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# Building From the Bottom Up: The Importance of Tier 1 Supports in the Context of Tier 2 Interventions

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## Abstract

School-Wide Positive Behavior Interventions and Supports (SWPBIS) relies on effective implementation of Tier 1 practices to ensure accurate identification of students in need of more intensive supports at Tier 2 or Tier 3. While measures of school-level fidelity are widely used, measures of classroom-level implementation of Tier 1 supports are less common. If classroom levels of Tier 1 supports are variable, schools may identify students for Tier 2 supports when, instead, teachers need support implementing Tier 1 in classrooms. The purpose of this case study was to assess the impact of a self-monitoring intervention, Monitoring Behavior on the Go (MoBeGo), on the academic engagement and disruptive behavior of a middle school student. Initially, the impact of the self-monitoring intervention was inadequate. In the context of evaluating the impact of a Tier 2 intervention, we identified an opportunity to assess whether a class-wide Tier 1 program, Class-Wide Function-Related Intervention Teams (CW-FIT), enhanced the effectiveness of the Tier 2 intervention. Using an A-B-BC-B-BC design, we compared the effectiveness of a Tier 2 intervention alone with a combined Tier 1 + Tier 2 intervention. When the class-wide Tier 1 program was layered on top of the Tier 2 intervention, the student's academic engagement showed an increase in level and stability.

## Keywords

classroom, intervention(s) for children with or at risk for EBD, self-management, positive behavior support(s)

Over the past 20 years, schools have increasingly adopted School-Wide Positive Behavior Interventions and Supports (SWPBIS) to more effectively meet students' behavioral needs. SWPBIS places behavioral supports into three or more distinct tiers based on the intensity of support students require, uses data to inform decisions about increasing student supports, and assists school personnel in more effectively meeting students' behavioral needs (Maggin et al., 2015; Sugai & Horner, 2009). In this way, SWPBIS helps schools and teachers allocate additional resources to students with more intensive behavior needs (Horner & Sugai, 2015).

In SWPBIS, Tier 1 consists of the following six key components: (a) creating a statement of purpose; (b) establishing a set of school-wide expectations for student behavior; (c) creating a procedure for explicitly teaching those behavioral expectations; (d) creating and implementing a system for recognizing and reinforcing appropriate behavior, such as a school-wide incentive or reward system; (e) clearly defining and consistently implementing a set of consequences for inappropriate behavior; and (f) collecting student behavior data and monitoring progress toward school-wide behavior goals (Lewis & Sugai, 1999).

When students are non-responsive to Tier 1, school personnel provide additional supports and monitoring through Tier 2 interventions (Ervin et al., 2007; Maggin et al., 2015). Tier 2 interventions are targeted supports delivered to students in small groups, making them relatively efficient and feasible for schools to implement. Even so, by definition, Tier 2 interventions require an investment of school resources above and beyond what is required at the Tier 1 level. The identification of students for Tier 2 interventions rests on the assumption that Tier 1 supports are implemented with high levels of fidelity in school and classroom environments. If this is not the case, schools may over-identify students for Tier 2 interventions when teachers may instead need additional coaching on the implementation of Tier 1 practices in their classrooms.

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## Measures of Tier 1 Fidelity

At present, there are three widely used measures for assessing Tier 1 fidelity: the *Schoolwide Evaluation Tool* (SET; Horner et al., 2005), the *Tiered Fidelity Inventory* (TFI; Algozzine et al., 2014), and the *Benchmarks of Quality* (BoQ; Kincaid et al., 2010). These measures are conducted annually or quarterly and are intended to provide summative measures of school-wide Tier 1 supports. While these measures indicate the presence of Tier 1 supports at the school level, the results are not granular enough to determine whether individual teachers are implementing Tier 1 supports with fidelity (Mathews et al., 2014). For this reason, a team may reach school-wide fidelity on Tier 1, but the implementation of SWPBIS at the classroom level may be variable. When this happens, it may be the case that a large number of students are falsely identified as needing Tier 2 supports. In other words, these measures may not help schools accurately differentiate between students who need more intensive behavior interventions and teachers who need additional support on Tier 1 implementation.

## Classroom-Level Implementation of Tier 1 Supports

In a recent study, Childs et al. (2016) assessed the effect of implementation fidelity of SWPBIS on negative student discipline outcomes (i.e., office discipline referrals [ODRs], in-school suspensions, out-of-school suspensions). Researchers used the BoQ, as this measure includes a Classroom Systems subscale. Findings indicated lower scores on the Classroom Systems subscale of the BoQ were significantly associated with higher levels of negative discipline outcomes. Authors hypothesized student outcomes may not be significantly affected until SWPBIS practices are implemented with fidelity at the classroom level (Childs et al., 2016).

Another recent study (Mathews et al., 2014) investigated the degree to which measures of SWPBIS implementation fidelity predict sustained implementation fidelity and student outcomes. Findings indicated classroom-level measures of fidelity are stronger predictors of sustained implementation fidelity and student outcomes than school-wide measures of fidelity. In this study, classroom-level measures of fidelity were the only statistically significant predictor of these outcomes (Mathews et al., 2014).

## Tier 1 Supports in Tier 2 Research

The identification process for Tier 2 interventions rests on the assumption that Tier 1 supports are in place with adequate levels of fidelity. Unfortunately, in the Tier 2 intervention literature, only a small percentage of studies measure and report fidelity of Tier 1 supports. In a recent systematic review of the Check-in/Check-out literature (Majeika et al., 2020), only 33.9% of included studies reported Tier 1 fidelity at the school level. Even in studies that provided measures of Tier 1 fidelity, researchers generally used one of the instruments described above (e.g., SET or TFI) and reported an overall average level of fidelity at the school level, but failed to report classroom levels of fidelity. Without measures of Tier 1 supports at both the school and classroom levels in these studies, it is difficult to conclude whether students were actually in need of Tier 2 intervention or whether teachers needed additional coaching on the implementation of Tier 1 supports.

Research has identified several classroom management interventions that enhance the implementation of Tier 1 practices. One intervention that systematically increases teacher use of Tier 1 behavior supports is Class-Wide Function-Related Intervention Teams (CW-FIT). CW-FIT is a class-wide intervention that fits into the SWPBIS framework and incorporates several evidence-based classroom management practices (i.e., group contingency, behavior-specific praise, behavioral pre-corrections). This class-wide intervention includes four primary components: (a) teaching classroom rules and skills, (b) using an interdependent group contingency, (c) using differential reinforcement to distribute points for appropriate behaviors and minimize attention for inappropriate behaviors, and (d) providing reinforcement for all teams who meet the predetermined daily point goal (Kamps et al., 2011). These components systematically improve implementation of Tier 1 supports at the classroom level by providing students with explicit instruction on classroom rules aligned with school-wide behavioral expectations, increasing teachers' positive reinforcement of those expectations, and giving students access to reinforcement for engaging in those expectations.

Two efficacy trials and several single-case studies have assessed the impact of CW-FIT on teacher and student behaviors. These studies found CW-FIT was associated with increases in praise, decreases in reprimands, and increases in class-wide engagement (Kamps et al., 2011; Wills et al., 2016, 2018a). Other studies have found CW-FIT decreased disruptive behavior and increased academic engagement for students at risk for emotional and behavioral disorders (EBD; Caldarella et al., 2015; Conklin et al., 2016; Kamps et al., 2011; Wills et al., 2014, 2016, 2018b).

Research has also identified several Tier 2 interventions associated with improved student behavior outcomes. A commonly implemented Tier 2 behavior intervention is self-monitoring. Research has found self-monitoring is an effective behavioral intervention for students with or at risk for EBD. In a recent review of self-monitoring studies for students with persistent behavior problems, Bruhn et al. (2015a) found positive effects on student behavior across all 41 included studies. While many studies have assessed the impact of these Tier 1 and Tier 2 interventions

independently, few studies have systematically compared the combined effect of Tier 1 and Tier 2 interventions on student behavior.

## Purpose

The purpose of this case study was to assess the impact of a technology-based self-monitoring intervention with programmed data-based decision rules, MoBeGo, on the academic engagement and disruptive behavior of a middle school student identified as needing Tier 2 behavioral supports. Initially, the impact of MoBeGo on this student's level of academic engagement and disruptive behavior was inadequate. In the context of evaluating the impact of MoBeGo, we identified an opportunity to assess whether the presence of a class-wide Tier 1 program, CW-FIT, enhanced the effectiveness of the Tier 2 intervention.

## Method

### Participants and Setting

*Setting.* Participants in the study were recruited from an urban, public middle school in the Southeast, serving 782 students. In the school, 53.9% of students were Latinx, 20.9% were African American, 19.3% were Caucasian, and 5.6% were Asian. The school had been implementing SWPBIS for 5 years. The school received a score of 73% on the TFI (Algozzine et al., 2014) for Tier 1 implementation, indicating basic Tier 1 practices were in place at the school level. The school-wide expectations were Be Respectful, Be Responsible, and Be Ready. The school's SWPBIS leadership team monitored ODRs on a weekly basis. During monthly leadership meetings, all students who received three to five ODRs were included on a list of students in need of Tier 2 behavioral support.

*Participants.* After obtaining the institutional review board (IRB) approval, researchers met with the principal to secure interest in participating in a larger study evaluating the use of MoBeGo. The principal gave researchers permission to speak with the staff about the project. An eighth-grade science teacher, Ms. Adams, expressed interest in participating. Her classroom consisted of 22 students. Ten of these students qualified for special education services and eight were considered English language learners. Ms. Adams nominated one student, Logan, to participate in the study due to frequent off-task and disruptive behavior. Logan was a 13-year-old Caucasian male with a special education diagnosis of a speech and language impairment. Logan received 30 min of special education support from a Speech-Language Pathologist, three times per week, in a pullout setting. At the start of the study, Logan had received three ODRs and was subsequently flagged for receiving a Tier 2 support. As researchers spent additional time in the classroom, Ms. Adams requested additional information on class-wide supports. Researchers offered to train Ms. Adams on CW-FIT. She consented to the training and volunteered to participate in the current study.

### Procedures

*Baseline.* Baseline consisted of business-as-usual classroom instruction. Throughout the study, Ms. Adams's teaching generally consisted of large group instruction or independent work related to chemistry. After the first five sessions of baseline, researchers trained Ms. Adams on how to collect baseline data in the MoBeGo app on an iPad. The MoBeGo app is iPad based and maintains a record of student performance over time. Ms. Adams collected baseline data on Logan's behavior in MoBeGo for the last three sessions of the baseline phase. During these sessions, business-as-usual classroom instruction continued. Ms. Adams scored Logan's behavioral performance in the app every 5 min. Immediately after scoring Logan's behavior, Ms. Adams hit the done button in the app and returned to instruction. Ms. Adams did not provide Logan with any feedback on his performance or with an opportunity to self-monitor his behavior during this phase.

*MoBeGo training.* Prior to the first MoBeGo intervention phase, researchers trained Ms. Adams and Logan on the self-monitoring intervention. Teacher training consisted of an overview of the potential benefits of self-monitoring, instruction on how to enter data, and instruction on how to provide feedback on student performance based on data collected in the app. Student training consisted of a brief introduction to the MoBeGo app, examples and non-examples of the target behaviors selected by Ms. Adams, instruction on how to enter scores in the app, and instruction on how to review progress using the MoBeGo graphing system.

*MoBeGo.* Following student training, the full MoBeGo intervention was introduced. During this phase, academic instruction continued as usual. Logan now self-monitored his behavior every 5 min and Ms. Adams evaluated his behavior on the same schedule. When Ms. Adams completed her rating of Logan's behavior, the app prompted her to hand the iPad to Logan to self-assess his behavior. At the end of the chemistry block, Ms. Adams reviewed Logan's performance with him using graphed data in MoBeGo. After Ms. Adams collected 3 baseline data points, MoBeGo set an initial point goal based on her ratings of Logan's behavior during baseline. During intervention, the app iteratively adjusted Logan's behavioral goal over time based on Ms. Adams's ratings of Logan's behavior in the app. The teacher provided behavior-specific praise and gave

Logan an immediate reinforcer when he met his point goal. She provided brief, corrective feedback when he did not meet his point goal.

*MoBeGo + CW-FIT.* Before implementing CW-FIT, research staff provided Ms. Adams with both an overview of the intervention and practice-based professional development on how to implement the intervention during instruction. Research staff first provided a 60-min overview of the intervention. Research assistants with prior experience implementing CW-FIT then supported Ms. Adams with implementation of the intervention. During this time, researchers modeled behavioral skill lessons and supported the teacher's initial efforts to manage the game during instruction using coaching and feedback. The teacher selected three targeted skills, aligned with school-wide expectations (i.e., Be Responsible: Follow Directions the First Time; Be Ready: Stay in Your Seat; Be Respectful: Ignore Inappropriate Behavior). During the introduction of the game, researchers reviewed these skills with students, discussed how the CW-FIT expectation aligned with the school-wide rules, and discussed additional ways to engage in school rules (e.g., ways to be ready other than staying in your seat) in the classroom. This process was repeated for 3 days until all three rules were explicitly taught to the class. Research staff modeled targeted teacher skills such as behavior-specific praise and pre-corrections for several days following initial introduction of the intervention.

Throughout this phase of the intervention, posters illustrating targeted behaviors and the daily point chart were displayed at the front of the classroom, visible to all students. Ms. Adams reviewed these posters with the class at the start of the block as a pre-correction for expected behaviors. Ms. Adams then identified the point goal and announced the available reinforcer for all teams who met the goal. For the duration of the chemistry block, a digital timer went off every 3 to 5 min. When the timer sounded, the teacher awarded points and provided behavior-specific praise to groups where all students displayed target behaviors. If one or more students in a group did not display the target behaviors, the teacher provided brief corrective feedback. Throughout the chemistry block, the teacher tallied points earned by each team on the CW-FIT point chart. At the end of the block, the teacher totaled the points for each team and provided an immediate reinforcer to teams that met the daily point goal. During this phase, Logan's MoBeGo intervention remained in place. One research assistant provided support to Ms. Adams to maintain high levels of fidelity with both interventions.

*Withdrawal.* During withdrawal, researchers removed CW-FIT but kept MoBeGo in place. Instruction during this phase was similar to instruction that took place in prior phases. To ensure all components of the CW-FIT intervention were withdrawn, observers continued to collect implementation fidelity data on CW-FIT during these sessions using the fidelity measure described below.

*Return to intervention.* During this phase, CW-FIT was reintroduced and MoBeGo remained in place.

## Dependent Measures

*Target student behavior.* Observers used the *Multiple Option Observation System for Experimental Studies* (MOOSES; Tapp et al., 1995) to record target student behaviors. This observation system uses real-time recording and allows for simultaneous collection of discrete behaviors (e.g., frequency of disruptive behaviors) and continuous behaviors (e.g., duration of academic engagement). Observers conducted daily 15 min direct observations during Logan's chemistry block. The primary dependent variable used to make phase change decisions in this study was Logan's academic engagement. Academic engagement was defined as working on an assigned or approved activity or appropriately waiting for further instruction from the teacher. Logan's academic engagement was calculated by dividing the total number of seconds he was engaged by the total number of seconds in the observation and multiplying by 100. Frequency of Logan's disruptive behavior was a secondary target behavior in this study. Disruptive behaviors were defined as verbal or physical displays of inappropriate behavior that included verbal statements or physical motor movements.

*Class-wide behavior.* In addition to the target student observations, observers used a momentary time sampling procedure with 30-s intervals, beginning on Session 13, to estimate the engagement of the entire class. Before observations began, observers sketched a picture of the classroom, including natural groupings of students in the room (e.g., table groups). Each group generally consisted of three to six students. Every 30 s, observers rotated through all groups of students. If all students in a group were on task, observers recorded a plus (i.e., engaged). If any student in a group was off task, observers recorded a minus (i.e., disengaged). To measure class-wide engagement, the same operational definition for academic engagement was employed but applied to all students in the class rather than just the target student. Average class-wide engagement was calculated by dividing the number of intervals students were engaged by the total number of intervals and multiplying by 100.

*Teacher behavior.* As a measure of Tier 1 practices, observers collected data on the frequency of teacher praise and reprimands. Teacher praise was defined as oral praise given by the lead teacher to the target student or to a group of students that included the target student. Teacher praise

**Table 1.** Average Inter-Observer Agreement Across Phases and Behaviors.

| Behavior | Baseline (%) | MoBeGo (%) | MBG + CW-FIT (%) | MoBeGo (%) | MBG + CW-FIT (%) |
|---|---|---|---|---|---|
| Target student | | | | | |
| Engagement | 94.4 | 82.5 | 91.0 | 82.3 | 96.6 |
| Disruptions | 95.7 | 86.3 | 91.6 | 86.1 | 87.5 |
| Overall | 97.1 | 89.1 | 91.3 | 82.9 | 97.8 |
| Class-wide | | | | | |
| Engagement | NA | 76.5 | 92.2 | 89.5 | 95.8 |
| Teacher | | | | | |
| Praise | 92.9 | 100 | 86.7 | NA | 100 |
| Reprimand | 100 | 100 | 100 | 100 | 100 |

*Note.* CW-FIT = Class-Wide Function-Related Intervention Teams; MBG = MoBeGo; NA = not applicable.

included verbal statements indicating approval of student behavior above and beyond adequacy or acknowledgment of a correct response. A reprimand was defined as a verbal statement intended to correct Logan's behavior as it occurred or after it had occurred. Reprimands included verbal comments such as scolding, negative statements indicating disapproval with the student's social behavior, or comments related to the student's inappropriate behavior. Observers coded reprimands when they were delivered by Ms. Adams to Logan or to a group of students that included Logan.

*Teacher rating data.* In addition to direct observation data, observers extracted teacher and student ratings of behavior from the MoBeGo app on a weekly basis. These data served as a secondary measure of student behavior. As noted below, Ms. Adams selected target behaviors for Logan to self-monitor in the MoBeGo app. She aligned Logan's target behaviors with the school-wide rules (i.e., "Be Respectful: Did I use appropriate language?"; "Be Responsible: Did I do my work?"; and "Be Ready: Did I stay in my seat?").

*Classroom management practices.* To assess the presence of general classroom management practices (i.e., Tier 1 supports), observers completed a nine-item *Classroom Management Rating Form* (CMRF; Downs et al., 2019). This rating scale is a modified version of the *Classroom Atmosphere Rating Scale* (Wehby et al., 1993) and has been used in previous efficacy trials of CW-FIT (Wills et al., 2016, 2018a, 2018b). Recent psychometric analyses of the CMRF found that the Cronbach's alpha was .96 for student classroom behavior and .83 for teacher classroom management practices (Downs et al., 2019).

*Observer training.* Observers included one PhD student in special education, one member of the research team who is a Board Certified Behavior Analyst with an MEd in special education, and two master's-level students studying special education. All observers were White females and had prior experience conducting direct observations with the systems in place for this study. Training consisted of three stages: (a) observers reviewed and memorized operational definitions of targeted behaviors, (b) observers independently practiced using MOOSES and the momentary time sampling procedures with videos and independently achieved 85% reliability with a master code for three consecutive sessions, and (c) observers reached 85% reliability with an expert coder during live observation sessions in classrooms. Observers were required to reach 85% reliability for two consecutive sessions in classrooms before conducting direct observations for the study.

*Observation procedures.* A single observer collected data in MOOSES on the following teacher and student behaviors simultaneously: target student engagement, target student disruptive behavior, teacher praise, and teacher reprimands. The same observer used the momentary time sample measure described above to collect data on class-wide engagement immediately following the 15-min MOOSES session. A secondary observer was occasionally present for reliability sessions.

## *Inter-Observer Agreement (IOA)*

Table 1 summarizes IOA data. IOA data on target student behaviors, teacher behaviors, and class-wide engagement were collected during 37.5% of baseline sessions, 50% of sessions during the MoBeGo-alone phase, 42.9% of sessions during the first MoBeGo + CW-FIT phase, 50% of sessions during withdrawal of CW-FIT (i.e., return to MoBeGo alone), and 50% of sessions during the re-introduction of CW-FIT (i.e., MoBeGo + CW-FIT). For data collected in MOOSES, IOA was calculated using a 5-s window of agreement around each frequency code (i.e., target student disruptive behaviors, teacher praise, teacher reprimand) in the primary coder's file. Agreements were scored when the secondary coder's file included frequency codes that matched the primary coder's file. IOA for frequency

codes was calculated using the following formula: agreements divided by agreements plus disagreements multiplied by 100. Mean IOA was 89.6% (range = 83.3%–100%) for disruptive behaviors, 94.3% (range = 60%–100%) for praise, and 97.6% (range = 85.7%–100%) for reprimands. For duration of academic engagement, second-by-second agreement was calculated using the following formula: agreements divided by agreements plus disagreements multiplied by 100. Mean IOA for academic engagement was 86.6% (range = 29.5%–99.%).

Observers used point-by-point agreement to calculate reliability scores for class-wide engagement using the following formula: total agreements divided by total agreements plus disagreements multiplied by 100. Mean IOA for class-wide engagement data was 90.6% (range = 76.5%–99.6%).

### Treatment Fidelity

*MoBeGo.* At the end of each MOOSES observation, observers completed a five-item procedural fidelity checklist to determine the use of the MoBeGo intervention components during sessions (i.e., iPad was present, pre-corrects on skills occurred at the beginning of the session, point goal shared with student, objective feedback provided at the end of the session, reinforcement provided if student met his goal). This information was supplemented by data collected from the MoBeGo app with information that researchers were not able to observe in vivo (i.e., teacher scored student on all expectations at the end of intervals, student scored self on all expectations at the end of intervals). MoBeGo fidelity data were collected across all phases of the study.

*CW-FIT.* An 11-item procedural fidelity checklist was used to determine the use of CW-FIT intervention components during sessions in which it was implemented and during withdrawal sessions. Items were scored as yes or no, and some items scored "yes" were given a quality rating (1–3) based on the degree to which they were implemented with fidelity. Observers began collecting CW-FIT fidelity data during the last two sessions of the first MoBeGo phase and collected these data across the remaining phases of the study.

### Social Validity

Researchers assessed teacher perceptions of both interventions through consumer satisfaction surveys. The classroom teacher completed a seven-item survey regarding her use of MoBeGo and a separate 11-item survey related to the use of CW-FIT. The surveys consisted of a combination of yes/no and open-ended questions addressing each of the following areas: feasibility, usefulness, effectiveness, and room for improvement. Logan was given an eight-item consumer satisfaction survey related to his use of MoBeGo over the course of the semester. The survey was read aloud to the student and involved a combination of yes/no and open-ended questions. It addressed each of the following areas: usefulness, effectiveness, and room for improvement.

### Design and Data Analysis

To assess the presence of a functional relation between Logan's academic engagement and the systematic introduction and withdrawal of the MoBeGo + CW-FIT treatment package, researchers employed an A-B-BC-B-BC multi-treatment design (Birnbauer et al., 1974). This multi-treatment design used the introduction, withdrawal, and re-introduction of two independent variables (i.e., CW-FIT and MoBeGo) to order conditions. Researchers employed visual analysis to determine whether a change in trend, level, or variability occurred when interventions were implemented and withdrawn.

## Results

### Target Student Outcomes

*Academic engagement.* Academic engagement data are displayed in Figure 1. The target student's baseline levels of academic engagement were low and showed a decreasing trend during baseline sessions. With the introduction of MoBeGo, his academic engagement showed an immediate change in level, but remained highly variable. When CW-FIT was introduced, the target student's academic engagement showed an immediate increase in level and improved stability. Once a stable pattern of responding was observed during this phase, CW-FIT was withdrawn. When CW-FIT was withdrawn, the target student's academic engagement returned to low baseline levels. Due to the immediate elevation in the target student's disruptive behaviors and the significant decrease in his academic engagement, the teacher requested CW-FIT to be re-implemented after 2 days of withdrawal. When CW-FIT was re-introduced, the target student's levels of academic engagement increased and showed improved levels of stability.

*Disruptive behavior.* Figure 2 shows the target student's disruptive behavior. During baseline observations, the target student engaged in high levels of disruptive behavior with an increasing trend. Following the introduction of MoBeGo, there was an immediate reduction in the target student's level of disruptive behaviors, but his disruptive behaviors remained highly variable throughout this phase of the study. When CW-FIT was introduced, there was again an immediate decrease in the target student's disruptive behaviors. By the end of this phase, his disruptive behaviors were low and stable. When CW-FIT was withdrawn, the target student's

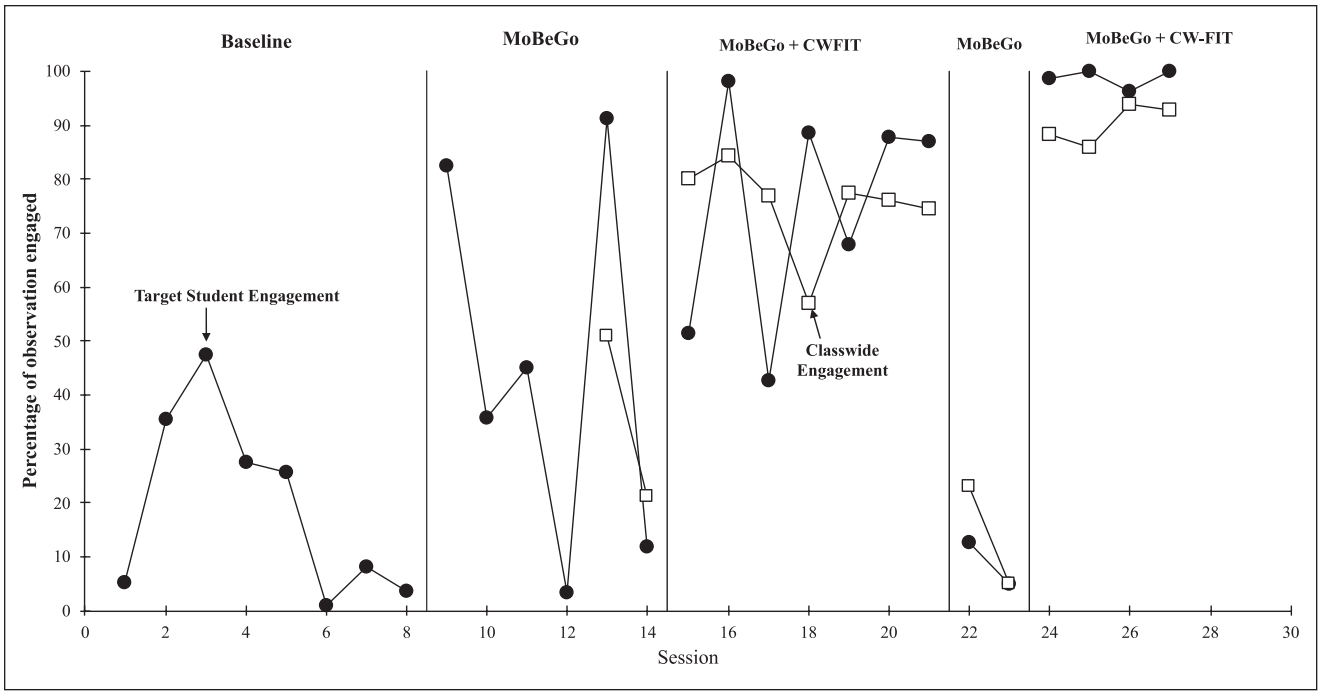


**Figure 1.** Target student and class-wide engagement.
*Note.* CW-FIT = Class-Wide function-Related Intervention Teams.

disruptive behaviors immediately increased, returning to baseline levels. When CW-FIT was re-implemented, there was an immediate decrease in the target student's disruptive behaviors and his disruptive behaviors remained relatively stable for the duration of this phase.

*Class-wide engagement.* Figure 1 shows class-wide engagement data. Due to the iterative approach, observers began collecting class-wide engagement data during the MoBeGo-only intervention phase. During this phase, class-wide engagement was relatively low. With the introduction of CW-FIT, there was an immediate increase in class-wide engagement. Class-wide engagement reached high, stable levels at the end of this phase. When CW-FIT was withdrawn, class-wide engagement decreased to levels below those observed during the first MoBeGo intervention phase. Class-wide engagement showed an immediate increase with the re-introduction of CW-FIT.

*Teacher behavior.* Figure 3 displays teacher praise and reprimand data. The teacher's baseline levels of praise were low and relatively stable. During the first session of the MoBeGo phase, frequency of teacher praise showed an immediate increase in level, but quickly returned to baseline levels. With the introduction of MoBeGo + CW-FIT, frequency of teacher praise showed an immediate increase in level. While frequency of teacher praise was variable during this phase, it remained above levels observed during both baseline and MoBeGo phases. Frequency of teacher praise decreased to 0 during both observation sessions when CW-FIT was withdrawn (i.e., sessions 22 and 23). When CW-FIT was re-introduced, frequency of teacher praise showed an immediate increase in level similar to that observed in the first MoBeGo + CW-FIT phase.

The teacher's baseline levels of reprimands were high and variable. When MoBeGo was introduced, frequency of teacher reprimands showed an immediate decrease in level but continued to be highly variable throughout this phase. With the introduction of CW-FIT, there was a further reduction in frequency of teacher reprimands and improved stability. With the withdrawal of CW-FIT, teacher reprimands returned to baseline levels. In the final MoBeGo + CW-FIT phase, reprimands returned to low, stable levels as observed in the first MoBeGo + CW-FIT phase.

Praise to reprimand ratios were also used as a measure of Tier 1 practices throughout the study. During baseline, Ms. Adams delivered 0.38 praise statements for every 7.88 reprimands. After introducing MoBeGo, this ratio improved slightly with an average of 0.50 praise statements for every 3.25 reprimands. The introduction of CW-FIT corresponded with an immediate and sustained improvement in the praise to reprimand ratio with 5.55 praise statements for every 0.55 reprimands.

*Teacher and student ratings.* As displayed in Figure 4, teacher ratings of Logan's behavior closely reflected direct

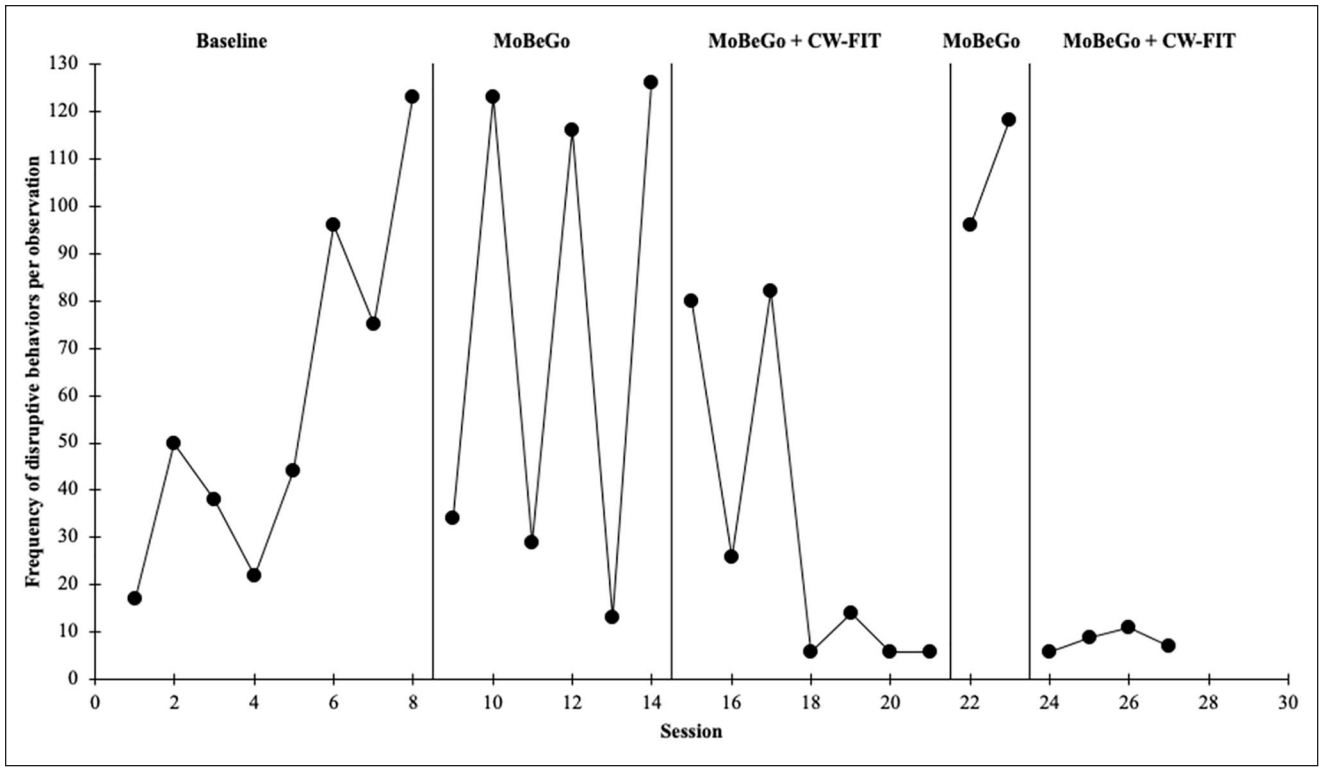


**Figure 2.** Frequency of target student disruptive behaviors.
*Note.* CW-FIT = Class-Wide Function-Related Intervention Teams.

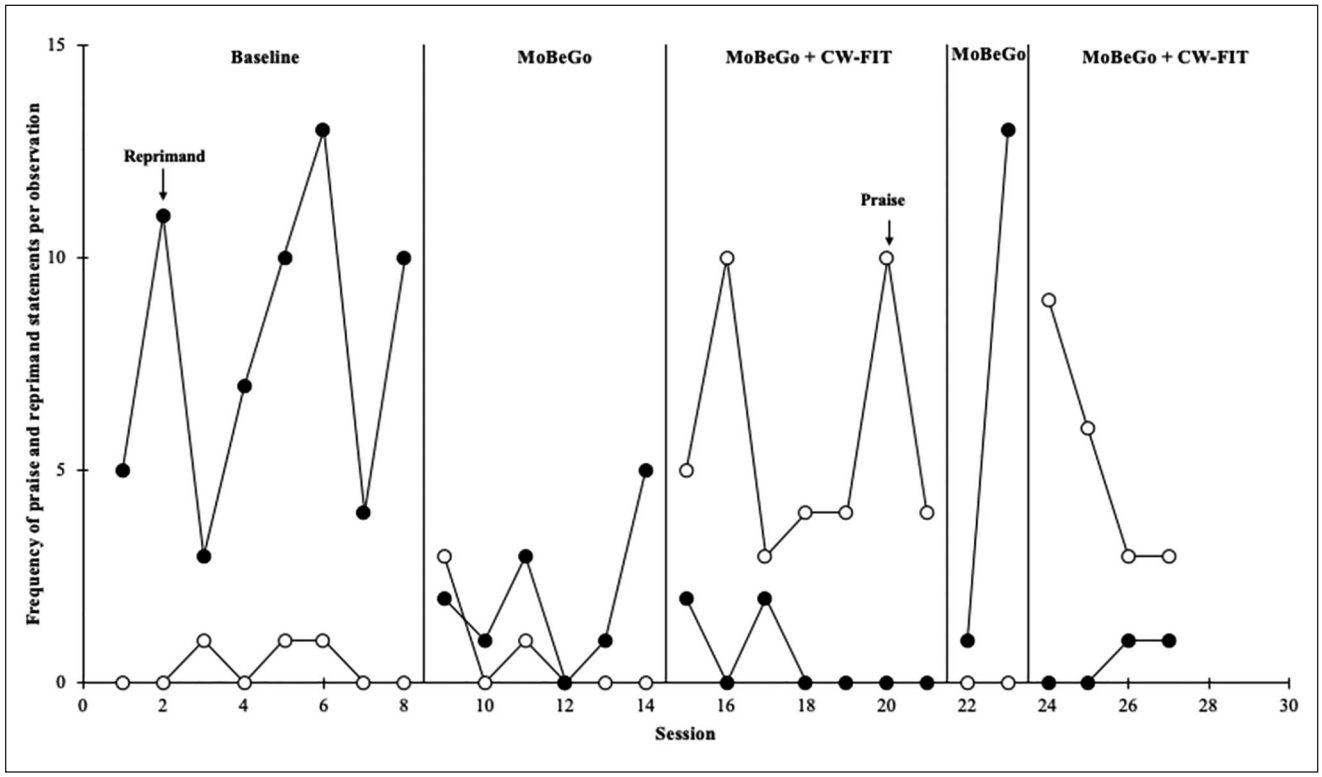


**Figure 3.** Teacher praise and reprimand.
*Note.* CW-FIT = Class-Wide Function-Related Intervention Teams.

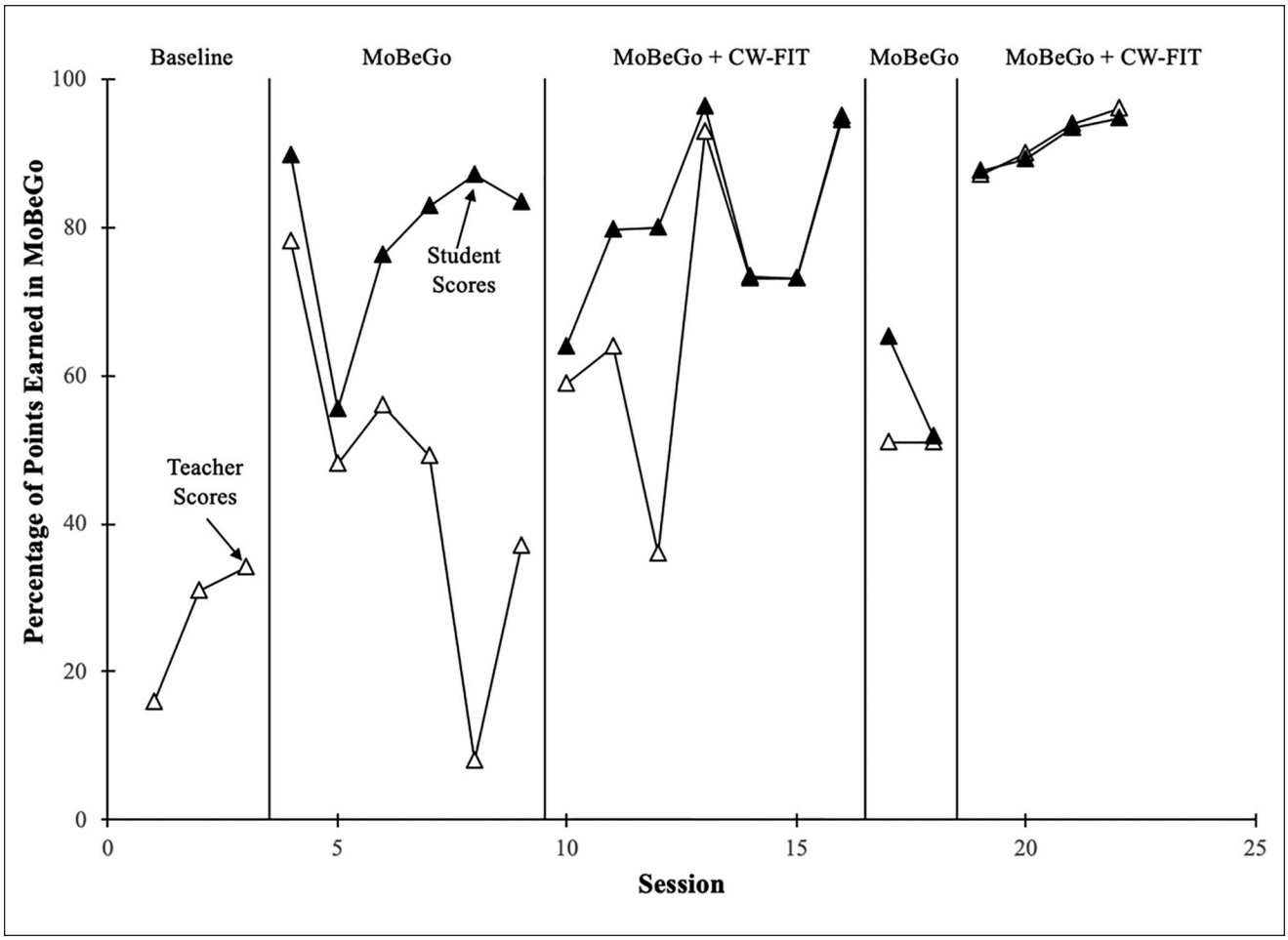


**Figure 4.** Teacher and student rating data.
*Note.* CW-FIT = Class-Wide Function-Related Intervention Teams.

observations of his academic engagement and disruptive behavior. Specifically, when Logan's academic engagement increased and disruptive behavior decreased, teacher ratings of Logan's behavior were higher.

*Classroom management practices*. Observers completed the CMRF (Downs et al., 2019) during all data collection sessions that included a class-wide engagement measure. These data provided an additional measure of the presence of Tier 1 practices in Ms. Adams's classroom. During the two initial CW-FIT baseline sessions, classroom management scores averaged 28.9% (range = 27.8%–33%). After introducing CW-FIT, classroom management scores increased to an average of 76.2% (range = 63.8%–96.4%).

*Treatment fidelity.* Observers conducted MoBeGo fidelity probes during all data collection sessions that included target student data, and CW-FIT fidelity probes during all data collection sessions that included a class-wide engagement measure. Individual session scores were averaged and reported by intervention phase. During the first five baseline sessions, 0% of MoBeGo intervention procedures were observed. Following teacher training on collecting baseline data in MoBeGo, baseline averages increased to 100% of app procedures being completed with fidelity by the teacher and remained at 0% for the student (i.e., the teacher scored student behavior, but the student did not) and 20% of classroom procedures being implemented with fidelity (i.e., the iPad was present). During intervention phases, Ms. Adams completed an average of 88.1% (range = 50%–100%) of app procedures and 94.3% (range = 50%–100%) of classroom procedures. Ms. Adams implemented 0% (range = 0%–0%) and 12.8% (range = 9.1%–16.7%) of CW-FIT procedures during the first and second MoBeGo phases, respectively. During the first and second MoBeGo + CW-FIT phases, Ms. Adams implemented 100% of CW-FIT procedures.

*Social validity.* Both Logan and Ms. Adams rated MoBeGo favorably at the conclusion of the intervention period. When asked what he liked most about MoBeGo, Logan stated that it helped him behave better in class. Ms. Adams explained that her favorite feature was the ability to track student behaviors in small intervals. When asked what he would change about the app, Logan said he would not change anything at this time. When asked what she would change about the app, Ms. Adams requested being able to decide whether or not the student is able to see teacher ratings of student behavior. Ms. Adams also rated CW-FIT favorably and explained that she saw a substantial improvement in her students' work completion and appropriate behavior when the intervention was in place. She did, however, express concerns about being able to provide daily tangible rewards to her students without having researcher support in the future. In a follow-up visit with the teacher the following school year, she was observed using CW-FIT without any support from research staff.

## Discussion

The purpose of this study was to assess the impact of a technology-based self-monitoring intervention with programmed data-based decision rules, MoBeGo, on the academic engagement and disruptive behavior of a middle school student at risk for a behavior disorder. Initially, the impact of MoBeGo on this student's level of academic engagement and disruptive behavior was inadequate. We used this opportunity to assess whether the presence or absence of CW-FIT, an evidence-based Tier 1 intervention, enhanced the effectiveness of MoBeGo, a Tier 2 intervention. The results of this study indicated there was a functional relation between MoBeGo + CW-FIT and academic engagement and disruptive behavior when compared with MoBeGo alone for a middle school student at risk for behavior disorders. Results also indicated there was a functional relation between MoBeGo + CW-FIT and the frequency of teacher praise and reprimands when compared with MoBeGo alone for a middle school teacher.

This study adds to the literature base on SWPBIS by illustrating the importance of ensuring there are adequate class-wide levels of Tier 1 supports in place before implementing a Tier 2 intervention. This study took place in a school that met fidelity for SWPBIS on the TFI (Algozzine et al., 2014), but baseline levels of class-wide engagement, teacher praise, and teacher reprimands indicated this was not the case in the context of the classroom itself. While this student showed some improvement after the implementation of MoBeGo, his behavior was highly variable. The improvement in the student's behavior when both CW-FIT and MoBeGo were in place indicates that improved levels of Tier 1 support may have mediated the impact of the Tier 2 intervention for this student.

In terms of teacher behavior, it is important to note that while the Tier 2 intervention, MoBeGo, was associated with a decrease in teacher reprimands, it had a minimal effect on levels of teacher praise. Once a Tier 1 intervention, CW-FIT, was layered on top of MoBeGo, teacher praise showed an increase in level and reprimands decreased to levels lower than those observed in the MoBeGo alone phase. The increase in levels of teacher praise observed during CW-FIT conditions reflects findings from prior studies of CW-FIT (Wills et al., 2018a, 2018b). A key component of this intervention is a systematic reminder (i.e., timer sounding every 3–5 min) for teachers to provide behavior-specific praise to students engaging in appropriate behaviors. While Tier 2 interventions are conceptualized as an intensification of Tier 1 practices, the results of this study indicate that a Tier 1 intervention, CW-FIT, was more effective in improving teacher implementation of key Tier 1 supports (e.g., teacher praise) than a Tier 2 intervention, MoBeGo.

### Limitations

The results of this study should be interpreted with the following limitations in mind. First, this study included only one participant. While CW-FIT was evaluated in efficacy trials (Wills et al., 2018a, 2018b) and prior versions of MoBeGo have been tested in several single-case studies (Bruhn et al., 2015b, 2016), no prior study has evaluated the effectiveness of MoBeGo and CW-FIT when implemented together. While this study provides preliminary evidence that a functional relation may exist between MoBeGo + CW-FIT and engagement and disruptive behavior, this study should be replicated with additional students in middle school settings.

As the initial purpose of this study was to assess the impact of a Tier 2 intervention, MoBeGo, on this student's engagement and disruptive behavior, class-wide engagement data were not collected until the final two sessions of the first MoBeGo phase. This limits the conclusions that can be drawn about the impact of the combined Tier 2 and Tier 1 interventions, MoBeGo + CW-FIT, on class-wide engagement in the context of this study. Future research should replicate this study with class-wide engagement data collected throughout all phases of the study.

Due to the time constraints imposed by the end of the school year, we were not able to include a CW-FIT alone phase. Future research should replicate this study with the inclusion of a CW-FIT alone phase to determine whether an intensive Tier 1 intervention such as CW-FIT can accomplish the goals of a Tier 2 intervention on its own. If so, this has important implications for practice in implementing multi-tiered systems of support.

### Implications for Practice and Research

The results of this study emphasize the importance of developing measures of Tier 1 fidelity at the classroom level. Future research should build on existing measures of classroom-level Tier 1 fidelity and develop and evaluate additional measures of these teacher practices at a classroom level. In classrooms, administrators and teachers should ensure adequate levels of Tier 1 supports are in place before implementing more resource-intensive Tier 2 or Tier 3 interventions.

It is also important to highlight the practice-based professional development provided to the teacher in this study as she implemented CW-FIT in her classroom. To change key teacher behaviors (e.g., praise, reprimands, opportunities to respond) in classrooms, teachers likely need scaffolded supports that involve more than a one-time training on an intervention or practice. In this study, research staff provided training, modeling, and continued coaching to ensure the teacher sustained high levels of implementation fidelity over time. A recent study explored the application of a multi-tiered system of support to teachers' implementation of classroom management practices, providing scaffolded supports based on teachers' responsiveness to coaching interventions (Simonsen et al., 2014). Future research should further evaluate the effectiveness of these types of scaffolded supports to ensure teachers have access to the resources they need to sustain implementation of evidence-based behavior management practices in classrooms.

Future research should also assess the impact of Tier 2 interventions on teacher behavior, particularly teacher behaviors associated with improvements in academic engagement and disruptive behavior for students with or at risk for behavior disorders (e.g., teacher praise, opportunities to respond, pre-corrections). The results from this study indicate that Tier 2 interventions may not intensify key Tier 1 teacher practices as effectively as Tier 1 interventions. This has implications for the development and implementation of Tier 2 behavior interventions.

In this study, as the target student's academic engagement and disruptive behavior decreased, class-wide engagement simultaneously improved with the implementation of CW-FIT. An important hypothesis to explore, particularly in the context of middle school classrooms, is the potential mediating impact peer behavior may have on the effects of a behavior intervention. In the case of this study, the target student may have engaged in disruptive behavior to seek peer attention. CW-FIT includes explicit instruction on and targeted reinforcement for ignoring inappropriate peer behavior (Conklin et al., 2016). This component may have added to the effectiveness of these two interventions for the target student in this study and may have important implications for future research, particularly in middle school settings. Future research should assess peer behaviors as a mediator of the impact of behavioral interventions on students with high levels of disruptive behavior.

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