strategies they need at different stages of their professional development.

Disclosure and Data Availability Statements

The authors report there are no competing interests to declare. Additionally, authors confirm the data supporting the findings of this study are available within the article and its supplementary materials, which are available from the corresponding author upon reasonable request.

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Tables 1, 2 and 3

Table 1

Definitions and Examples of OTR Types and Essential Components

	Essential Components				
OTR Type	**Input** *Definition*: providing a clear context of the content	**Prompt** *Definition*: signaling how students will respond with a clear indication of the response form	**Question/Statement** *Definition*: presenting a question or a statement for students to respond or to repeat	**Monitor** *Definition*: determining the accuracy of students' responses by explicitly verbalizing the act of monitoring	**Feedback** *Definition*: providing affirmation for correct response or correct feedback
Verbal *Definition*: requesting students to respond vocally in choral responding or turn-and-talk	We have been discussing the main character's point of view of our book.	When I give you the signal, I want everyone to turn to someone close to you and share verbally how to determine a character's point of view.	How do you determine a character's point of view? (*Wait time is provided, signal is given, students turn and share.)*	Thank you everyone for sharing with a neighbor. While you were talking, I was listening and I wrote some words on the board.	Great responses. We look at pictures and look for their feelings and dialogs to determine a character's point of view.
Gesture *Definition*: requesting students to respond using some forms of gesture or body parts such as thumb up/down, standing up/sitting down, holding up a yes/no card	One way to determine the character's point of view is to look at the picture.	Look at page 4 of our book and point to the picture.	Everyone, make the same facial expression of the picture on page 4. (*Wait time is provided, signal is given, students mimic the same facial expression.)*	Great! Most of you show a "surprise" look on your face.	The picture of this main character shows that she was surprised, and a "surprise" face looks like this (teacher models).
Written *Definition*: requesting students to produce a written response on a notebook/paper, on a write-on response card, or on a board	Another way we can determine a character's point of view is to look for their feelings and dialogs in the story.	In a moment, I am going to ask you to go back to the first page of the book and find some words or text that also tell us what the main character's point of view is. I want you to put a little star or a mark next to words.	Go ahead and read the first page of the book and mark next to the words that show the character's point of view. *(Wait time is provided, signal is given, students mark on their book*.)	Wow! I appreciate your work and see we all have marked some words on the first page of the book.	Many of you marked the words that start with "Valerie felt …" Yes, Valeri is the main character and "Valerie felt …" shows her feelings, which is her point of view.
Technology *Definition*: requesting students to respond using some form of computer-based technology such as PollEverywhere, Kahoot, PearDeck	Let's do more practice about identifying the story character's point of view.	Please go to Kahoot and you will respond to some questions about the character's point of view using your ChromeBook.	Here is the first question in Kahoot. Select the sentence that indicates the character's point of view. *(Wait time is provided, signal is given, students respond in Kahoot*.)	Fantastic job! Everyone got it correctly.	Response A is the correct answer because it shows the character's feelings, which also indicates the character's point of view.

Table 2

Elaine's Mean Percentages of Implementation Fidelity by Essential Components

Condition	Input	Prompt	Question/ Statement	Monitoring	Feedback	2+ OTR Types	Fidelity
Baseline	100%	58.3%	100%	26.4%	59.3%	100%	58.5%
Post-PD	100%	97.2%	100%	30.1%	69.7%	100%	79.7%
Coaching Criterion 1	100%	98.2%	100%	61.5%	91.7%	100%	90.3%
Coaching Criterion 2	100%	100%	100%	72.6%	95.8%	100%	93.7%

Table 3

Impact of OTR Rate Increase on Whole-Class Student Engagement Opportunities

Instructional Time	OTR at Baseline (0.8 OTR/minute)	OTR in Final Phase (2.5 OTR/minute)	Difference (Increase in OTR)
10 minute per class of 10 students	8 OTR (80 student responses)	25 OTR (250 student responses)	+17 OTR (+170 student responses)
30 minute per class of 10 students	24 OTR (240 student responses)	75 OTR (750 student responses)	+51 OTR (+510 student responses)
60 minute per class of 10 students	48 OTR (480 student responses)	150 OTR (1,500 student responses)	+102 OTR (+1,020 student responses)
180 instructional days (5 hr per day) per class of 10 students	432,000 OTR (4,320,000 student responses)	1,350,000 OTR (13,500,000 student responses	+918,000 OTR (91,800,000 student responses)

Figure 1

Data-driven Decision-Making Process

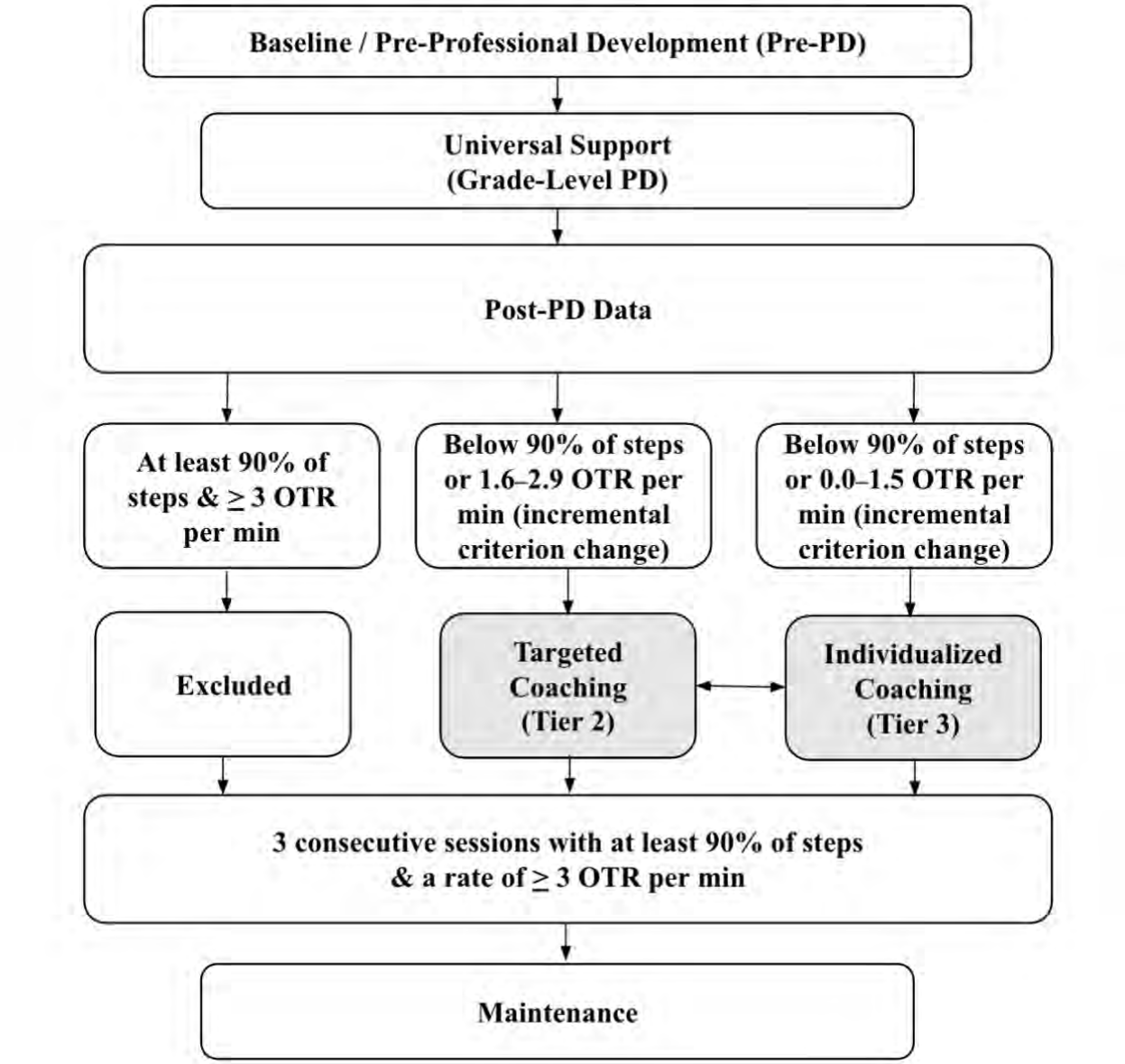

Figure 2

Sample OTR Observation Form

Teacher's Implementation of OTR Observation Form

Date: 10.2.23 Teacher: _____ Observation Period: 00:00–10:00 (Intervention)

Content: Literacy instruction

Interval	**Teacher behavior** Types of OTR used: V = verbal G= gesture W= written T= technology 5 OTR delivery skills: I = Input (on topic) P = Prompt (explain how they want students to respond) Q/S = Question/Statement (for students to respond) M= Monitor F = Feedback (statement indicates correct response beyond "good" or "yes")					
0'01"-1'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
1'01"-2'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
2'01"-3'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
3'01"-4'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
4'01"-5'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
5'01"-6'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
6'01"-7'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
7'01"-8'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
8'01"-9'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
9'01"-10'00"	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F	V G W T I P Q/S M F
OTR Rate	Total # of OTR 22 / # of min 10 = 2.2 OTR per min					
Total # of Essential Components	**I=22 P = 22 Q/S =22 M=17 F=16 2+ OTR types= 0 1**					
% of Fidelity = 100 (#s of essential components) / 111 (5 x # of OTRs + 1) x 100 = 90.1 %						

Figure 3

Elaine's Percentage of Implementation Fidelity of OTR Delivery (Upper Panel) and OTR Rate (Lower Panel)