University of Tennessee, Knoxville
Trace: Tennessee Research and Creative Exchange

Doctoral Dissertations

Graduate School

8-2017

Comparing Group Contingencies: An Investigation of the Role of Group Size in a First-Grade Classroom

Katelyn Crabtree Scott
University of Tennessee- Knoxville, kcrabtr3@vols.utk.edu

To the Graduate Council:

I am submitting herewith a dissertation written by Katelyn Crabtree Scott entitled "Comparing Group Contingencies: An Investigation of the Role of Group Size in a First-Grade Classroom." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in School Psychology.

Christopher H. Skinner, Major Professor

We have read this dissertation and recommend its acceptance:

Tara C. Moore, David F. Cihak, Merilee McCurdy

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

Comparing Group Contingencies: An Investigation of the Role of Group Size in a First-Grade Classroom

A Dissertation Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Katelyn Crabtree Scott

August 2017

Dedication

This dissertation is dedicated in memory of my loving grandfathers, Mr. Jerry Robinson and Dr. Carson Crabtree, for their continuing support and encouragement throughout my graduate school career.

Acknowledgement

First and foremost, I would like to extend thanks to my committee members, Dr. Christopher Skinner, Dr. Tara Moore, Dr. David Cihak, and Dr. Merilee McCurdy for their direction and guidance for development of this dissertation. I extend a sincere thank you to my committee chair, Dr. Christopher Skinner, for always pushing me to strive for excellence and for his constant feedback without which this dissertation would not be possible. Thank you for all of your lessons on the art of writing and single subject design.

I am very thankful and appreciative to Mrs. Danielle Payne, Mrs. Debbie Engle, Ms. Angela Davis, Mr. Jake Jones, Dr. Kathleen Aspiranti, and Dr. Sara Haugli for welcoming me into the Prospect Elementary community and supporting me throughout this entire process. This dissertation was made possible because of the willingness of these wonderful Prospect staff and administrators. I would like to extend special gratitude to Mrs. Payne's first-grade class for their participation in this study. It was truly a pleasure to work with Mrs. Payne and I am eternally grateful for her support.

I would like to also thank my wonderful parents for their guidance and for instilling in me a hardworking nature, always pushing me to accomplish my goals, and constantly praying for me and pointing me to the Lord. Finally, I extend a very special thank you to my wonderful, loving, and devoted husband, Adam. Your daily encouragement and support never ceases to amaze me.

Abstract

Group-oriented contingencies are often used in the classroom as a means to enhance academic performance. Randomization of contingency components and group size have important implications for the effectiveness of these contingencies. The current study was designed to extend research on group contingencies by evaluating and comparing a randomly-selected small group dependent contingency with a large group interdependent contingency in a first-grade classroom. In this classroom, students sit at tables consisting of four students. Percentage correctly completed on daily independent math assignments represented the dependent variable. Class-wide averages, small group averages (i.e., tables), and individual student data was collected. Researchers also evaluated acceptability of the interventions to evaluate whether one contingency was preferred to another.

An adapted alternating treatment design was used to evaluate the effects of the contingencies on student math academic performance. Across all phases, typical classroom procedures remained in place and students were given 25 minutes to complete the independent assignments. If the class average or small group met a randomly selected criterion, the class earned access to a randomly selected group reward. Visual analysis of the alternating treatments graph showed increased math performance across both interventions in comparison to typical classroom procedures. No meaningful differences were found between the contingencies.

Survey and interview data reveal that both teachers and students found the interventions highly acceptable. Teachers reported to prefer the small group condition due to practical implications of grading less student assignments. Students were reported to enjoy the additional mystery component in the small group condition. These findings have theoretical and applied implications. Study limitations and directions for future research are discussed.

Table of Contents

List of Tables

List of Figures

Chapter I

Literature Review

Students across the country are struggling to reach high levels of academic achievement, with many classrooms containing students at-risk for academic failure (Harris & Herrington, 2006; Musti-Rao & Cartledge, 2007; Yurick, Robinson, Cartledge, Lo, & Evans 2006). Evidence-based interventions are needed to enhance student academic performance (Kratochwill & Shernoff, 2004; Slavin, 1987). Previous researchers have examined contingencies as a means of enhancing academic performance across target behaviors and students (e.g., Heering & Wilder, 2006; Popkin & Skinner, 2003; Turco & Elliott, 1990). Contingencies describe relationships between behaviors and environmental events (Kazdin, 2001; Kelshaw-Levering, Sterling-Turner, Henry, & Skinner, 2000). As described by Skinner, Skinner, and Burton (2009), contingencies are associated with an *'if-then environment-behavior'* relationship: under environmental conditions (i.e., when stimuli is presented), *if* students demonstrate a behavior, *then* an external consequence will be provided by the environment. To illustrate, if Jane correctly spells 95% of the words on her spelling test (the behavior), then the teacher will respond by giving Jane a gold star (the consequence).

Kazdin (2001) explains that three components form a contingency: antecedents, behaviors, and consequences. Antecedents include the stimuli or contexts that occur prior to a behavior and influence the behavior. For example, a ringing telephone serves as an antecedent to answer the telephone. When we hear a telephone ring, the *antecedent*, we typically respond by answering the phone. In this example, the actual *behavior* is answering the phone. Finally, *consequences* are those events that follow the behavior, which are likely to influence whether or not individuals will engage in that behavior under similar antecedent conditions (e.g., answer the phone the next time it rings). As consequences occur following a behavior, they may have an effect on whether a behavior increases, decreases, or remains the same (Kazdin & Rotella, 2013).

Continuing with the previous telephone example, if our behavior of answering the phone is followed by the consequence of hearing another person on the other end of the line, then we may be more likely to answer the phone when it rings again (Kazdin, 2001). Consequences can function as reinforcers or punishments, or function as a neutral stimulus if there is no effect on the behavior.

Contingencies are often described using the terms of positive and negative reinforcement and positive and negative punishment (Kazdin, 2001). A consequence serves as a reinforcer when it increases the probability that the reinforced behavior will recur when one is presented with similar antecedent stimuli, which leads to an increase or strengthening of a behavior. The terms positive and negative refer to the delivery or removal of a stimuli contingent upon behaviors. For example, verbal praise from a teacher for strong academic performance would be considered a positive reinforcer if it increases the likelihood that strong academic performance will recur. Negative reinforcement involves escaping or avoiding something contingent upon a behavior. As with positive reinforcement, this contingency increases the likelihood or probability of the behavior recurring (Kazdin, 2001). A common example of negative reinforcement involves the daily act of turning off one's alarm clock when it rings in the morning. Turning off the alarm clock (the behavior), results in the removal of an aversive stimuli (buzzing noise), which increases the probability of the person turning off the alarm when it buzzes.

Punishment represents another class of contingencies. While reinforcement increases the likelihood of recurring behaviors, punishment decreases the probability that a behavior will recur (Kazdin & Rotella, 2013). Punishment involves either the presentation (positive punishment) or removal (negative punishment) of a stimulus contingent upon behavior response (Kazdin, 2001).

As an example of the presentation of a stimulus that serves as punishment, a teacher may deliver a stern reprimand to his or her students contingent upon their inappropriate behavior. If the teacher's reprimand is followed by a decrease in the students' inappropriate behavior, the reprimand served as a punisher. Punishment may also be presented in the form of removing a stimulus or event contingent upon a behavior (Kazdin, 2001). For example, contingent upon Jane's misbehavior, a teacher may remove 5 minutes of recess time. If functioning as a punisher, the removal of recess time represents negative punishment if it decreases the probability of Jane misbehaving.

Individual Contingencies

In addition to classifying contingencies as positive and negative reinforcement and punishment, contingencies can also be classified as individual or group-oriented (Kelshaw-Levering et al., 2000). When applying an individual contingency in a classroom setting, an individual student's target behavior is reinforced when the student meets a criterion. Whether the student receives access to a reinforcer is based solely on the individual's performance or demonstration of a target behavior (Skinner et al., 2009). The components of the individual contingency involve a target child, a target behavior, a criterion, and a consequence. For example, Joey will receive 5 points of extra credit if he scores 90% or higher on his spelling test. Joey, the target student, will receive access to a reinforcer of 5 points of extra credit if his spelling performance, which represents the target behavior, meets or exceeds the criterion of 90%.

With individual contingencies, all of the components of the contingency can be customized for one student (Popkin & Skinner, 2003). Individual contingencies are beneficial when attempting to target individual student needs or skills, as educators have the opportunity to adjust target behaviors and/or criteria (Skinner et al., 2009). If a student demonstrates development in a certain target behavior, then contingencies may need to be adjusted as the student's skill further progresses (e.g., shaping).

Within a special education classroom, two students may have different target behaviors that need to be addressed. For instance, Joey's target behavior may be spelling 10 second-grade words per week, while Jane's target behavior is spelling 20 fourth-grade words per week. The nature of individual contingencies allows educators to manage multiple academic behaviors across students, depending on individual student needs (Skinner, Williams, & Neddenriep, 2004).

In another example, both Joey and Jane may have the same target behaviors of 10 second-grade words, but the criteria may need to be varied across students (Skinner et al., 2009). On the weekly spelling test, Joey may only be writing one or two words correctly each week, while Jane typically writes 9 or 10 words correctly. For Joey, a criterion of eight words correct (80%) in order to earn a reward may be ineffective because it is too high. In other words, Joey may not even try to meet the criterion. Alternatively, because Jane is already exceeding the proposed criterion of eight words, establishing a lower criterion to earn a reward amounts to lowering expectations, which could cause a decrease in Jane's spelling test performance.

Individual contingencies may also involve customized or idiosyncratic reinforcers (Skinner et al., 2009). While extra time at recess for accurate homework answers may be positively reinforcing for Joey, the same consequence may function as a punisher for Jane who does not prefer to play outside. Also, even when a consequence is reinforcing for both Joey and Jane, the quality or strength of the reinforcer may vary across students. Extra recess time may be a reinforcer for both students, but a stronger reinforcer for Joey. Consequently, providing extra recess time may be more effective in altering Joey's behavior than Jane's. Because Jane prefers playing computer games to playing outside, extra recess time is a lower quality reinforcer for Jane and may be insufficient for altering her behavior. Selecting reinforcers based on idiosyncratic preferences increases the likelihood that the contingencies will be effective (Skinner et al., 2009).

When all components are considered together, response effort also plays a role (Skinner et al., 2004). Joey may require more time and effort to learn his spelling words (e.g., 30 minutes per day), compared to Jane who only requires 5 minutes per day to learn her spelling words. In this situation, Joey may need a higher quality reinforcer than Jane because meeting the criterion requires much more effort. Considering the previous example, both Joey and Jane are reinforced by an extra 10 minutes of recess. While Joey enjoys playing outside, he may need a higher quality reinforcer (e.g., an extra 20 minutes of recess) because of the amount of effort he must expend to earn access to the reinforcer. Because individual contingencies allow educators to tailor contingency components, problems caused by ratio strain (i.e.., effort-reinforcer relations) can be addressed by manipulating rewards, target behaviors, and criteria across students (e.g., different for Joey and Jane) and within students over time (e.g., shaping, Skinner et al., 2004).

Despite the advantage of customizing all components of the individual contingencies, Skinner et al. (2004) indicate several practical limitations with applying individual contingencies in classroom settings. A primary disadvantage of individual contingencies becomes apparent when you consider a class of 20 students and a teacher attempting to focus on five different academic target behaviors. Due to the limited time constraints of a typical school day, teachers would likely find this situation to be difficult to manage. One potential solution is only to implement individual contingencies for those students in the classroom who require additional academic assistance. While it does represent a valid alternative, many educators would likely see this arrangement as unfair to those students in the classroom who do not need additional academic help. Because of the large number of students and target behaviors, it is nearly impossible for a teacher to manage individual contingencies for all students within the classroom. For these reasons, educators often implement group-oriented contingencies (Skinner et al., 2009).

Group-Oriented Contingencies

Whereas individual contingencies apply to only one student, group-oriented contingencies are commonly used and can be more contextually valid (i.e., can be implemented in the classroom). In the case of individual contingencies, all components of the contingency can be customized for one student. With group oriented-contingencies, some or all components of the contingency are group-oriented, whether held constant across all members of the group or based on some aspect of the group's performance (Litow & Pumroy, 1975). Group contingencies are particularly efficient for educators to implement because they involve the same target behaviors, criteria, and reinforcement across all members of the group (Skinner, Skinner, & Sterling-Turner, 2002).

Three different types of group contingencies are examined within the existing literature: independent group-oriented contingencies, dependent group-oriented contingencies, and interdependent group-oriented contingencies (Litow & Pumroy, 1975; McKissick, Hawkins, Lentz, Hailley, & McGuire, 2010; Skinner et al., 2004; Skinner et al., 2009). The three different types of group contingencies differ in two significant ways: the way in which student performance affects the probability of reinforcement and how peer performance affects the probability of reinforcement (Skinner et al., 2004). Researchers present inconsistent findings on the comparative effectiveness of the three types of group contingencies (Kelshaw-Levering et al., 2000; Theodore, Bray, & Kehle, 2004). However, each type of group contingency is associated with advantages and disadvantages (Kelshaw-Levering et al., 2000). As the focus of this research is to enhance desired academic behaviors in the classroom environment, the discussion of group-oriented contingencies will focus solely on applied advantages and disadvantages of group-oriented positive reinforcement.

Independent group-oriented rewards. [1] With independent group-oriented rewards, all students have the same contingency components: the same target behavior, criteria, and rewards (Popkin & Skinner, 2003; Skinner et al., 2004). Though most of the contingency components are group-oriented, access to the reinforcer is based on each student's individual behavior. Each individual student receives access to the same reward based upon his or her own target behavior or performance meeting the same criterion (Skinner et al., 2004). In this manner, independent group-oriented rewards are considered fair across students, educators, and parents because each individual student is responsible for his or her own behavior, yet the target behaviors, criteria, and reinforcers remain constant across all students (Turco & Elliott, 1990). Most school discipline procedures represent independent group-oriented contingencies (Skinner et al., 2009). For example, a school may establish a policy in which any student who physically assaults another student will be suspended for one week.

In the classroom, letter grades represent a commonly used independent group-oriented reward; students receive letter grades based on the same target behavior and criteria (Skinner et

[1] The reason we use *reward* instead of *reinforcer* is because it is feasible that a group-oriented reward changes some student's behaviors and not others; thus, we are not justified in calling it a reinforcer.

al., 2009). Suppose a teacher assigns letter grades to students based on individual performance on spelling exams. Those students who earn 90% or above are rewarded with a letter grade of A. In this case, the target behavior (i.e., spelling test performance), the criterion (90% or higher), and the reward (i.e., letter grade of A) are constant across all students. However, access to the reward is contingent upon each student's individual performance, as opposed to the group's performance (Skinner et al., 2009).

One advantage of independent group-oriented rewards is that they are easier for educators to manage and apply with integrity (Skinner et al., 2009). In a classroom of 25 students, it would be difficult and time-consuming for a teacher to deliver rewards to students who earned them when each student has a different criterion, reward, and/or target behavior. Additionally, they are also considered fair. Consequently, independent group-oriented rewards are typically implemented within most general education classrooms (Skinner et al., 2004).

Despite many advantages, there are also disadvantages associated with independent group-oriented rewards, including potential social issues (Skinner et al., 2009). As target behaviors, criteria, and rewards are held constant, students may infer classmates' performance by observing who receives access to reinforcers. For example, each student's performance on a test is typically not shared with classmates; however, when students know who did and did not receive access to reinforcers, they also know who met the criterion and who did not meet the criterion. To illustrate, if each student was to receive access to a handful of candy contingent upon scores 80% or higher on a spelling test, then classmates know which students scored below 80%, as these students did not receive candy. These procedures may cause students to inappropriately or negatively label those who do not receive access to rewards (Skinner, 2004).

Other limitations of independent group-oriented rewards are associated with criteria and reinforcers being held constant across all students (Skinner et al., 2009). With common contingency components across students, the effectiveness of the contingency will vary for each student. Again, with an 80% accuracy criterion, a reward may prove to be a very effective reinforcer for enhancing some students' spelling test performance (e.g., those scoring 60-70%), but be too weak to influence other students' behavior (e.g., students scoring 0-40%). Consequently, a common criterion and reward may not be equally effective across all students in the classroom. Furthermore, because students with weak academic skills require more time and effort to meet academic target criteria, independent group-oriented rewards may be least effective for students who most need to engage in targeted academic behaviors (Skinner et al., 2009).

While a common reward may be powerful for some students, other students in the classroom may require stronger rewards to enhance academic performance, especially when skill development varies across students. Preference for rewards may also influence contingencies. Suppose students are rewarded with 5 minutes of extra computer time for spelling performance. Time on the computer may be a high-quality reward for Joey, but a low-quality reward for Jane, who prefers to read chapter books instead of playing on the computer. With contingency components remaining constant across all students, it becomes difficult for educators to meet individual preferences (Popkin & Skinner, 2003; Skinner et al., 2009).

Another potential disadvantage of independent group-oriented rewards arises when only some students earn access to the rewards. Again, consider the example where some students earn several small pieces of candy contingent upon meeting a particular criterion. There are several ways that students who did not earn the reward could still receive access to the reward, which could reduce the effectiveness of the contingency. Specifically, they could steal candy from others or purchase their own candy. Furthermore, classmates may choose to share their candy with peers who did not earn it (Skinner, 2004).

Dependent group-oriented rewards. With dependent group-oriented rewards, all or no members of the group receive access to a reward based on one individual student (or a smaller group of students) meeting a particular target behavior criterion (Popkin & Skinner, 2003; Skinner et al., 2004). In this manner, all students' access to rewards is contingent upon the behavior of a selected classmate(s) (Skinner et al., 2004). With dependent group-oriented rewards, the target behavior is often individualized, as it is typically based on one student's behavior. The reward is considered group-oriented because either all or none of the students receive access to the same consequence.

Within a classroom, a teacher may reward his or her entire class with a pizza party if one student within the class earns at least a 90% on the weekly spelling test. Suppose Joey is chosen as the target student of the contingency and scores a 95% on his spelling test. In this example, the entire class will earn the reward of a pizza party because Joey met the selected criterion based on his spelling test performance. A primary advantage of dependent group-oriented rewards is that everyone receives the reward and no student is left out from receiving the reward. Social praise is another advantage of dependent group-oriented rewards, specifically in the case where the target child meets the criterion and earns access to the reinforcer for fellow group members (Popkin & Skinner, 2003; Skinner et al., 2004). In the previous example, it is likely that Joey will receive social praise from his classmates because his target academic behavior met the criterion and provided access to the reward for the entire class. While the previously considered example involved the target student meeting a criterion, consider the example in which the target student prevents the class from earning access to a reward. Some educators view dependent group-oriented rewards as unfair because most students' access to a reward is dependent upon the behavior or performance of another student. If Joey earned a 75% on his spelling exam, his academic performance did not meet the established criterion of 90% and the class will not receive a pizza party. Consequently, dependent group-oriented rewards are associated with some disadvantages, including the immense pressure placed on individual target students, which could in turn lead to threatening behavior from other peers (Popkin & Skinner, 2003).

Unknown target students. Gresham and Gresham (1982) developed a strategy to avoid some of the negative social side effects associated with dependent group-oriented rewards. The researchers evaluated the effects of a dependent group-oriented reward condition in reducing disruptive behavior within a special education classroom of 12 students. The target children within this condition were unknown to students. From baseline, researchers determined the two most disruptive children in the classroom (the target children) and designated these students as "team captains," but this information remained unknown to participants. Gresham and Gresham formed two groups, assigning each designated "team captain" (i.e., the two most disruptive students from baseline) to a different team. The team with the fewest number of disruptive behaviors demonstrated by the team captain (the target child) was awarded access to a reinforcer at the end of the day. Procedures continued over a period of five days. Disruptive behavior decreased following the dependent group-oriented reward and researchers suggested that the unknown target child component was effective in eliminating social pressure from peers (Gresham & Gresham, 1982).

Interdependent group-oriented rewards. Interdependent group-oriented rewards may address the behavior of an entire group of students and encourage students to cooperate (Kelshaw-Levering et al., 2000). With this contingency, all students receive access to reinforcers that are contingent upon some aspect of the entire group's behavior, such as the class average on an exam; consequently, students have a greater probability of receiving access to a reward when both themselves and their peers excel (Kelshaw-Levering et al., 2000; Popkin & Skinner, 2003). Slavin (1987) notes that this intertwining of consequences, or intertwining of fates, encourages greater cooperation across a group of students. Cooperation is further promoted with interdependent group-oriented rewards because either everyone in the classroom or none of the students receive reinforcement; thus, no students are singled out to receive access to rewards (Popkin & Skinner, 2003). Because of the all-or-none approach in receiving access to rewards, many educators may consider this type of contingency easier to manage within a classroom setting (Skinner et al., 2004).

There are several advantages of delivering the same rewards to all students in the classroom. Again, considering the candy example, it is much easier for teachers to give candy to all students in the class rather than track each student's performance and determine on a student-by-student basis who receives access to the candy. Additionally, when everyone receives candy, students may be less likely to share or steal candy. Third, students are not given information regarding their classmates' academic performance when all or none of the group earns access to the candy. Finally, delivering reinforcers to all or none of the class may allow educators to apply activity reinforcers which are often powerful and free, yet difficult to deliver to some students and not others. For example, listening to music during seatwork may be a cost effective and powerful reward; however, it is almost impossible to deliver to some students and not others.

Earning extra playground time is also difficult to deliver to some students and not others, as another adult is required: one to supervise those students on the playground and another to supervise those students in the classroom (Skinner, 2004).

Despite many of the advantages associated with interdependent group-oriented rewards, they are often considered unfair (Skinner et al., 2009). Specifically, students who perform well may not receive access to rewards because their classmates perform poorly. Because this situation can cause students to threaten or retaliate against their poor performing classmates, Skinner et al. (2009) recommends only targeting academic behaviors and not providing any public feedback on any students' performance, unless the group earned the reward. Additionally, Skinner suggests that current individual and independent rewards be kept in place and interdependent group rewards be layered on top of those other contingencies. Thus, when students complain that it not fair, teachers can both remind them of their rewards based on only their own performance (e.g., grades) and also remind them that there is no losing with this contingency, only the opportunity to receive access to additional rewards (Skinner, 2004).
The opposite is also true for interdependent group-oriented rewards, as many educators consider it unfair when poor performing students receive access to rewards.

Another disadvantage associated with interdependent group rewards involve the common reinforcer, or consequence, delivered to students. As previously described, some rewards may be high-quality reinforcers for some students, but not others (Skinner, Caswell, & Dunn, 1996; Skinner, 2004). For example, candy may be a high-quality reinforcer to Joey, but Jane may prefer salty snacks. Low-quality reinforcers are less likely to influence behavior. Moreover, it is particularly disadvantageous when a consequence serves as a reward for some yet a punisher for others. If a consequence is a punisher for some students, sabotaging the group's performance may be negatively reinforced (McKissick et al., 2010).

Application of Interdependent Group Rewards Within the Classroom

Interdependent group-oriented rewards have been used to reduce inappropriate behaviors in the classroom (Litow & Pumroy, 1975). Barrish, Saunders, and Wolf (1969) evaluated the effects of an interdependent group-oriented reward in reducing out-of-seat and inappropriate talking behaviors in a general education fourth-grade classroom. Their study involved the use of the *Good Behavior Game*, in which the class was divided into two teams and the team receiving the least number of tallies for disruptive behavior would receive reinforcement from a menu of reinforcers (Barrish et al., 1969). Results from the study suggested that the contingency was effective in significantly reducing disruptive behavior within the classroom. Further examination of the literature on the efficacy of group contingencies supports their utility as an intervention to address disruptive classroom behaviors (Coogan, Kehle, Bray, & Chafouleas, 2007; Heering & Wilder, 2006; Kelshaw-Levering et al., 2000; McKissick et al., 2010; Murphy, Theodore, Aloiso, Alric-Edwards, & Hughes, 2007; Skinner et al., 2009; Stage & Quiroz, 1997; Theodore et al., 2004). In their meta-analysis, Stage and Quiroz (1997) examined the overall effectiveness of group-oriented rewards and reported that group contingencies were more effective than other interventions in targeting student behavior.

Recently, there has been a surge in research for developing desired academic behaviors (Hawkins, Musti-Rao, Hughes, Berry, & McGuire, 2009; Popkin & Skinner, 2003; Reinhardt, Theodore, Bray, & Kehle, 2009; Sharp & Skinner, 2004; Skinner et al., 2004). There are advantages of targeting academic behaviors over inappropriate behaviors (Popkin & Skinner, 2003). One primary concern is when a specific problem behavior is targeted and reduced, it is possible that students may begin engaging in other problem behaviors (McKissick et al., 2010). When targeting problem behaviors, these behaviors are typically public to the rest of the students in the classroom (e.g., out-of-seat behaviors). If a student is engaging in a problem behavior in which a reward is contingent upon reduction of that behavior, other students become aware when that student does not meet the criterion. Academic target behaviors are less transparent to other students. If a student in the class does not perform well on an exam, the student's grade remains unknown to his or her classmates. Furthermore, as one of the primary goals of education is to equip students with knowledge that they can then apply as a productive member of society, targeting academic behaviors will likely lead to higher rates of student engagement and academic performance.

Unknown and/or randomly selected components. Other recent developments with group-oriented rewards are the application of unknown, or randomly selected, components (e.g., target behavior, criteria, and reinforcers). Skinner and Watson (1997) recommended that educators should consider randomizing contingency components to reduce some of the potential limitations associated with group reinforcement. The randomization of target behaviors may increase the probability of students modifying multiple behaviors (McKissick et al., 2010). When students are unaware of which potential target behaviors will be randomly selected as part of the contingency, students may be more likely to alter each of the possible target behaviors (Skinner & Watson, 1997). For example, a teacher may implement a group-oriented reward in which the class will receive access to a pizza party contingent upon "A" class averages in either math or spelling performance. Students will be unaware of whether math or spelling will be selected as the target behavior. Because the target behavior remains unknown, students will likely be encouraged to perform well on both math and spelling exams in order to receive access to the reward.

The component of unknown target students may also address some of the disadvantages of group reward procedures. As previously discussed, Gresham and Gresham (1982) eliminated the potential social side effects associated with dependent group-oriented rewards. Researchers implemented dependent group-oriented rewards contingent upon reduction in disruptive behaviors. However, participants were unaware of which students were selected as the target students. Advantages of this application include removing social stress on students whose performance is contingent upon other students receiving access to a reward. From their results, Gresham and Gresham (1982) discovered a reduction in problematic behaviors when using a dependent group-oriented reward with an unknown target student.

Heering and Wilder (2006) also examined dependent group-oriented rewards using unknown target students. In a multiple baseline design across two third- and fourth-grade classrooms, researchers evaluated the effects of a dependent group-oriented reward on students' on-task behaviors. The intervention allowed students the opportunity to earn access to preferred items or activities that were identified based on a stimulus preference assessment. If a randomly chosen row of students were on-task at randomly selected moments during math class, all students were granted access to those preferred items or activities that had been previously identified as reinforcing to participants (Heering & Wilder, 2006). Teachers observed the randomly selected row and checked a box for "yes" or "no" if the row was determined to be on-task. Because participants were unaware of which row of students was selected, participants did not know which of those students did not meet criteria for the target behavior. As such, there were likely fewer social threats for students who did not meet the criteria (Kelshaw-Levering et al., 2000). With the group contingency component of unknown target students, on-task behavior increased from baseline mean levels of 50% to intervention mean levels of 85% (Heering & Wilder, 2006). While a decrease in disruptive behavior was noted, more studies are necessary to determine the effects of group-oriented rewards on enhancing academic performance. Researchers noted that increasing on-task behavior during academic instruction did not directly lend itself to influence effects on academic performance (Heering & Wilder, 2006).

Educators may also consider the component of random criteria as a means to increase the likelihood of helping students to maintain an academic behavior over time (Kelshaw-Levering et al., 2000). For example, suppose a teacher rewards his or her students based on spelling test averages and randomly selects the criteria (e.g., 75%, 85%, 90%, or 95%) needed to receive access to the reward. If the criteria are randomly selected, students do not know how well they need to perform to earn a group reward (Skinner et al., 2004). In this case, students know that higher performance will increase the probability of earning a reward.

The randomization of criteria also is likely to address the individual development across students (Hawkins et al., 2009). If reward criteria are too high, some students may not engage in the target behavior. Likewise, if the reward criteria are too low, some students may underperform. As such, randomly selecting the criteria may increase the likelihood that students will enhance performance in order to receive access to the reward (Hawkins et al., 2009).

Researchers also suggest random selection of rewards when implementing group contingencies in the classroom (Kelshaw-Levering et al., 2000). Randomization of group rewards may diminish satiation effects and assist in minimizing weak rewards (McKissick et al., 2010). According to Rhode, Jenson, and Reavis (1993), unknown rewards, also termed "mystery motivators," are useful when implementing group-oriented rewards. With this strategy of unknown rewards, students may improve target behaviors because it is possible that the unknown reward will be strongly reinforcing to some students (Kelshaw-Levering et al., 2000). Moreover, when students are unaware of which reinforcer will be earned, the anticipation of receiving access to the reward is better maintained with this component of uncertainty (Murphy et al., 2007). Skinner et al. (1996) further explain that students are less likely to sabotage the group's performance when students are unsure of which reinforcer they are working towards receiving. Hawkins et al. (2009) suggest that teachers should include a pool of rewards that features at least one reward that is positively reinforcing to each student in the class. With a pool of reinforcers, students are likely to put forth greater effort when the reward is unknown and randomly selected (Hawkins et al., 2009).

Effects of Contingency Components on Academic Behaviors. Popkin and Skinner (2003) examined the effects of interdependent group-oriented contingencies on academic performance and randomly selected all components of the contingency: criteria, target behaviors, and reinforcers. They found that randomly selecting academic performance criteria, target behaviors, and reinforcers led to enhanced performance on independent seatwork assignments for five male students with emotional behavioral disturbance in a self-contained classroom. Interdependent group-oriented contingencies were implemented across three intervention phases, with students receiving access to randomly selected rewards contingent upon meeting randomly selected criteria based on the class average of daily assignments (Popkin & Skinner, 2003).

In the first phase of the intervention, the five students had the opportunity to earn access to rewards contingent upon the class average meeting a randomly selected criterion for spelling performance (e.g., 85% class average on the spelling test). If the class met the randomly selected criterion, the teacher randomly selected a reward for the class to receive (Popkin & Skinner, 2003). After nine days of targeting spelling performance, mathematics performance was added as a possible target behavior. The teacher would randomly select criteria from a goals box that contained both mathematics and spelling performance criteria. Finally, in the third phase, English performance was added as another possible target behavior. As each academic target (e.g. spelling, math, English) was added with each subsequent phase, the target students remained the same, yet the target academic behavior (e.g., spelling, math, or English), criterion (e.g., 80% accuracy, 85% accuracy, etc.), and rewards were randomly selected by the teacher (Popkin & Skinner, 2003).

Popkin and Skinner (2003) concluded that students demonstrated improvement in spelling and math performances following phases 1 and 2 in which those academic behaviors were targeted. When English performance was added as a target behavior in phase 3, increases in English performance were not as dominant, likely due to strong baseline performance in the area of English. Mathematics performance decreased in students when English performance was added as a target behavior, but this decrease only occurred for the first day of the third phase. One concern with including multiple target behaviors is that students are required to put forth more effort across three different behaviors in order to earn access to a reinforcer. In this case, it is possible that including multiple target behaviors with the same reinforcer requires too much effort from students (Popkin & Skinner, 2003).

Reinhardt et al. (2009) extended Popkin and Skinner's (2003) research by examining the effects of randomization of an interdependent group-oriented contingency on the homework accuracy of six fourth-grade students in a general education class. Similar to Popkin and Skinner (2003), Reinhardt et al. used a multiple baseline design in which each academic target behavior (reading comprehension, mathematics, and spelling) was added in subsequent intervention phases as a target behavior. Their results suggested that the interdependent group contingency with the randomly selected components (criteria, academic behaviors, and reinforcers) was effective in improving homework accuracy rates in the areas of reading comprehension, mathematics, and spelling (Reinhardt et al., 2009).

Sharp and Skinner (2004) used group contingencies with randomized criteria within their study to improve academic performance in reading. The researchers applied two interdependent group-oriented contingencies to enhance reading performance in second-grade students, with one contingency featuring a fixed criterion in which each student was required to pass at least one chapter book quiz for the class to receive access to the reward. For this contingency, if each student in the class passed at least one chapter book quiz within 6 weeks, the class would receive an ice-cream party. The other contingency featured a randomly selected criterion in which students were unaware of how many quizzes they must pass each week in order to receive access to the reward. Their teacher randomly selected the criterion from a bag containing slips of paper, ranging from 1 to 13 quizzes. If the class passed at least the randomly selected number of quizzes that week (e.g. 7), the entire class was awarded an extra half-hour of free time. To increase the probability that students would earn the reward for the first week of intervention, the teacher altered the slips of paper so that all of the slips contained the number "6" for the number of quizzes students must pass. Across the remaining five weeks of intervention, the slips of paper were not altered and were randomly selected.

Researchers found that the class met the fixed contingency criterion in which each student passed a chapter book quiz within six weeks (Sharp & Skinner, 2004). The class also met the randomly selected criterion in which the class passed at least the number of quizzes that was randomly selected from a bag each week over a period of six weeks. While researchers rigged the randomly selected criterion for Week 1 to ensure that the class met their goal, they cautioned future researchers from rigging selection of criteria (Sharp & Skinner, 2004).

Based on the increase in number of chapter book quizzes passed, the researchers suggested that the intervention was effective in increasing the class-wide reading performance (Sharp & Skinner, 2004). Although results from the study supported enhanced reading performance in participants, researchers were hesitant to develop strong conclusions because of their A-B design. Additionally, because the intervention featured multiple components, it is impossible to determine which components influenced the enhanced reading performance. At a four-week follow-up with the teacher, the teacher was continuing to implement the randomized group contingency with her students and had increased the criteria in her pool of numbers (number of quizzes passed each week). The data from the study suggest that the teacher found the intervention acceptable (Sharp & Skinner, 2004).

Group size

Another component to consider is group size and its influence on the effectiveness of group-oriented rewards. Shapiro and Goldberg (1986) suggested that individual student performance is more impactful towards group outcome in smaller groups as opposed to larger groups. To illustrate, when an interdependent group reward is implemented within a larger group, such as an entire class of 25 students, individual student performance may only contribute a small percentage to the overall performance of the entire group in meeting the specific criterion (Shapiro & Goldberg, 1990). For example, if the classroom of 25 students has a group contingency in which all students receive access to a reward if the class average on a math exam equals or exceeds 80%, then each student's performance constitutes 4% toward the class average (1 student out of 25 students). However, individual student performance will contribute substantially more, such as in the case of a small group consisting of only a few students (Shapiro & Goldberg, 1990).

Within the classroom, it is common for teachers to seat students in small groups. Considering the previous example of 25 students in a classroom, suppose the class is given access to a reinforcer if a small group meets the criterion of an 80% or higher average on a math exam. Within one small group of five students, each student in the group will contribute to 20% of the small group average (1 student out of 5 students), substantially more than the contributions of one student out of the entire class. Consequently, group size may influence student performance, with smaller groups being more effective for group-oriented rewards. When access to a reward is contingent upon only a few students as opposed to an entire class, those select students hold a higher stake in helping a class to receive a reward (Shapiro & Goldberg, 1990).

To evaluate their claims on the impact of group size, Shapiro and Goldberg (1990) examined the relationships between group size and types of group contingencies. Procedures were implemented across a two-part study with a specific focus on enhancing spelling performance in sixth-grade students. Researchers implemented an alternating treatment design across both studies. In study one, sixth-grade students from two classrooms were randomly assigned to either a large group ($n = 8$) or small group ($n = 4$) within each class and alternated between an interdependent and dependent group-oriented contingency (e.g., Group 1: interdependent condition/dependent condition; Group 2: dependent condition/interdependent condition). Students were assigned to the large and small groups based on mean baseline spelling test scores to ensure that groups had equal spelling test means (Shapiro & Goldberg, 1990). High-performing students were also paired in groups with low-achieving students.

The percentage of words spelled correctly on a daily 10-item spelling test was used as the target behavior (Shapiro & Goldberg, 1990). During the dependent condition, an unknown student's spelling test average was randomly selected from a large box; if that score was 90% or higher, the entire class received five points. The randomly selected student remained unknown to all participants. In the small group versus large group interdependent group contingency, groups received five points contingent upon the group's spelling test average performance of 90% or higher (Shapiro & Goldberg, 1990). This contingency was constant across both group size conditions.

On each day of the intervention for Study 1, the teacher announced both the group size condition (small versus large) and type of group contingency (interdependent versus dependent) that would be in effect for the following day (Shapiro & Goldberg, 1990). To ensure that students remained aware of which conditions were in effect for a particular day, each combination of group size and group contingency was assigned a specific color. Intervention procedures were implemented across three phases. During the first alternating-treatments phase, Group 1 was assigned to the interdependent condition and Group 2 was assigned to the dependent group condition. Across 16 days, participants experienced the group contingency under both large- and small- group conditions, as the sizes of groups were counterbalanced across treatment days. In the second intervention phase, group contingency type was reversed in which Group 1 was assigned to the dependent condition and Group 2 was assigned to the interdependent condition. Treatments continued across 16 days, with group size conditions counterbalanced in the alternating-treatments design. For the final phase, researchers implemented the condition that resulted in the highest spelling performance and was rated as most acceptable by participants: the interdependent group contingency in small groups (Shapiro

& Goldberg, 1990). This condition was implemented across both groups (the two classes) for eight days.

From their findings, Shapiro and Goldberg (1990) concluded that interdependent and dependent group-oriented contingencies influenced enhanced spelling performance, particularly for the low-achieving spelling students. No differences between group sizes were noted for either contingency condition. The researchers suggest that this failure to find spelling performance differences between either type of contingency and group size may be attributed to the size of the groups compared within the study (small = 4; large = 8). Because the differences between group sizes were substantially small, the researchers attempted to address the concern by comparing groups of four students against a large group of 48 students in Study Two (Shapiro & Goldberg, 1990).

In Study Two, Shapiro and Goldberg (1990) compared group size within only one type of contingency. The researchers examined the effects of large group ($N = 48$) versus small group conditions ($n = 4$) within an interdependent group-oriented contingency in two sixth-grade classrooms. Group size was counterbalanced across alternating treatment conditions. Similar to procedures in Study One, the percentage of correctly spelled words on daily 15-item spelling exams was used as the target behavior. In both group size conditions, groups received 5 points if the group spelling test average was 90% or higher. In an alternating treatment phase, group size was counterbalanced across 16 treatment days. A second treatment phase was implemented with only the interdependent small group (4 students) condition for seven days (Shapiro & Goldberg, 1990).

The results of Study Two also supported the effectiveness of interdependent group contingencies in enhancing spelling performance in low-achieving spellers (Shapiro & Goldberg, 1990). While improvements were noted in both the large- and small-group conditions, the researchers found that low-achieving students performed better in the small-group contingency condition of four students as opposed to the class-wide condition. This finding contrasted with the results of Study One in which no differences were found between group sizes.

Shapiro and Goldberg (1990) concluded that perhaps the group sizes of four and eight students in Study One were not substantial enough to produce an effect of group size. However, results from both studies supported that the use of interdependent and dependent group contingencies was effective in enhancing spelling performance in sixth-grade students (Shapiro & Goldberg, 1990). Moreover, in Study Two, researchers found that when an interdependent contingency was used, the low-performing students fared best in a small group condition. This finding may have applied advantages for educators when implementing group contingencies in the classroom. In a small group condition, each student contributes substantially more to the group average as compared to the large group condition. Referring to Shapiro and Goldberg's study, each student in the small group condition of 4 students accounted for 25% of the group average (1 out of 4 students), yet only approximately 2% of the average for the large group average (1 out of 48 students).

Results from Heering and Wilder's (2006) study examining the effects of a dependent group contingency on students' on-task behaviors also suggest the importance of evaluating the factor of group size. Researchers randomly selected rows of students and evaluated if students in that row were on task during academic instruction. If the chosen row of students were on task at the randomly selected time intervals (e.g., every 10 min.) during math class for 75% or more of the observed intervals, then all students in the class received access to a reward. Each classroom included four to five rows of students. Of particular importance to their study is that target students (the randomly selected row) were unknown to participants. The randomly selected rows were not revealed to the class; therefore, if a row was not on-task at the observed interval, other students were unaware (Heering & Wilder, 2006).

Heering and Wilder (2006) concluded that the dependent group contingency led to significant increases in on-task levels of students. It is likely that students were encouraged to remain on-task throughout the class because they were not aware of whether their row would be randomly observed. If a row of students was not selected, then those students contributed to 0% of the on-task contributions. However, in a classroom containing four rows of students, each row contributed to 25% of the on-task behavior if a row was selected one time across four randomly observed intervals (1 row out of 4). If a row was randomly selected more than once, then students contributed to an even greater proportion of the on-task behavior (i.e., if rows 1, 2, and 3 were selected once, while row 4 was selected 2 times over the course of the contingency). Consequently, group size may have had significant implications toward the effects of the contingency.

Purpose of the Current Study

The purpose of the current study was to evaluate and compare two different group-oriented contingencies in a first-grade classroom. The target behavior is the percentage of independent mathematics seatwork completed correctly. One contingency was an interdependent group-oriented reward. Students had the opportunity to earn access to the reward based on the class average math performance on the independent mathematics seatwork assignments. A particular limitation of this contingency is class size. With 16 students in the class, each student's performance only contributes 6% to the class scores. Another limitation is practical in nature.

Specifically, in order to determine if the class meets the criteria, each student's performance must be scored and then a class average must be calculated.

The other contingency that was applied is a randomly selected dependent group-oriented reward (Heering & Wilder, 2006). Students in this classroom sit in tables of four students. For this contingency, access to rewards was based on the performance of one table; however, this table was randomly selected and unknown to the students (Gresham & Gresham, 1982). Consequently, if a student's table was selected, each student's performance contributed 20-25% of the score. However, if a student's table was not selected, his or her score contributed 0%. Thus, we hoped to determine if randomly selecting a small group will allow educators to enhance the effectiveness of group contingencies when working with large groups. Also, this contingency may prove more acceptable to educators, as determining whether the group earns the reward requires grading fewer assignments. In order to address limitations associated with a priori criteria selection and reward identification, both criteria and rewards were randomly selected across all conditions (Skinner et al., 1996, 2009; Sharp & Skinner, 2004). Additionally, student and teacher acceptability data were collected (Turco & Elliott, 1990).

Research Questions

Specific research questions addressed in the study included:

1. Will students increase percentage of math problems correctly completed as a result of two types of group-oriented contingencies with randomized criteria and rewards:

    a. Class-wide interdependent group contingency?

    b. Randomly selected small group dependent group contingency?

2. Will group size be a factor in the effectiveness of the contingencies; will the dependent contingency (randomly selected small group average) versus the interdependent contingency (class-wide average) differ in effectiveness?

3. Will students and teachers find the treatments acceptable and will one of the contingency conditions (dependent versus interdependent) be preferred over another?

Chapter II

Method

Participants and Setting

Participants included 16 first-grade students at a rural elementary school in the Southeastern United States. The first-grade class was made up of 10 girls and 6 boys (14 Caucasian, 1 Hispanic, and 1 African-American student), one lead teacher, and one teacher assistant. All students were six or seven years old. No students in the classroom were retained from the previous year and no students were identified as having a disability. All participants completed the study each school day over a period of seven weeks in the middle of the fall semester. The lead teacher was in her second year of teaching. Procedures were conducted within the general education classroom. There were four round tables in the room and students spent most of the day working at their assigned tables. Four students were assigned to each table. An additional round table was located near the teacher's desk on the left side of the classroom. The teacher used this table for small-group instruction and progress monitoring. The primary researcher was a School Psychology doctoral student. The primary researcher implemented all procedures and graded all materials.

Informed Consent

Prior to beginning the study, informed consent was obtained from the teacher, the principal of the elementary school, the school district institutional review board, and the university institutional review board. Parental consent was obtained for completion of the student surveys. After these consents were obtained, assent was obtained from each student.

Materials and Measures

Materials for the current study included daily independent math assignments, manila envelopes with index cards listing the randomized criteria and reward options, a white envelope with index cards containing each table number, and rewards (e.g., candy). Three gift bags (pink, gray, and black) were labeled with the appropriate condition (pink bag = "Mystery Table Day", gray bag = "Class Day", and black bag ="No Mystery Day") and used to store index cards that contained criteria and table numbers.

Throughout the study, daily independent math assignments were not altered. Students continued to work on their mathematics assignments as part of their typical classroom routine. All students received the same daily assignments and no attempts were made in order to equate assignment difficulty across or within students. The independent math assignments consisted of worksheets selected by the teacher from various educational resources. It was expected that these worksheets required students to complete computation and word problems that corresponded to the particular math objectives that the class was currently studying. Underlying mathematical concepts on the assignments typically included addition and subtraction computations and word problems, fact families, ordinal rankings, inequality equations, and even/odd numbers. On some assignments, coloring components were included. Only computations were scored for those assignments and students were instructed to color only when they finished computations. Number of items for each daily math assignment within this study ranged from 8 to 60, with an average of approximately 26 (*SD* = 13. 40) items per assignment.

Design and Dependent Variable

An adapted alternating treatment design was used to evaluate the effects of the group-oriented rewards using unknown criteria on percentage of independent math work correctly completed (Sindelar, Rosenburg, & Wilson, 1985; Skinner & Shapiro, 1989). The target behavior was academic performance on the independent math assignments (percent correctly completed), which were administered to students upon arrival to their classroom in the mornings. The design included a baseline followed by an alternating treatments phase. During baseline, typical classroom procedures (TCP-BL) were applied, which included independent group-oriented contingencies. For the alternating treatments phase, one of two interventions was applied each day, with a typical classroom condition (i.e., baseline phase procedures) implemented one day per week (TCP-AT). For both treatments, all or none of the class received access to rewards. The class-wide condition (CWC) was an interdependent group reward in which the class' access to rewards was based on the class-wide average for the percentage of items completed correctly on the independent math assignment equaling or exceeding a randomly selected criterion. The small group condition (SGC) was a contingency in which the class' access to rewards was based on an unknown, randomly selected small group's average performance on the independent math assignment. Each group included all members of tables of four students.

Each day, students were given independent math assignments that were evaluated for accuracy by the primary researcher. Items that were not completed were scored as incorrect. For each assignment, the grader calculated the percent of items correctly completed. These data served as the dependent variables for this study. The class-wide mean accuracy on the math assignments represented the dependent variable for the CWC, while the randomly selected small group mean accuracy represented the dependent variable for the SGC.

Procedures

Baseline (TCP-BL). During the baseline phase, no additional contingencies were implemented within the classroom. Data collection took place across four consecutive school days. The typical classroom procedures and independent group-oriented contingency remained in place. In the morning, all students exited the cafeteria following the morning bell and entered the classroom. Upon entering the classroom, the teacher announced the independent math assignment and students were instructed to pick up the worksheet packet and begin working independently on the assignment at their seat. Students sat at tables (Table 1, 2, 3, or 4) consisting of four students. The teacher grouped students at tables according to behavior; those students who have demonstrated more problem behaviors were not typically seated at the same table in order to minimize classroom disruption. Each table was assumed to have heterogeneous groups of students of roughly equal ability levels.

Students were given approximately 25 minutes to work on their independent math assignment. At the end of the allotted 25-minute time period, the teacher collected the independent math assignments. The primary researcher immediately graded the assignments for percent completed correctly. Students received a percentage grade contingent upon their own academic performance on the independent assignment. Following initial grading, assignments with incorrect or incomplete items were redistributed to students to place in a "Work-to-finish" folder. Students had the opportunity to rework incorrect items or complete unfinished items throughout the school day during designated work times. After the students correctly completed all items on the assignment, they placed the assignment in a folder to send home. If the assignment was not correctly completed prior to recess time, students worked on the assignment during recess. The loss of recess time was a typical classroom procedure that was designed to function as an independent group-oriented punisher.

Teacher preparation and rewards/criteria generation. The primary researcher conducted a training session before the alternating treatment phase was implemented. First, the experimenter spent approximately 15 minutes reviewing the procedures with the lead teacher and teaching assistant. Next, the researcher provided the teacher and teaching assistant with a treatment protocol (see Appendix E). The teacher then proposed the acceptable rewards for the study. She included rewards that she believed were appealing to students and could be easily administered to individual students. These consisted of five possible rewards (i.e., a pencil, a sticker, a lollipop, a Starburst, or a Hershey Kiss). The primary researcher wrote each reward on an index card and placed it in the "Rewards" envelope. The primary researcher gathered all rewards so that they were readily available for all students in the classroom for each day of the alternating treatments phase.

Criteria were established and selected based on baseline data analysis. The 30 criteria were as follows: one index card with "25%", one index card with "40%", three index cards with "50%", three index cards with "70%", four index cards with "75%", four index cards with "80%", four index cards with "85%", five index cards with "90%", and five index cards with "95%". The primary researcher wrote each criterion on an index card and placed the card in a manila folder labeled "Goals." Although the index cards in the folder contained performance criteria, the term "goals" was used to enhance communication with the students (e.g., when describing the procedures and for the label on the folder).

Student training. The primary researcher, lead teacher, teaching assistant, and students met for one 20-minute group session at the beginning of the school day prior to the first day of the alternating treatments phase. The primary researcher introduced herself to the class and presented the procedures as the *Math Academic Reward Game* (as adapted by Popkin & Skinner, 2003). Using the script from Appendix F, the primary researcher informed students that they would have the opportunity to earn rewards based upon their performance on their independent math assignments. Students were told that either everyone or no one in the classroom would receive the reward based on either the class-wide performance or a "mystery table" performance. Students were also informed that on select days, typical classroom procedures would remain in place and no reward would be available (i.e., "No Mystery Day"). As the students sat in tables consisting of four students, each table knew their designated table number (1, 2, 3, or 4). At the end of the discussion, the primary researcher called on several students to explain the procedures to ensure student comprehension of the study.

Alternating treatments phase. During the alternating treatments phase, typical classroom procedures (TCP) remained in place. When students came in the classroom each morning, the primary researcher announced that it was a class-, mystery table-, or no reward-day. The alternating treatments phase was run for 24 consecutive school days, with the exception of a three-day holiday break after session 24. For the alternating treatments phase, there were three conditions: the randomly selected small group dependent condition (SGC), the class-wide interdependent condition (CWC), and the typical classroom procedures condition (i.e., baseline procedures, TCP-AT). The randomly selected small group dependent condition was selected as the first intervention based on a coin toss by the primary researcher. This intervention was implemented for two consecutive school days. The class-wide interdependent condition was then implemented for the next two consecutive school days to ensure that participants understood the distinction between the two group-oriented rewards (Sindelar et al., 1985). The contingency conditions were then randomly selected by a coin toss with a rule that there could be no more than two consecutive days of a contingency. Criteria were rigged for the first week of the intervention phase to ensure students met the goal. To control for spillover effects, the typical classroom procedures condition (TCP-AT) was implemented one day per week (Sindelar et al., 1985). The TCP-AT was pre-designated each week of the intervention to ensure that this condition was implemented on different days of the week in order to control for variability in student performance across different times of the week. When a criterion was selected each day, the index card with the chosen criterion was moved to a bag ("Mystery Table Day," "Class Day," or "No Mystery Day") that sat on the teacher's desk at the front of the classroom.

Procedures for small group dependent contingency condition (SGC). When students entered the classroom in the morning, the primary researcher announced that it was "Mystery Table Day." The researcher randomly selected a table from a small envelope with the designated table, but the table number was unknown to students. After the table number was randomly selected, it was placed in a small pink bag labeled "Mystery Table Day" and remained unknown to students. The researcher also randomly selected a criterion from the manila envelope labeled "Goals" and placed this randomly selected criterion in the "Mystery Table Day" bag for that day. The "Mystery Table Day" bag was placed on the teacher's desk at the front of the classroom for students to see as a reminder of the small group condition. Students were instructed to pick up their independent math assignments and were given 25 minutes to complete the assignments. At the end of the 25 minutes, the teacher announced that it was time for students to turn in their assignments to the primary researcher and move to the carpet to begin the morning lesson. While the students were at the carpet, the primary researcher graded the independent math assignments for each student of the randomly selected table and calculated a group average. If the small group's average met or exceeded the randomly selected criterion for that day, the researcher announced which table met the criterion and earned the class access to a randomly selected reward. This announcement was made immediately after the researcher completed grading of the assignments, while students were seated at the carpet. The researcher then randomly selected a reward from the rewards envelope and immediately distributed the reward to all students of the class. If the randomly selected small group did not meet the criterion for the day, then the researcher announced that the mystery table did not meet the criterion but this table number remained unknown to students.

Procedures for class-wide interdependent condition (CWC). For the class-wide interdependent condition, when students entered the classroom in the mornings, the researcher announced that it was a "Class Day" for earning a reward. The researcher randomly selected a criterion from the "Goals" envelope, placed it in a gray bag entitled "Class Day," and placed the bag on the lead teacher's desk at the front of the classroom as a visual reminder for students of the class-wide reward condition. Classroom procedures were identical to those used for the small group dependent condition, allowing students 25 minutes to complete their math assignments. When the teacher announced that it was time for students to move to the carpet to begin the morning lesson, the primary researcher graded the independent math assignments for each student in the class and calculated a class average. If the class average met or exceeded the randomly selected criterion for that day, the researcher announced that the class met the criterion and would receive access to a reward. This announcement was made immediately following grading of the assignments, usually while students were seated at the carpet. The researcher then randomly selected a reward from the rewards envelope and immediately distributed the reward to all students of the class. If the class did not meet the randomly selected criterion for the day, then the researcher announced that the class did not meet the criterion and would not receive a reward for that day.

Procedures for typical classroom condition. On days in which the class did not have the opportunity to receive access to a group-oriented reward, typical classroom procedures remained in place. When students entered the classroom in the morning, the teacher announced that it was "No Mystery Day" day, but students were expected to accurately complete their independent math assignments. If students did not accurately complete the math assignment by the end of the day, then students lost recess time and were expected to work on the math assignment during recess. The primary research graded each student's independent math assignment following the allotted 25-minute time period to complete the assignment. Assignments were redistributed to students in their "Work-to-Finish" folder to correct or complete inaccurate items.

Analysis procedures. After each day, the class average and small group average of percent correctly completed on the independent math assignment was plotted on a time-series graph. Visual analysis of this graph was used to make judgments regarding the variability, trend, or level in the data in order to determine if and when a clear separation occurred between the contingency conditions. This analysis was used to determine when the alternating treatments phase should discontinue.

Procedural Integrity and Interscorer Agreement. To ensure that the intervention was implemented as intended, the primary researcher or the assistant teacher reviewed a checklist comprising all treatment components prior to the onset of the intervention session (Appendix E). Following completion of the intervention session, the primary researcher completed the checklist. The assistant teacher independently recorded procedural integrity across 50% of the intervention sessions. Results showed 100% procedural integrity across all sessions. The primary researcher scored all individual math assignments. A teaching assistant independently scored a randomly selected sample of 30% of the in-class assignments to ensure interscorer agreement. The number of agreements was divided by the number of agreements plus the number of disagreements and then multiplied by 100. Inter-scorer agreement was always 100%, with the exception of Session 24 in which inter-scorer agreement was 86%. Total inter-scorer agreement was averaged to be 99%.

Social Validity Measure. Treatment acceptability was evaluated through a paper-and-pencil survey administered to participants following all data collection procedures. To evaluate teacher acceptability, after the last session of data collection, both the lead teacher and assistant teacher completed an 11-item Likert-type scale (see Appendix B). The scale ranged from 1 ("Strongly Disagree"*)* to 6 ("Strongly Agree"). This scale was adapted from some items of an acceptability measure developed by Fudge et al. (2008). The lead teacher also participated in a semi-structured interview (see Appendix C) with the primary researcher after the last session of data collection.

An 11-item Likert-type picture scale (Appendix D) was used to determine student acceptability for the contingencies. The picture scale ranged from "Very Much," "Don't Care," or "Not at All." Only those students who obtained parental consent completed the questionnaire. Fourteen students completed the questionnaire, as one student did not bring back consent and one student's parent did not grant consent. The primary researcher administered the survey to each small group table and read all items aloud to the students. These items were completed independently and anonymously. Items focused on the extent to which students believed that the contingencies assisted with completion of math assignments. At the end of the survey, participants responded to two forced-choice social validity items regarding their preferred condition and their classmates' preferred condition.

Chapter III

Results

Visual Analysis of Alternating Treatments Graphs

Figure 1 (Appendix A) depicts an alternating treatments graph that displays the class average on the independent math assignments (i.e., percent correctly completed) across baseline and alternating treatments phases. Because decisions (e.g., when to begin and end alternating treatments phase) were based on visual analysis of class average data (e.g., variability, trends), any attempt to analyze individual or small group (e.g., assigned tables) performance using visual analysis of repeated measures graphs was abandoned. For those interested in how each table performed, see the repeated measures graphs in Appendix A (Figures 2-5).

Table 1 provides descriptive data across all conditions for the entire class and each small group (i.e., assigned table for math assignments). Additionally, to provide clear data on effect size, these averages were transposed to letter grades based on the following 10-point scale: 90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, and 59% and below = F. The data in Table 1 will be referenced when discussing results for Figure 1.

Figure 1 shows that during the first baseline session, the class average math performance was lower (57%) than the final three days of baseline, which showed little variability and no clear trend ($\overline{X}$= 66.3, *SD* = 0.58). Immediately after each group contingency was implemented, math performance increased and remained higher throughout the alternating treatments phase. As shown in Table 1, during the alternating treatments phase, means for both the CWC intervention ($\overline{X}$ = 83.4) and SGC interventions ($\overline{X}$ = 83.9) were similar and both were higher than typical classroom procedures during the baseline phase ($\overline{X}$ = 64.0) and alternating treatments phase ($\overline{X}$ = 62.5). These average performance data support visual analysis of Figure 1 and suggest that both interventions led to increases in class-average performance on independent math assignments, with neither intervention being superior to the other.

Visual analysis of alternating treatments phase data (see Figure 1) reveals no consistent trends for either intervention condition. The data for the small group condition is more stable (*SD* = 4.5) than the class-wide condition (*SD* = 7.7). Also during the alternating treatments phase, there is no clear trend for the typical classroom procedure condition (TCP-AT); however, there was one outlier (Day 15) when performance was unusually low ($\overline{X}$ = 47.0). Excluding this outlier, the data during the TCP-AT condition is very stable and similar to the final three baseline sessions. These comparisons of TCP across baseline and alternating treatments phases suggest that the carryover effects or contrast effects did not contaminate our class average findings (Sindelar, Rosenburg, & Wilson, 1985; Skinner & Shapiro, 1989).

Statistical Analysis of Class-Average Data Across Phases and Conditions

Means and letter grades. Data displayed in Table 1 show that class average performance under typical classroom procedures for both baseline (64%) and alternating treatments (63%) phases would result in a letter grade of D. During the alternating treatments phase, the two interventions increased the class-wide average to a B (i.e., 84% for small group contingency intervention and 83% for the class-wide contingency). These data suggest that both interventions caused meaningful or educationally valid increases in mathematics performance. The class received access to the reward 9 out of 10 (90%) times in the SGC and 8 out of 10 times (80%) in the CWC.

Table 1 also indicates that each small group (assigned table) performed better under both treatments (small group condition and class-wide condition) than the typical classroom management procedures (TCP), baseline and alternating treatments phase. Group 2 showed the most improvement. The group's average performance during both TCP conditions would result in an F grade. Under both treatment conditions, their group average would earn a grade of B.

When comparing the two treatment conditions to the two TCP conditions, the other three groups increased their small-group letter grade by one or two letter-grades. All mean differences amount to at least one letter grade improvement under the two treatments.

Effect sizes. Class-average data across phases and conditions was also compared using two methods for calculating effect sizes, percent non-overlapping data points (Parker & Hagan-Burke, 2007) and Hedges' *g* (Hedges, 1981). The effect size data are displayed in Table 2, which presents the class-wide comparisons across all phases and conditions of the study. When SGC is compared with both typical classroom procedures conditions (TCP-BL and TCP-AT), there are no overlapping data points. Thus, each SGC session resulted in higher class average math performance than each TCP session. Also, when CWC data is compared to the TCP-BL data there are no overlapping data points. When CWC data is compared to TCP-AT, 90% of the data points are non-overlapping. These data suggest that both interventions (SGC and CWC) had a consistent positive effect on math performance, with the one exception, comparing sessions 9 (TCP-AT = 67%) and session 10 (CWC = 68%). The difference in this overlapping data point was only 1%. For the two interventions, only 10% of the data are non-overlapping, which suggests no consistent differences in treatment effects across the two treatments. PND analysis supports visual analysis of repeated measures graphs, which suggest that both interventions caused similar increases in class average math performance.

Percent nonoverlapping data (PND) provides an indication of the consistency of differences, but it does not take into account the size of differences. Hedges' *g* was calculated by comparing the difference in means across conditions divided by the pooled standard deviations of the corresponding conditions. Analyses' comparing both interventions to each TCP condition revealed large increases in math performance (see Table 2). Effect sizes comparing the SCG condition to both TCP conditions were large (i.e., *g* = 4.37 TCP-BL to SGC; *g* = 3.29 TCP-AT to SGC). Effect sizes comparing the CWC condition to both TCP conditions were large (i.e., *g* = 2.74 TCP-BL to CWC; *g* = 2.47 TCP-AT to CWC). Effect sizes comparing the two interventions yielded a very small effect size (i.e., *g* = 0.08 SCG to CWC). Thus, Hedges' *g* calculations are consistent with visual analyses of repeated measures graphs and PND analyses, as they suggest that both interventions caused large increases in class-wide math performance, with no meaningful differences across the two treatments.

Within-Student Analysis

Descriptive statistics. Table 3 presents the mean and standard deviation data for each student across conditions. In comparing TCP-BL conditions to the intervention conditions, average math performance was higher for 14 of the 16 students (88%) during the small group condition and 13 of the 16 students (81%) during the class-wide intervention. Across both interventions, the exceptions were students 2, 8, and 10 (see Table 3).

As math objectives typically become more difficult as students progress through the curricula, comparisons of intervention performance with TCP-AT are fairer than those from the TCP-BL. Two students (Student 11 and 12) had perfect (100%) TCP-AT scores. Both students had lower scores during the intervention conditions, but these scores still ranged from 94% to 98%. The only other student to score lower on a treatment conditions was Student 1, who averaged a 78% during the TCP-AT condition, but a 64% during the CWC condition. Further analysis of data for Student 1 revealed that the student was absent for seven (25%) sessions, which may account for this decreased performance. Student 1 was absent for one TCP-BL session, two consecutive SGC sessions, three CWC sessions across two consecutive weeks, and one TCP-AT session.

Effect size analysis: Hedges' *g*. Mean differences across conditions, along with pooled standard deviations for each student, are shown in Table 5. These data were used to calculate within-student effect sizes, Hedges' g. Table 6 presents the effect size (ES) for each student across phases and conditions (96 comparisons). Table 7 shows the frequency of small ($ES \leq .30$), medium ($0.30 < ES < 0.50$), and large effect sizes ($ES \geq 0.50$) across participants.

Table 7 supports all earlier analyses, which suggest no consistent differences across students when comparing TCP during baseline and alternating treatments phases and no consistent difference across students when comparing the SGC and CWC treatments. However, it is important to note that when comparing SGC with CWC, 7 students had moderate or large effect sizes favoring the SGC condition, while 4 had moderate or large effect sizes favoring CWC. While these data suggest moderate to large idiosyncratic effects, ES comparisons can be heavily influenced by within-condition standard deviations. When within-subject, within-condition standard deviations are very small; small mean differences can result in large ES scores. Analyses comparing SGC to both TCP conditions show large increases in math performance for 11 of the 16 students (69%). Analyses comparing CWC to both TCP conditions shows large increase in math performance for 10 of the 16 students (63%). These data suggest that the intervention caused meaningful increases for the majority of the students in the class.

When comparing SGC to TCP-AT, only two students had a negative effect size. Again, these were Students 11 and 12 who scored 100% during BL and 98% and 96%, respectively, during the SGC condition. When comparing CWC to TCP-AT, 3 students had negative effect sizes. Again, Students 11 and 12 went from 100% during TCP-AT to 94% and 98%, respectively, during CWC. The only other student to show a decrease or negative ES was

Student 1, who went from 78% during TCP-AT to 64% during CWC. While this decrease was large, the student was also absent for 25% of the sessions.

Letter grades. While effect size data are often used to provide an indication of the strength of an intervention, analyses of individual students' grades may provide a better understanding of the effect of the intervention (Popkin & Skinner, 2003). Table 4 shows letter grades across condition and corresponding percent correct scores. Because TCP-AT was interspersed with the two treatment conditions and TCP-BL occurred earlier, perhaps when the curricula were easier, the grade change comparison will focus on comparing the two interventions with TCP-AT.

Comparing SGC to TCP-AT shows that 12 of the 16 (75%) students increased their letter grade under the SGC intervention and 4 (25%) students had no change in their letter grade. Of the 12 students who increased their letter grade, 6 students increased their performance 1 letter grade, 5 students increased their performance 2 letter grades, and 1 student (Student 16) increased his performance 4 letter grades. Specifically, Student 16 had an F (59%) under TCP-AT and an A (90%) under SGC.

Of the 4 students who showed no difference in letter grades across SGC and TCP-AT conditions, Students 11 and 12 had 100% during TCP-AT; consequently, they could not increase their letter grade or percent correct performance. For these two students, the more important comparison may be of their TCP-BL performance with their TCP-AT, SGC, and CWC scores. During TCP-AT, SGC, and CWC, Student 11 and Student 12 earned a letter grade of A across all conditions and percent correct scores ranging between 94% and 100% across all conditions. However, TCP-BL data were lower as Student 11 earned a B (82%) and Student 12 earned a D (64%). The increased performance across all conditions after the interventions were applied may be an indication of spillover effects. For example, these students may have begun to apply themselves after the intervention phase began, even under the TCP-AT condition when no reinforcement was offered. The other two students (Students 6 and 7) who showed no letter grade increases had letter grades of F across all conditions and phases. However, when comparing TCP-AT to SGC, Student 6 increased his performance from 39% to 53% and Student 7 increased performance from 9% to 45%.

Comparing CWC to TCP-AT shows that 10 of the 16 students increased their letter grade under the CWC intervention. Of these 10 students, 4 students increased their performance 1 letter grade, 5 students increased their performance 2 letter grades, and 1 student (Student 3) increased his performance 3 letter grades; from an F (49%) to an B (84%). Of the 16 students, 5 showed no change in letter grades. Of these 5 students, 2 students (Students 11 and 12) had 100% during TCP-AT, thus, they could not increase their letter grade or percent correct scores. Student 5 increased his average performance from 81% to 89%, Student 8 from 25% to 51%, and Student 15 from 73% to 75%. Only 1 student had a stronger performance on TCP-AT relative to CWC. Student 1 had a letter grade of C (78%) during TCP-AT and a letter grade of D (64%) during CWC. Again, because this student was an outlier, we investigated his attendance and found he had missed 25% of the school days when sessions were run.

Comparing the SGC to the CWC performance shows no difference in letter grades across 8 of the 16 (50%) students. For 6 students (Students 1, 3, 4, 5, 15, and 16), the SGC intervention was associated with a higher letter grade than the CWC intervention, with 5 students scoring 1 letter grade higher and 1 student scoring 2 letter grades higher. For two students (Students 6 and 7), the CWC intervention results in a higher letter grade than SGC. For both students, the CWC was associated with a 2 letter-grade improvement over SGC.

When examining letter grades and percent correct across conditions for each student, it appears that most students benefited from both interventions. Of those who did not benefit, only one meaningful difference was found. Specifically, Student 1 showed a lower performance under CWC relative to TCP-AT. However, this outlier may have been influenced by excessive absences.

Teacher Acceptability

Both the lead teacher and assistant teacher were given acceptability forms (see Appendix B) to complete immediately following the last day of the alternating treatments phase. The lead teacher rated each item a 6 on the rating scale, "strongly agree," with the exception of Item 8, suggesting that she strongly prefers the small group dependent group condition over the class-wide interdependent group condition (refer to Table 8). The assistant teacher rated each item with either a 5 ("agree") or 6 ("strongly agree"), with the exception of Item 8, also suggesting that she prefers the SGC intervention in comparison to the CWC intervention. These data suggest that both teachers found both contingency conditions to be highly acceptable, with a greater preference for the small group dependent group condition, or Mystery Table Day.

The lead teacher participated in an individually administered semi-structured interview (see Appendix C). She indicated that the *Math Academic Reward Game* was a system that she hopes to continue implementing and extend to other academic subjects (e.g., spelling). She reported improvement in student academic performance as well as behavior. She noticed that many of her students spent more time completing assignments and were careful to answer all of the items before turning in the assignments. The lead teacher also noticed that many students used block manipulatives to assist with math problems; she noted that she rarely observed this behavior prior to the intervention.

The lead teacher also reported that many students commented how much they enjoyed the *Math Academic Reward Game* and were very eager each morning to find out which condition would be implemented. She reported that the intervention allowed her more flexibility in working with a student receiving Tier II services through Response to Intervention (RtI) because other students were motivated by the potential incentive to complete their independent math assignments. Also, she reported that the class average for benchmark assessments in mathematics was higher following the implementation of the intervention. The teacher indicated that she believed that the *Math Academic Reward Game* was fair across all students and that it worked well in motivating her students to accurately complete their math assignments. She believed that it was most effective for students who typically did not complete their independent assignments or simply wrote down random, incorrect answers to most items.

The lead teacher reported some negative aspects of the *Math Academic Reward Game.* She reported that the intervention did raise the noise level in the classroom, as she often had to tell the class to lower their voices. Additionally, she commented that on one occasion she observed a student giving answers to a peer, adding that some of the students likely felt some pressure to perform, especially those lower achieving students.

When asked why she preferred the small group dependent condition (“Mystery Table Day”) over the class-wide interdependent condition, the teacher reported that the SGC was more manageable because it required less grading and was thus more time efficient. This was confirmed by analysis of time to grade each daily assignment, with average time to grade each small group at 2 min 51 s, and average time to grade the entire class at 11 min 4 s (refer to Table 11). The teacher also reported that students appeared to enjoy the additional mystery component of which table would be chosen. The teacher expressed interest in continuing to use the intervention in the future, but noted that it would be more difficult to manage in the absence of the primary researcher, as the primary researcher graded all assignments throughout the study. When asked what she would change regarding the procedures, the teacher reported that immediately providing rewards, at times, was distracting to students and she would prefer to distribute rewards at the end of the school day. This change would also provide the teacher with more time to score the students' work. Overall, the teacher reported that she really enjoyed the intervention procedures and felt that it improved math academic performance in her students. Her responses suggest a strong level of teacher acceptability.

Student Acceptability

Table 9 summarizes the student reported, forced choice, social validity data. Social validity results were positive across the 14 students who completed the student acceptability survey. Of the 14 students, 10 (71.4%) indicated that they preferred the small group intervention (Mystery Table Day), while four students (28.6%) reported that they preferred the class-wide intervention (Class Day). When asked which condition their classmates preferred, 9 students (64.3%) reported the Mystery Table condition, while 5 students (35.7%) reported the Class Day condition.

Table 10 summarizes acceptability of the group contingencies, without distinguishing between the two interventions. All students (100%) who completed the survey rated that they “very much” liked the *Math Academic Reward Game* and believed that it was “very much” fair across all students in the classroom. The majority of students (92.9%) rated that they “very much” thought the *Math Academic Reward Game* helped their small groups complete their work, while all students (100%) rated that the intervention “very much” helped them to complete their individual assignments. These responses suggest a strong level of student acceptability for both interventions.

Chapter IV

Discussion

This dissertation was designed to evaluate and compare two group-oriented contingencies in a first-grade classroom. While previous researchers have validated the efficacy of both interdependent and dependent group-oriented contingencies on academic behaviors (Hawkins et al., 2009; Popkin & Skinner, 2003; Reinhardt et al., 2009; Skinner et al., 2002), the current study extends this research by evaluating the practical implications of group size with inclusion of randomly selected components (i.e., criteria and rewards).

Evaluating Each Intervention

Class average data provide some consistent and clear results with respect to ruling out threats to internal validity. During the alternating treatment phase, mathematics performance increased over TCP-BL performance on days when interventions were applied. The failure to find increases in performance on days when TCP was applied during the alternating treatment phase suggests that threats to internal validity did not contaminate these findings. Also, because student performance during TCP across the alternating treatments and baseline phases was very similar, the current results suggest that multiple-treatment interference (e.g., spillover effects, contrast effects) had little impact on our class average results. These findings were supported by visual analysis of repeated-measures graphs and effect size calculations. Consequently, the current study provides strong evidence that both interventions enhanced class average mathematics performance.

The class-wide math average improved two letter grades from TCP conditions to both intervention conditions, increasing from a D average during both TCP conditions to a B average across both contingencies. Analyses of small group (i.e., tables) data demonstrate large and educationally valid improvements across both interventions, with letter-grade improvements ranging from one letter to three letter-grade increases across the small groups. Across individual student data and comparing TCP-AT data to the small group condition at the individual student level showed that all students either improved or maintained their letter-grade averages under the small group condition. When comparing TCP-AT data to the class-wide condition, 15 of 16 students either improved or maintained their letter-grade average under the class-wide condition, with the exception of one student (Student 1), whose atypical performance may have been caused by his excessive absences.

With the exception of Student 1, the current study provides evidence that both interventions either enhanced or had no meaningful impact on each student's mathematics performance. Thus, the results of the current study add to the body of research validating the utility of dependent and interdependent group-oriented contingencies with randomized contingency components for enhancing mathematic performance of general education students (Kelshaw-Levering et al., 2000; Popkin & Skinner, 2003; Reinhardt et al., 2009; Sharp & Skinner, 2004; Skinner et al., 2004).

Relative Effectiveness

Visual analysis of class average repeated measures graphs suggests neither intervention was superior to the other. This finding was also supported by measures of effect size. Thus, analysis of class-wide data suggests that both interventions were similarly effective. Analysis of individual student performance showed that for some students, one intervention was superior to the other; however, no consistent difference emerged across students. This finding is consistent with other research comparing the effectiveness of various group-oriented contingencies (Kelshaw-Levering et al., 2000; Theodore et al., 2004).

All students and teachers rated both intervention conditions as highly acceptable. When comparing the two interventions, we found few meaningful or consistent differences on their impact on math performance; however, social validity data provide more support for the small group dependent condition than the class-wide condition. Social validity data revealed that both teachers and most students preferred the small group dependent condition. Of the 14 students who participated in the student acceptability survey, 71.4% preferred the small group condition. Both the lead teacher and teacher assistant reported preference to the small group condition. Specifically, the lead teacher reported that the small group condition was preferable to the class-wide condition because of the practical implications associated with grading fewer assignments and calculating the average from fewer assignments. Additionally, the teacher reported that the additional mystery component of a randomized, unknown small group was appealing to students. Thus, despite some limitations, the current findings of this study have theoretical and applied implications.

Applied and Theoretical Implications

An interview with the lead teacher suggests several positive and negative side effects associated with the application of these group contingencies. In a semi-structured interview, the teacher indicated that her students improved their scores on math RtI benchmark assessments. Thus, future researchers should determine if the application of group contingencies yields broader improvement in math skill development. Also, she reported that after she implemented the group contingencies, students used their block manipulatives to assist with their math assignments. She noted that students did this independently, without teacher prompting. Future researchers may want to consider evaluating the effects of group contingencies on other math-related behavior (e.g., using manipulatives, checking their work).

Teachers also reported that the interventions were easy to implement and highly acceptable. Both the lead teacher and assistant teacher preferred the small group condition to the class-wide condition, with reports indicating that the small group condition was more time-efficient and practical to carry out in a classroom setting due to the ease of grading only four student assignments in comparison to 16 student assignments. Analyses examining the time-to-grade small group assignments versus class-wide assignments confirm that the small group condition was time-efficient.

Although results suggest that both intervention conditions led to increases in mathematics performance for almost every student in the classroom, some negative side effects of the intervention were reported. Before the study began, the teachers were informed that students might be more likely to help each other when the contingencies are applied, but they were also warned that they might just give each other the correct answers. The teachers were told to monitor and prompt students to stop giving answers to their peers. In one instance, the teacher observed one student giving another student answers to items. This occurred during the small group condition. This instance suggests that future researchers may want to determine if specific types of contingencies (e.g., small group dependent) are more likely to occasion inappropriate behaviors (e.g., giving peers' answers instead of helping them solve problems on their own) in certain contexts (e.g., when each small group sits together at their own small group table). In this instance, the teacher observed another student providing answers to an assignment for another student in his or her small group, suggesting that at least one first-grade student was conscious of the role of classmates' performance towards earning the group reward.

Another negative side effect reported from the teacher included an increase in classroom volume. The teacher had to prompt the class to lower their voice volumes several instances throughout the study. This occurred across each intervention type, sometimes when students were working, but most frequently before or immediately after the random components were revealed. While this negative side effect is a concern associated with using randomized components, the teacher also reported that the students appeared to like the small group dependent condition because it included an additional randomized component.

Despite the disruptive nature of increase in classroom volume, it is probable that small group members encouraging one another (e.g., prompting or praising) or working together contributed to this increased noise. Slavin (1987) discusses the implications of peer interaction and student cooperation on the effectiveness of group contingencies. Because the probability of students' receiving access to a reward is increased when both their own performance and their peer's performance meets or exceeds expectation, students are likely to encourage one another and rely on one another, which is likely to enhance the effectiveness of the contingency (Kelshaw-Levering et al., 2000; Slavin, 1987). This support between peers is likely to be reflected with increased noise levels within the classroom during group work times. Future researchers may want to determine if the effectiveness of group contingencies is positively correlated with increased noise.

All study procedures were carried out while the lead teacher was working individually with a student receiving Tier II intervention services to align with the state-mandated RtI program. Results of the current study show immediate, educationally valid increases in math performance across almost all students and across class-wide averages, suggesting that group contingencies are an effective intervention for teachers to implement during independent seatwork times. As educators face increased expectations to designate time for RtI services within the classroom, these research findings suggest practical advantages for educators as a means of promoting academic behavior during independent work times. Due to the nature of only grading a few students' assignments in the small group dependent contingency, the small group intervention represents another advantage for educators seeking efficient and easy-to-administer interventions.

Limitations and Future Research

Despite many advantages, future researchers should address several limitations of the current study. Because this study was conducted in only one classroom, there are numerous threats to external validity that should be addressed by future researchers. Future researchers should evaluate and compare similar interventions across different settings (e.g., general education classroom, larger classroom, special education classrooms), students (e.g., age, ethnic background, gender), and teachers. It may be helpful for future researchers to evaluate these contingencies within an upper-elementary or middle school classroom. Also, the small group condition was developed to fit this classroom's context; students work in tables of four students. Future researchers may want to conduct similar studies without intact groups.

Another limitation of this study is related to assignment variation. Assignments varied in number of problems and concepts across sessions. Because math objectives and content typically become more difficult as students progress through the curricula, our comparisons of TCP-BL with any other condition are tenuous. Perhaps future researchers should conduct more tightly controlled studies with standardized assignments.

In addition, future researchers should conduct similar studies across different target behaviors (e.g., reading, language arts, disruptive behaviors). Researchers may also want to consider whether the sequential addition of other target behaviors (e.g., spelling) enhances the effectiveness of intervention procedures (see Popkin & Skinner, 2003). While math performance was the only target dependent variable within the current study, future researchers should compare these intervention procedures with inclusion of randomization of contingency components across multiple academic subjects.

The lead teacher reported that she thought the procedures were most effective with the low-performing students who were not motivated to do the work. The current data does show some rather remarkable increases in performance for some low-performing students. Future researchers may want to consider using reinforcement procedures during achievement testing to ensure that they obtain a more accurate depiction of student skill development.

The current study was only run for about seven weeks. Future researchers may want to implement longitudinal studies to determine if both interventions would remain effective over time, and evaluate effects on math esteem and attitudes of students. Low-performing students in the current study demonstrated dramatic improvements in their math performance, which may have likely increased math esteem.

The *Math Academic Reward Game* was implemented mid-way through the fall semester and continued until the start of the holiday break. Because of the holiday break, no maintenance data was collected in order to determine whether math performance remained high when the alternating treatments phase was withdrawn. Future researchers should evaluate whether this increase in math performance remains enhanced even when intervention conditions are not in place.

Alfie Kohn argues that external rewards lead to decreased intrinsic motivation in students, known as the overjustification effect (Kohn, 1999). In comparing TCP-BL data to TCP-AT data, 5 students improved performance and 5 students maintained the same letter-grade; 6 students demonstrated a decrease in performance in the TCP-AT condition. These results suggest that most of the students' (63%) performance did not align with the overjustification effect. It is also important to consider that the TCP-AT data represents a fairer depiction of student performance in comparison to TCP-BL data, as math objectives become more difficult as students progress through the curricula. Those students with decreased math performance from TCP-BL to TCP-AT may have been a result of more difficult mathematics content.

There are also limitations associated with teacher and student acceptability surveys. Both the lead teacher and assistant teacher rated all items as either *agree* or *strongly agree*, which shows high acceptability toward the intervention conditions. Teachers may have rated the interventions as highly acceptable in order to please the primary researcher. Additionally, because the primary researcher graded all daily assignments in the study, gathered the rewards, and trained the students, teacher acceptability ratings may not generalize to conditions where teachers run all aspects of the contingency.

Students completed the social validity surveys at their small group tables. While the primary researcher read each item aloud and ensured that the students understood that there was no right or wrong answer, the first-grade students may have been easily influenced by what their peers were marking as answers on their papers. Most students in the class rated each item as *very much*, suggesting high acceptability. Also, the majority of students (63%) completing the survey reported a preference for the "Mystery Table" condition. It should be noted that students received access to the reward 90% of the time in the small group condition compared to 80% of the time in the class-wide condition, suggesting that a higher instance of earning the reward in the small group condition may have caused higher preference for "Mystery Table Day." Future researchers should evaluate the influence of frequency of access to rewards and relationship with acceptability ratings. Similar to the teacher data, it is also possible that students rated the intervention highly acceptable in order to please the primary researcher. Further social validity data should be collected with more participating students and teachers in more natural environments (e.g., when a teacher implements all procedures).

The lead teacher reported that one aspect of the intervention procedures that she would modify was the immediacy of the reward delivery, as it was sometimes distracting from classroom instruction. Additionally, the teacher indicated that she would not always be able to score assignments immediately after they were completed. Future researchers should conduct similar studies when feedback and reinforcement is more delayed.

Criteria were randomized within the current study in order to address individual development across students and account for low-performers versus high-performers (Hawkins et al., 2009; Kelshaw-Levering et al., 2000; Skinner et al., 2004). The 30 possible criterions remained constant throughout the study. Future research may warrant adjustment of these criteria based on performance data. For example, as students enhance their performance researchers should enhance their criteria (see Sharp & Skinner, 2004).

In addition to randomization of rewards and criteria, future researchers should consider randomization of target behaviors and unknown target students. Similar to Gresham and Gresham's (1982) study, future researchers should consider randomly selecting one student. While the small group dependent condition was more practical than the class-wide condition, random selection of one student would require even less scoring time.

Summary and Concluding Remarks

Previous researchers have validated group-oriented contingencies as a means of enhancing academic performance across target behaviors and students (Heering & Wilder, 2006; Popkin & Skinner, 2003; Turco & Elliott, 1990). Positive effects of both dependent and interdependent contingencies have been examined within the group contingency literature

(Gresham & Gresham, 1982; Hawkins et al., 2009; Heering & Wilder, 2006; Popkin & Skinner, 2003; Reinhardt et al., 2009; Sharp & Skinner, 2004; Skinner et al., 2004). Many educators have concerns, however, with the aspect of reinforcing academic performance, arguing that this reinforcement may decrease the likelihood that students would engage in academic behaviors if these reinforcement procedures were withdrawn (Skinner et al., 2004). Researchers suggest that implementing unknown, randomly selected components reduce many of the potential limitations associated with group reinforcement (McKissick et al., 2010; Popkin & Skinner, 2003; Skinner & Watson, 1997; Skinner et al., 2004).

In the current study, class-wide math performance was at a D average across typical classroom procedures. After implementation of both group interventions, class-wide performance increased by two letter grades, to a B average. Increased math performance was also demonstrated across each small group and across individual students. These research findings hold important implications for educators. Within the current study, group-oriented contingencies with randomized reinforcement and criteria represented an efficient and easily administered intervention for enhancing academic performance for this classroom of first-grade students. This finding was consistent with previous research that suggests academic performance improves when group contingencies are implemented within the classroom (Popkin & Skinner, 2003; Reinhardt et al., 2009; Sharp & Skinner, 2004; Skinner et al., 2004).

While no meaningful differences were found between the two interventions, social validity findings reveal that the dependent, small group contingency was preferred to the class-wide interdependent contingency across teachers and most students. When considering implementation of group-oriented contingencies within the classroom, educators are encouraged to use randomly selected small group dependent contingencies for time-efficiency purposes.

Also, the additional mystery component of the unknown small group may be especially appealing to younger students.

The current study involved delivering a piece of candy, a pencil, or a sticker on days when the student met criteria. Also, the current small-group condition required teachers to perform scoring tasks earlier than they normally would have scored assignments. Finally, the current study increased noise levels in the classroom. When one weighs these costs, with the benefits of increasing class average performance by two letter grades, the small group contingency seems well worth the cost. When one considers other much more costly intervention and remediation procedures (e.g., RtI, after-school programs) that may not occasion as much improvement as the small-group condition, the current results may be even more impressive. Thus, future researchers interested in enhancing academic performance using contextually valid procedures should continue to investigate group-oriented contingencies.

References

Barrish, H.H., Saunders, M., & Wolf, M.M. (1969). Good behavior game: Effects of individual contingencies for group consequences on disruptive behavior in a classroom. *Journal of Applied Behavior Analysis, 2*, 119-124.

Coogan, B.A., Kehle, T.J., Bray, M.A., & Chafouleas, S.M. (2007). Group contingencies, randomization of reinforcers, and criteria for reinforcement, monitoring, and peer feedback on reducing inappropriate classroom behavior. *School Psychology Quarterly, 22*(4), 540-556.

Fudge, D.L., Skinner, C.H., Williams, J.L., Cowden. D., Clark, J., & Bliss, S.L. (2008). Increasing on-task behavior in every student in a second-grade classroom during transitions: Validating the color wheel system. *Journal of School Psychology, 46,* 575-592.

Gresham, F.M., & Gresham, G.N. (1982). Interdependent, dependent, and independent group contingencies for controlling disruptive behavior. *Journal of Special Education, 16*, 101-110.

Harris, D.N., & Herrington, C.D. (2006). Accountability, standards, and the growing achievement gap: Lessons from the past half-century. *American Journal of Education, 112*, 209-238.

Hawkins, R.O., Musti-Rao, S., Hughes, C., Berry, L., & McGuire, S. (2009). Applying a randomized interdependent group contingency component to classwide peer tutoring for multiplication fact fluency. *Journal of Behavioral Education, 18*, 300-318.

Hedges, G. (1981). Distribution theory for Glass's estimator of effect size and related estimators. Journal of Educational and Behavioral Statistics, *6,* 107-128.

Heering, P.W. & Wilder, D.A. (2006). The use of dependent group contingencies to increase on-task behavior in two general education classrooms. *Education and Treatment of Children, 29*(3), 459-468.

Kazdin, A.E. (2001). *Behavior modification in applied settings.* (6th ed.). Belmont, CA: Wadsworth Thomson Learning, Inc.

Kazdin, A.E. & Rotella, C. (2013). *The everyday parenting toolkit: The Kazdin method for easy, step-by-step lasting change for you and your child.* New York, NY: First Mariner Books.

Kelshaw-Levering, K., Sterling-Turner, H., Henry, J., & Skinner, C. (2000). Randomized interdependent group contingencies: Group reinforcement with a twist. *Psychology in the Schools, 37*(6), 523-534.

Kratochwill, T.R., & Shernoff, E.S. (2004). Evidence-based practice: Promoting evidence-based interventions in school psychology. *School Psychology Review, 33,* 34-48.

Litow, L. & Pumroy, D.K. (1975). A brief review of classroom group-oriented contingencies. *Journal of Applied Behavioral Analysis, 8*(3), 341-347.

McKissick, C., Hawkins, R., Lentz, F., Hailley, J., & McGuire, S. (2010). Randomizing multiple contingency components to decrease disruptive behaviors and increase student engagement in an urban second-grade classroom. *Psychology in the Schools, 47*(9), 944-959.

Murphy, K.A., Theodore, L.A., Aloiso, D., Alric-Edwards, J.M., & Hughes, T.L. (2007). Interdependent group contingency and mystery motivators to reduce preschool disruptive behavior. *Psychology in the Schools, 44*(1), 53-64.

Musti-Rao, S., & Cartledge, G. (2007). Effects of a supplementary early reading intervention with at-risk urban leaders. *Topics in Early Childhood Special Education, 27*, 70-85.

Parker, R.I., & Hagan-Burke, S. (2007). Useful effect size interpretations for single-case research. *Behavior Therapy, 38,* 95-105.

Popkin, J. & Skinner, C. (2003). Enhancing academic performance in a classroom serving students with serious emotional disturbance: Interdependent group contingencies with randomly selected components. *School Psychology Review, 32(*2), 282-295.

Reinhardt, D., Theodore, L., Bray, M., & Kehle, T. (2009). Improving homework accuracy: Interdependent group contingencies and randomized components. *Psychology in the Schools, 46*(5), 471-489.

Rhode, G., Jenson, W.R., & Rheavis, H.K. (1993). *The tough kid book: Practical classroom management strategies.* Longmont, CO: Sopris West, Inc.

Shapiro, E.S., & Goldberg, R. (1986). A comparison of group contingencies in increasing spelling performance among sixth grade students. *School Psychology Review, 15*, 546-557.

Shapiro, E.S. & Goldberg, R. (1990). In vivo rating of treatment acceptability by children: Group size effects in group contingencies to improve spelling performance. *Journal of School Psychology, 28*, 233-250.

Sharp, S.R. & Skinner, C.H. (2004). Using interdependent group contingencies with randomly selected criteria and paired reading to enhance class-wide reading performance. In C.H. Skinner (Ed.) *Single-subject designs for school psychologists* (pp. 11-27). New York, NY: The Haworth Press, Inc.

Sindelar, P.T., Rosenburg, M.S., & Wilson, R.J. (1985). An adapted alternating treatments design for instructional research. *Education and Treatment of Children, 8*, 67-76.

Skinner, C.H. (2004, March). *Group reinforcement: A class-wide approach for preventing and remedying academic and behavior problems*. Symposium conducted at the Annual Convention of the National Association of School Psychologists, Dallas, TX.

Skinner, C.H., Caswell, C.S., & Dunn, M. (1996). Independent and interdependent group contingencies: Smoothing the rough waters. *Special Services in the Schools, 12*, 61-78.

Skinner, C.H., & Shapiro, E.S. (1989). A comparison of taped-words and drill interventions on reading fluency in adolescents with behavior disorders. *Education and Treatment of Children, 12*, 123-133.

Skinner, C.H., Skinner, A.L., & Burton, B. (2009). Applying group-oriented contingencies in the classroom. In A. Akin-Little & S. Little (Eds.), *Behavioral interventions in schools: Evidenced-based positive strategies* (pp. 157-170). Washington, DC: American Psychological Association.

Skinner, C.H., Skinner, A.L., & Sterling-Turner, H.E. (2002). Best practices in contingency management: Application of individual and group contingencies in educational settings. In A. Thomas and J. Grimes (Eds.), *Best practices in school psychology IV* (pp. 817-830). Bethesda, MD: NASP.

Skinner, C.H., & Watson, T.S. (1997). Lotteries in the classroom. *Behavioral School Psychology Digest, 1*(4), 11-12.

Skinner, C.H., Williams, R.L., & Neddenriep, C. (2004). Using interdependent group-oriented reinforcement to enhance academic performance in general education classrooms. *School Psychology Review, 33*(3), 384-397.

Slavin, R.E. (1987). Cooperative learning: Where behavioral and humanistic approaches to classroom motivation meet. *The Elementary School Journal, 88*(1), 29-37.

Stage, S.A., & Quiroz, D.R. (1997). A meta-analysis of interventions to decrease disruptive behavior in public education settings. *School Psychology Review, 26*, 333-368.

Theodore, L.A., Bray, M.A., & Kehle, T.J. (2004). A comparative study of group contingencies and randomized reinforcers to reduce disruptive classroom behavior. *School Psychology Quarterly, 19*(3), 253-271.

Turco, T.L. & Eliott, S.N. (1990). Acceptability and effectiveness of group contingencies for improving spelling achievement. *Journal of School Psychology, 28*, 27-37.

Yurick, A.L., Robinson, P.D., Cartledge, G., Lo, Y., & Evans, T.L. (2006). Using peer-mediated repeated readings as a fluency-building activity for urban leaders. *Education and Treatment of Children, 29,* 469-506.

Appendices

Appendix A

Tables and Figures

Table 1

Descriptive Statistics on Independent Math Assignments for Baseline and Intervention Phases

	TCP:BL	***SGC***	***CWC***	***TCP:AT***
	M (SD) *Range* [Letter Grade]	**M** (SD) *Range* [Letter Grade]	**M** (SD) *Range* [Letter Grade]	**M** (SD) *Range* [Letter Grade]
Class-wide Average	**64.0%** (4.7) *57%-67%* [D]	**83.9%** (4.5) *77%-91%* [B]	**83.4%** (7.7) *68%-92%* [B]	**62.5%** (10.4) *47%-69%* [D]
Group 1	**59.3%** (9.6) *50%-68%* [F]	**82.7%** (12.1) *60%-98%* [B]	**81.2%** (12.1) *67%-99%* [B]	**53.0%** (19.4) *30%-71%* [F]
Group 2	**48.8%** (7.8) *39%-56%* [F]	**67.0%** (13.3) *50%-93%* [D]	**71.3%** (11.9) *50%-87%* [C]	**38.0%** (19.3) *12%-55%* [F]
Group 3	**79.8%** (11.3) *64%-90%* [C]	**94.0%** (7.2) *78%-100%* [A]	**93.7%** (6.0) *83%-100%* [A]	**87.75%** (9.3) *75%-97%* [B]
Group 4	**70.3%** (12.7) *61%-88%* [C]	**90.3%** (12.0) *63%-100%* [A]	**84.6%** (16.5) *42%-100%* [B]	**71.0%** (8.2) *65%-83%* [C]

Note. TCP: BL = typical classroom procedures, baseline data phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical control procedures: alternating treatment phase.

Table 2

Mean differences, Pooled Standard Deviations, effect sizes, and PND across baseline and alternating treatment phases

Comparisons	Mean Difference	Pooled SD	Hedge's G	PND
TCP:BL - SGC	-19.90	4.60	4.37	100%
TCP:BL -CWC	-19.40	6.38	2.74	100%
TCP:BL - TCP:AT	1.50	8.07	0.19	25%
TCP:AT-SGC	-21.40	8.01	3.29	100%
TCP:AT-CWC	-20.90	9.15	2.47	90%
SGC-CWC	0.50	6.31	0.08	10%

Note. TCP: BL = typical classroom procedures, baseline phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical control procedures: alternating treatment phase; PND = percentage nonoverlapping data.

Table 3

Mean and standard deviation for each student by condition and phase

Students	**TCP:BL** **Mean** (SD)	**TCP:AT** **Mean** (SD)	**SGC** **Mean** (SD)	**CWC** **Mean** (SD)
1	**62.33** (37.63)	**77.67** (21.13)	**87.88** (27.60)	**64.43** (36.08)
2	**100.00** (0.00)	**89.00** (19.05)	**97.56** (3.84)	**99.80** (0.63)
3	**71.00** (11.17)	**49.25** (42.75)	**77.70** (32.94)	**83.50** (21.29)
4	**5.75** (7.23)	**13.75** (27.50)	**72.13** (23.04)	**60.00** (41.83)
5	**86.50** (12.07)	**80.50** (37.03)	**96.20** (5.75)	**89.10** (31.34)
6	**18.25** (17.86)	**38.50** (45.12)	**52.89** (36.21)	**78.78** (17.28)
7	**17.75** (8.66)	**8.50** (10.34)	**45.38** (33.30)	**69.67** (29.51)
8	**73.25** (24.10)	**24.75** (27.18)	**66.00** (33.32)	**50.70** (29.18)
9	**79.75** (14.66)	**73.75** (49.22)	**98.20** (3.22)	**98.30** (2.26)
10	**95.00** (8.66)	**77.25** (24.16)	**82.89** (28.99)	**84.90** (18.39)
11	**82.25** (8.06)	**100.00** (0.00)	**97.50** (3.69)	**94.00** (14.06)
12	**63.75** (44.98)	**100.00** (0.00)	**95.50** (9.13)	**98.20** (3.82)
13	**12.00** (2.83)	**62.00** (43.49)	**80.63** (33.66)	**80.50** (23.77)
14	**91.25** (10.31)	**89.25** (10.69)	**98.50** (2.95)	**95.30** (6.95)
15	**69.00** (30.67)	**73.25** (23.41)	**92.56** (7.23)	**75.00** (27.93)
16	**78.25** (19.97)	**59.25** (29.24)	**90.00** (31.62)	**89.30** (27.54)

Note. TCP: BL = typical classroom procedures, baseline phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical classroom procedures: alternating treatment phase.

Table 4

Means and letter grade for each student by condition and phase

Students	**TCP:BL** **Mean** [Letter Grade]	**TCP:AT** **Mean** [Letter Grade]	**SGC** **Mean** [Letter Grade]	**CWC** **Mean** [Letter Grade]
1	**62** [D]	**78** [C]	**88** [B]	**64** [D]
2	**100** [A]	**89** [B]	**98** [A]	**100** [A]
3	**71** [C]	**49** [F]	**78** [C]	**84** [B]
4	**6** [F]	**14** [F]	**72** [C]	**60** [D]
5	**87** [B]	**81** [B]	**96** [A]	**89** [B]
6	**18** [F]	**39** [F]	**53** [F]	**79** [C]
7	**18** [F]	**9** [F]	**45** [F]	**70** [C]
8	**73** [C]	**25** [F]	**66** [F]	**51** [F]
9	**80** [C]	**74** [C]	**98** [A]	**98** [A]
10	**95** [A]	**77** [C]	**83** [B]	**85** [B]
11	**82** [B]	**100** [A]	**98** [A]	**94** [A]
12	**64** [D]	**100** [A]	**96** [A]	**98** [A]
13	**12** [F]	**62** [D]	**81** [B]	**81** [B]
14	**91** [A]	**89** [B]	**99** [A]	**95** [A]
15	**69** [D]	**73** [C]	**93** [A]	**75** [C]
16	**78** [C]	**59** [F]	**90** [A]	**89** [B]

Note. TCP: BL = typical classroom procedures, baseline phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical control procedures: alternating treatment phase.

Table 5

Mean Differences and Standard Deviations Across Phases for Individual Students

Student	TCP:BL –TCP:AT Mean (SD)	TCP:BL – SGC Mean (SD)	TCP:BL – CWC Mean (SD)	TCP:AT – SGC Mean (SD)	TCP:AT – CWC Mean (SD)	SCG- CWC Mean (SD)
1	-15.34 (24.91)	-25.54 (23.82)	-1.10 (25.65)	-10.21 (15.62)	14.24 (18.29)	24.45 (16.77)
2	11.00 (11.00)	2.44 (1.29)	0.20 (0.20)	-8.56 (11.08)	-10.80 (11.00)	-2.24 (1.31)
3	21.75 (14.63)	-6.70 (11.82)	-12.50 (8.75)	-28.45 (23.78)	-34.25 (22.41)	-5.80 (12.40)
4	-8.00 (14.21)	-66.38 (8.91)	-54.25 (19.05)	-58.38 (15.98)	-46.25 (23.22)	12.13 (20.40)
5	6.00 (19.47)	-9.70 (6.29)	-2.60 (11.60)	-15.70 (18.60)	-8.60 (20.99)	7.10 (10.07)
6	-20.25 (17.48)	-34.64 (15.00)	-60.53 (10.62)	-14.39 (25.58)	-40.28 (23.29)	-25.89 (13.37)
7	9.25 (5.83)	-27.63 (13.32)	-51.92 (11.97)	-36.88 (13.61)	-61.17 (12.29)	-24.29 (16.82)
8	48.50 (15.08)	7.25 (16.00)	22.55 (15.18)	-41.25 (17.55)	-25.95 (16.43)	15.30 (14.44)
9	6.00 (17.20)	-18.45 (7.40)	-18.55 (7.36)	-24.45 (24.63)	-24.55 (24.62)	-0.10 (1.22)
10	17.75 (13.07)	12.11 (10.44)	10.10 (7.67)	-5.64 (15.47)	-7.65 (13.41)	-2.01 (11.28)
11	-17.75 (4.03)	-15.25 (4.20)	-11.75 (6.00)	2.50 (1.18)	6.00 (4.45)	3.50 (4.60)
12	-36.25 (22.49)	-31.75 (22.67)	-34.45 (22.52)	4.50 (2.88)	1.80 (1.22)	-2.70 (3.13)
13	-50.00 (21.83)	-68.63 (12.06)	-68.50 (9.91)	-18.63 (24.78)	-18.50 (23.81)	0.13 (15.36)
14	2.00 (7.41)	-7.25 (5.24)	-4.05 (5.64)	-9.25 (5.42)	-6.05 (5.77)	3.20 (2.39)
15	-4.25 (19.29)	-23.56 (15.53)	-6.00 (17.94)	-19.31 (11.94)	-1.75 (14.96)	17.56 (9.61)
16	19.00 (17.70)	-11.75 (14.12)	-11.05 (13.24)	-30.75 (17.71)	-30.05 (17.01)	0.70 (13.26)

Note. TCP: BL = typical classroom procedures, baseline phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical control procedures: alternating treatment phase.

Table 6

Effect sizes of Math Performance for Individual Students Across Phases.

Student	TCP:BL - TCP:AT	SGC -TCP:BL	CWC -TCP:BL	SGC - TCP:AT	CWC - TCP:AT	SGC - CWC
1	-0.50	0.84	0.06	0.38	-0.40	0.74
2	0.74	-0.74	-0.37	0.93	1.33	-0.84
3	0.70	0.23	0.65	0.80	1.21	-0.21
4	-0.40	3.38	1.69	2.39	1.27	0.39
5	0.22	1.21	0.09	0.79	0.26	0.32
6	-0.59	1.07	3.47	0.37	1.45	-0.91
7	0.97	1.00	2.11	1.32	2.46	-0.78
8	1.89	-0.23	-0.81	1.30	0.90	0.49
9	0.17	2.35	2.44	0.99	1.00	-0.04
10	0.91	-0.46	-0.59	0.20	0.38	-0.08
11	-3.11	2.97	0.92	-0.78	-0.49	0.34
12	-1.14	1.33	1.52	-0.57	-0.54	-0.39
13	-1.33	2.17	3.15	0.51	0.57	0.00
14	0.19	1.26	0.51	1.56	0.75	0.60
15	-0.16	1.37	0.21	1.41	0.07	0.86
16	0.76	0.40	0.43	1.00	1.07	0.02

Note. TCP: BL = typical classroom procedures, baseline phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical control procedures: alternating treatment phase.

Table 7

Frequency counts of students with Small (S), Medium (M), and Large (L) Effect Sizes.

Comparison across Phases	Small Positive ES	Medium Positive ES	Large Positive ES	Small Negative ES	Medium Negative ES	Large Negative ES
TCP:BL – TCP:AT	3	0	6	1	1	5
SGC – TCP:BL	1	1	11	1	1	1
SGC – TCP:AT	1	2	11	0	0	2
CWC – TCP:BL	3	1	9	0	1	2
CWC - TCP:AT	2	1	10	0	2	1
SGC - CWC	1	4	3	3	1	3

Note. TCP: BL = typical classroom procedures, baseline phase; SGC = Small Group Condition data; CWC = Class-wide condition data; TCP: AT = typical control procedures: alternating treatment phase.

Table 8

Lead Teacher Intervention Acceptability Survey and Responses

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. The *Math Academic Reward Game* was a good intervention.	1	2	3	4	5	**6**
2. Most teachers would find the *Math Academic Reward Game* appropriate to deal with academic behavior in the classroom.	1	2	3	4	5	**6**
3. I noticed students' math performance improve when the *Reward Game* was used.	1	2	3	4	5	**6**
4. I spent less time disciplining students when using the *Math Academic Reward Game*.	1	2	3	4	5	**6**
5. The *Math Academic Reward Game* quickly improved students' math performance.	1	2	3	4	5	**6**
6. I will use the *Math Academic Reward Game* for improving academic performance in other subjects.	1	2	3	4	5	**6**
7. I prefer the Mystery Table Condition rather than the Class Day Condition.	1	2	3	4	5	**6**
8. I prefer the Class Day Condition rather than the Mystery Table Condition.	**1**	2	3	4	5	6
9. The *Math Academic Reward Game* was fair for all students in the class.	1	2	3	4	5	**6**
10. I will use the *Math Academic Reward Game* with future classes.	1	2	3	4	5	**6**
11. I would recommend the *Math Academic Reward Game* to other teachers.	1	2	3	4	5	**6**

Note. Underlined and bold numbers denote the lead teacher's responses.

Table 9

Student Acceptability Survey: Forced Choice Data

	Small Group Condition Frequency (%)	Class-wide Condition Frequency (%)
1. Which condition did you prefer?	10 (71.4%)	4 (28.6%)
2. Which condition did you peers prefer?	9 (64.3%)	5 (35.7%)

Table 10

Student Acceptability Survey and the Number and Percent of Students Who Responded Very Much, Don't Care, or Not at All

	Very Much	Don't Care	Not at All
1. How important is it for you to do well on your morning math assignments?	14 (100%)	0	0
2. How important is it for other students in your class to do well on their morning math assignments?	13 (92.9%)	1 (7.1%)	0
3. How much did you like the *Reward Game?*	14 (100%)	0	0
4. Is doing math more fun with the *Reward Game?*	14 (100%)	0	0
5. How much do you think the Reward Game Helped you complete your work?	14 (100%)	0	0
6. How much do you think the *Reward Game* helped your group to complete their work?	13 (92.9%)	1 (7.1%)	0
7. How much do you think the Reward Game helped your class to complete their work?	14 (100%)	0	0
8. How much would you like to use the *Reward Game* for other activities?	14(100%)	0	0
9. Was the *Reward Game* fair for everyone in the class?	14(100%)	0	0
10. How much did you like not knowing the mystery goals each day?	12 (85.7%)	1 (7.1%)	1 (7.1%)
11. How much did you like not knowing the mystery rewards each day?	13 (92.9%)	0	1 (7.1%)

Table 11

Mean, Standard Deviations, and Range of Time in Minutes to Grade Daily Assignments

	Mean *(SD)* Range
Small Group Average	**2 min 51 s** (*54 s*) 1 min 7 s – 4 min 34 s
Class-wide Average	**11 min 4 s** (*3 min 57 s)* 4 min 22 s - 18 min 16 s

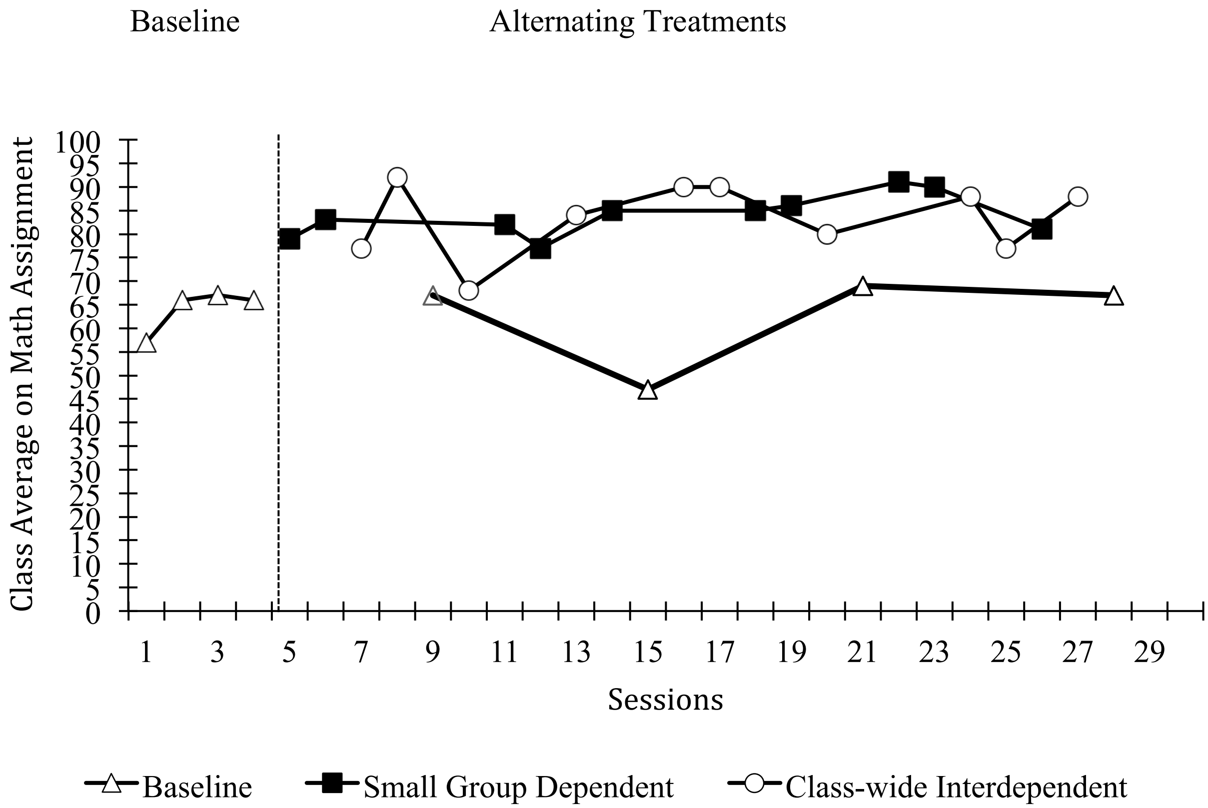

Figure 1. Class-wide average independent math assignments across baseline and alternating treatment phases.

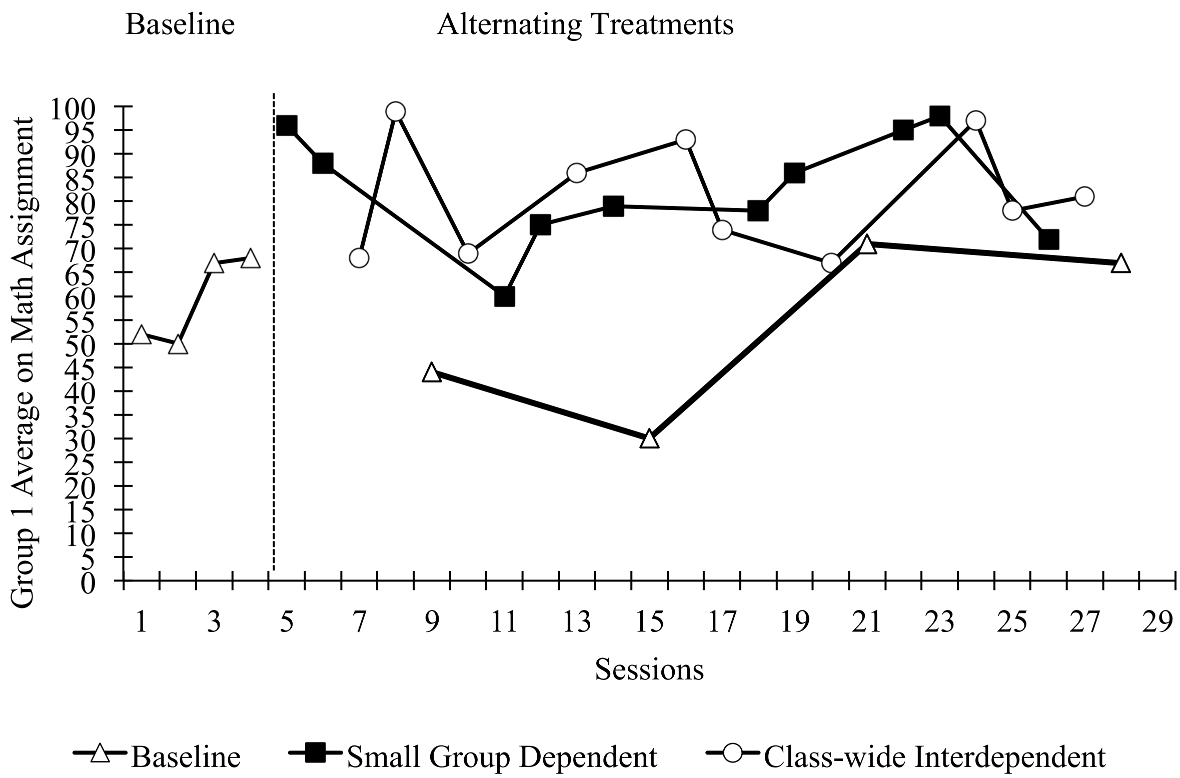

Figure 2. Table 1 average for independent math assignments across baseline and alternating treatment phases. During baseline, the Group 1 average math performance was low but variable across the four sessions. Immediately after each group contingency was implemented, math performance increased for the small group intervention (96%), but remained comparable to baseline for the class-wide intervention (68%). Visual analysis reveals no consistent trends for either intervention condition. However, across both conditions, during the alternating treatments phase, means for both the class-wide average intervention and the small group average interventions were similar and both were higher than typical classroom procedures during the baseline phase and alternating treatment phases.

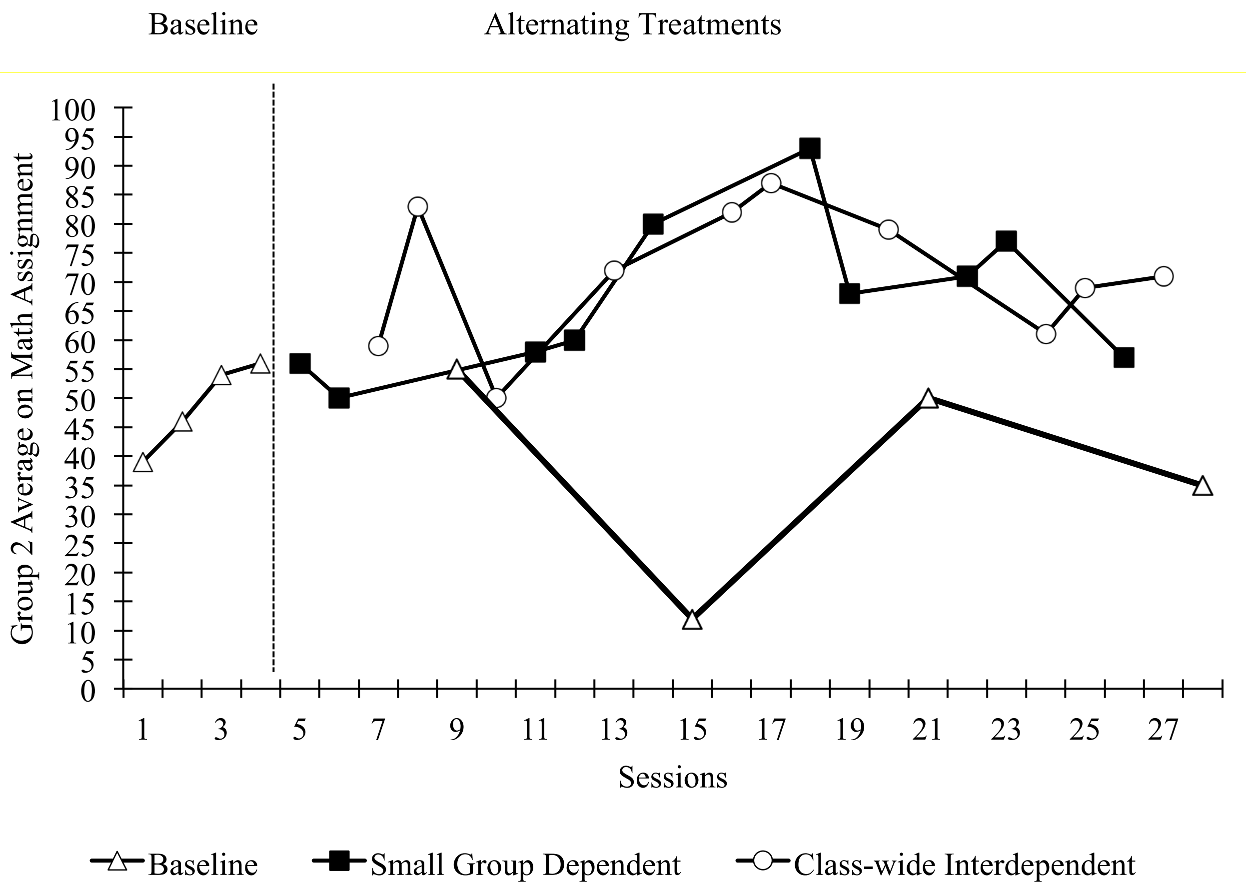

Figure 3. Table 2 average independent math assignments across baseline and alternating treatment phases. During baseline, the Group 2 average math performance was low but showed an increasing trend across the four sessions. Immediately after each group contingency was implemented, math performance did not immediately increase across the interventions. Visual analysis reveals no consistent trends for either intervention condition. However, across both conditions, during the alternating treatments phase, means for both the class-wide average intervention and the small group average interventions were similar and both were higher than typical classroom procedures during the baseline phase and alternating treatment phases.

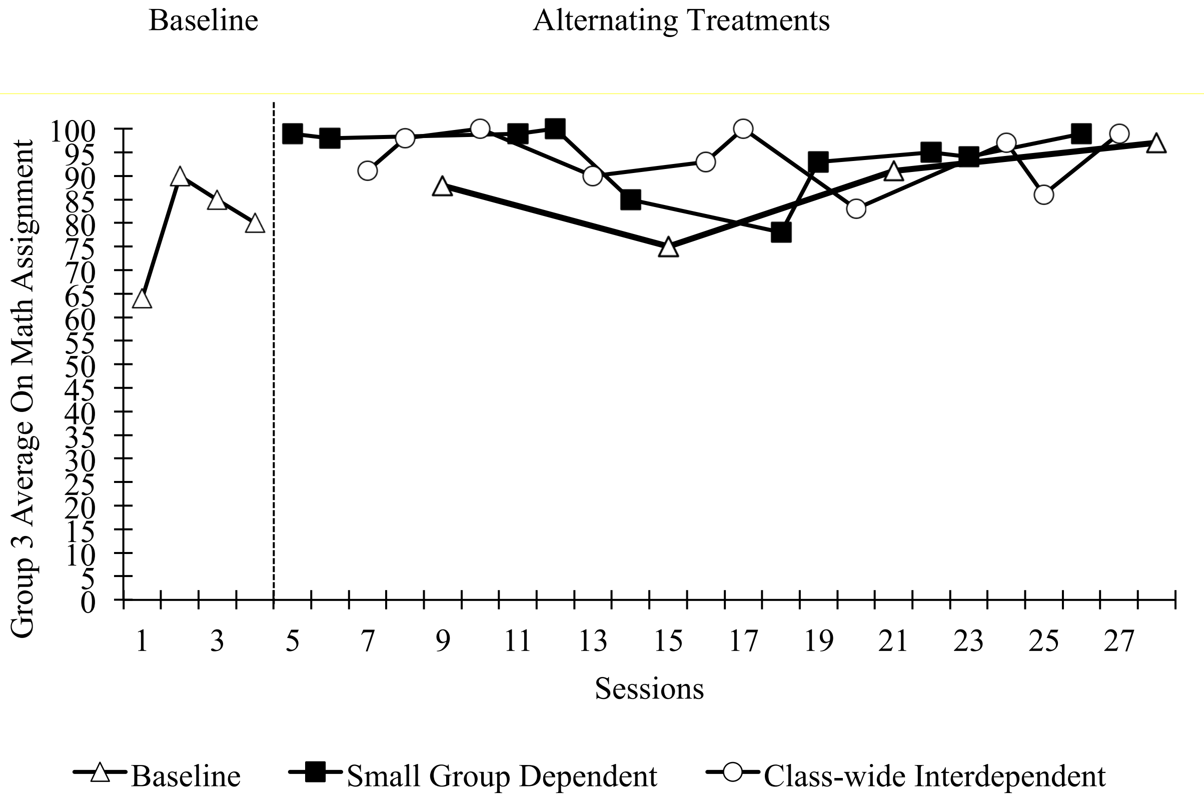

Figure 4. Table 3 average independent math assignments across baseline and alternating treatment phases. During baseline, the Group 3 average math performance was inconsistent across the four sessions, with a range from 64% to 90%. Immediately after each group contingency was implemented, math performance immediately increased across only the small group intervention. Visual analysis of Figure 4 reveals no consistent trends for either intervention condition. Across both conditions, during the alternating treatments phase, means for both the class-wide average intervention and the small group average interventions were similar and both were higher than typical classroom procedures during the baseline phase and alternating treatment phases.

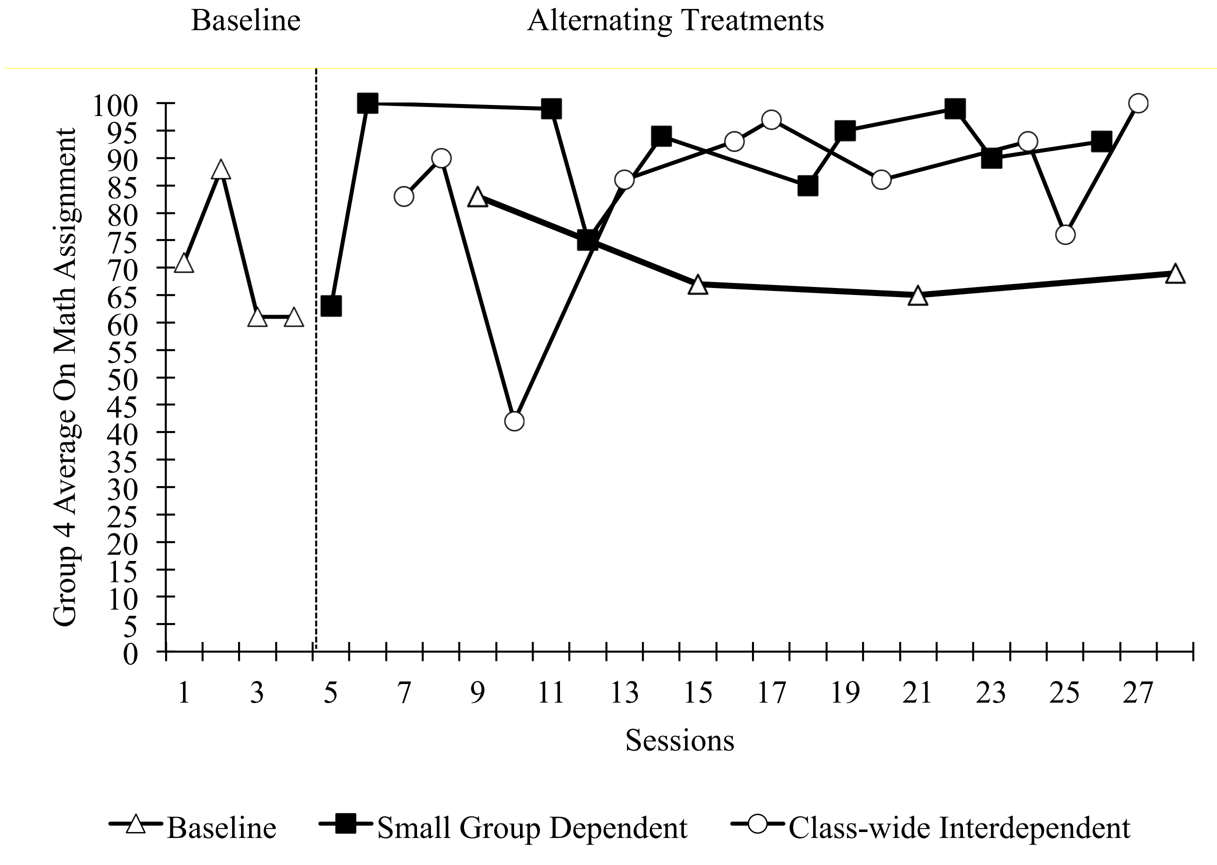

Figure 5. Table 4 average independent math assignments across baseline and alternating treatments phases. During baseline, the Group 4 average math performance was inconsistent across the four sessions, with a range from 61% to 88%. Immediately after each group contingency was implemented, math performance remained comparable to baseline for both interventions. Visual analysis reveals no consistent trends for either intervention condition. Across both conditions, during the alternating treatments phase, means for both the class-wide average intervention and the small group average interventions were similar and both were higher than typical classroom procedures during the baseline phase and alternating treatment phases.

Appendix B

Teacher Acceptability Survey

Directions: Please indicate your agreement with each item by circling the number.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. The *Math Academic Reward Game* was a good intervention.	1	2	3	4	5	6
2. Most teachers would find the *Math Academic Reward Game* appropriate to deal with academic behavior in the classroom.	1	2	3	4	5	6
3. I noticed students' math performance improve when the Reward Game was used.	1	2	3	4	5	6
4. I spent less time disciplining students when using the *Math Academic Reward Game.*	1	2	3	4	5	6
5. The *Math Academic Reward Game* quickly improved students' math performance.	1	2	3	4	5	6
6. I will use the *Math Academic Reward Game* for improving academic performance in other subjects.	1	2	3	4	5	6
7. I prefer the Mystery Table condition rather than the Class Day condition.	1	2	3	4	5	6
8. I prefer the Class Day condition rather the Mystery Table condition.	1	2	3	4	5	6
9. The *Math Academic Reward Game* was fair	1	2	3	4	5	6

for all students in the class.						
10. I will use the *Math Academic Reward Game* with future classes.	1	2	3	4	5	6
11. I would recommend the *Math Academic Reward Game* to other teachers.	1	2	3	4	5	6

Appendix C

Teacher Acceptability Interview

I would like to learn more about your experience with the Math Academic Reward Game. This will in no way affect the results of my dissertation but will serve to improve future implementation.

1. In your opinion, was the Reward Game effective in improving math scores?
2. What types of positive side effects did you observe after implementation of the Math Academic Reward Game?
3. Did you observe any negative side effects of student performance, classroom procedures, or student behaviors?
4. Is there anything you would change regarding the procedures?
5. Is there anything you did not like about the Math Academic Reward Game?
6. Were there any students who did not show improvements with the Math Academic Reward Game?
7. Did you feel that all conditions were fair across all students in the classroom?
8. Which condition (Mystery Table vs. Class Day vs. Typical Day) did you prefer? Why?
9. Are you likely to continue using the Math Academic Reward Game in the future? Why or why not?

Appendix D

Student Acceptability Survey

	Very Much	Don't Care	Not at All
1. How important is it for you to do well on your morning math assignments?			
2. How important is it for other students in your class to do well on their morning math assignments?			
3. How much did you like the *Reward Game*?			
4. Is doing math more fun with the *Reward Game?*			
5. How much do you think the *Reward Game* helped you complete your work?			
6. How much do you think the *Reward Game* helped your group complete their work?			
7. How much do you think the *Reward Game* helped your class to complete their work?			
8. How much would you like to use the *Reward Game* for other activities?			
9. Was the Reward Game fair for everyone in the class?			
10. How much did you like not knowing the mystery goals each day?			
11. How much did you like not knowing the mystery rewards each day?			

1. Circle your favorite day:
A. Mystery Table Day
B. Class Day

2. Circle your classmates' favorite day:
A. Mystery Table Day
B. Class Day

Appendix E

Procedural Integrity Checklist

1. ______ The teacher announced to the class which reward contingency was in effect for that day (mystery table, class-wide, or no mystery day) and randomly selected a table number from the table hat on Mystery Table Day.
    a. Mystery Table: "Today is a Mystery Table Day. I will pull out a Mystery table Number from this hat and place it into the bag."
    b. Class Day: "Today is a Class Day. Remember that everyone's math score will be included in the average."
    c. No Mystery Day: "Today is No Mystery Day. You will not have the opportunity to earn a mystery reward but you are still expected to accurately complete your morning work before recess!"
2. ______ The teacher randomly selected an index card from the Goals hat and placed it into the bag for the particular condition (Class versus Mystery Table).
    a. "I am selecting a goal from the hat and I will place it into the Mystery Table/Class bag."
3. ______ The researcher collected the appropriate math assignments (all members of the randomly selected small group or the entire class of students) when the class was called to the carpet.
4. _______ The researcher correctly scored and recorded the math assignments. (Interrater agreement for 20%).
5. ______ After grading, the researcher announced whether the goal was met to determine if the class received access to a reward.
    a. Mystery Table Day
        i. Met goal: "Table X met the goal for today and the class will receive a mystery reward."
        ii. Did not meet goal: "The mystery table did not meet the goal and the class will not receive a mystery reward."
    b. Class Day
        i. Met goal: "The class met the goal for today and everyone will receive a mystery reward."
        ii. Did not meet goal: "The class did not meet the goal and the class will not receive a mystery reward."
6. ______ The teacher randomly selected a reward from the rewards envelope when the goal was met or exceeded.
7. ______ After randomly selecting the reward, the teacher immediately distributed the same reward to all students in the classroom if the goal was met or exceeded.

Appendix F

Prior to intervention phase to introduce procedures:

Primary researcher or teacher: "Class, we will be playing an *Academic Reward Game* over the next few weeks. Each morning when you come into the classroom, you will see a bag on your teacher's desk that says one of the following: Mystery Table Day, Class Day, or No Mystery Day *(show the bags to the class).* We want to see your performance on the independent morning math assignments. You will be able to earn a mystery reward if you are able to meet a mystery goal for that day.

For example, for the Mystery Table day, I will be choosing a table number from an envelope to figure out which mystery table has a chance to earn a reward for the entire class. I will draw the table number and place it in the mystery table bag. I will not tell you which Table number I selected. I will also draw a mystery goal out of the envelope and place it in the bag. The goal might be 75%, 80%, 85%, 90%, or 95%. I will find your table's average to see if you were able to meet your goal. If I chose 85%, then if the mystery table average was 85% or higher, the table would earn a mystery reward for the class. When it is time to stop working on your math morning work and come to the carpet, you will turn in your math sheets to Ms. Katie and she will grade the Mystery table's sheets. After grading, Ms. Katie will tell you if the mystery table met the goal. If the table meets the goal for that day, we will choose a mystery reward from an envelope and the entire class will earn the reward. Remember that if you do not finish your work or have wrong answers, you will still place the assignment in your "Work to Finish" folder and work on it throughout the day. If you do not finish the assignment before recess, you will have to work on it during recess.

If you walk in and it is a Class day, I will draw a mystery goal out of the envelope and place it into the Class Day bag. If I choose 90%, then if the class average is 90% or higher, the entire class will earn a mystery reward. When it is time to stop working on your math morning work and come to the carpet, you will turn in your math sheets to Ms. Katie and she will grade everyone's math work and find the class average. After grading, Ms. Katie will tell you if the class met the mystery goal. If the class meets the goal for that day, we will choose a mystery reward from an envelope and the entire class will earn the reward. Remember that if you do not finish your work or have wrong answers, you will still place the assignment in your "Work to Finish" folder and work on it throughout the day. If you do not finish the assignment before recess, you will have to work on it during recess.

If you walk in and it is No Mystery day, then I will not choose a mystery goal and you will not have the opportunity to earn a mystery reward. Instead, you will be expected to complete your morning math work and turn it in to Ms. Katie when it is time for you to come to the carpet. Remember that if you do not finish your work or have wrong answers, you will place the assignment in your "Work to Finish" folder and work on it throughout the day. If you do not finish the assignment before recess, you will have to work on it during recess.

Assessment check:

Let's make sure that you understand the game, okay? If you come in to the classroom and there is a Mystery Day bag, then who can tell me what that means? (*Call on student*). So, if the mystery day average is 80% and I had an 85% goal, will the class earn a reward? (*Call on student*). What if the mystery day average is 80% and I had a 70% goal, will the class earn a reward? (*Call on student*). What happens on a Class Day? What about a No Mystery Day?

Appendix G

Parental Consent Form

Dear Parent,

My name is Katie Scott and I am a doctoral student in the School Psychology program at the University of Tennessee. I am currently working on research for my dissertation designed to enhance academic performance in students. I am seeking your consent for your child to complete a survey related to the study and to include your child's results in my study findings. I will be working with and be supervised by Dr. Christopher H. Skinner, a professor at the University of Tennessee.

If you agree to allow your child to participate, your child will complete a small picture survey at the completion of the study and circle to what degree they enjoyed participation in the study. All typical classroom routines will remain the same. I will be collecting data from the independent math morning work that students are required to complete each morning. Data collection is expected to last five to six weeks. These worksheets are graded every morning and I will be examining the percentage that is accurately completed. The intervention will involve a group contingency in which students will not be told what percentage correct they need to complete in order to receive a class-wide reward.

If you agree to allow your child to participate, your child may quit the study at any time. This will have no effect on your child's grade. Although results of our research may be shared with others through professional publications or presentation, your child's name will never be revealed. I will not be collecting individual data so names will never be contained in study records.

If you have any questions about this study or consent form, feel free to contact me, Katie Scott at (336) 580-0526. If you agree to allow your child to be included in the research findings, please check the appropriate box and sign the form in the space provided for parental signature or legal guardian.

If you have any questions about your rights as a research participant, please contact the UT Office of Research Compliance Officer at (865) 974-7697.

Thank you for your and your child's time and consideration,

Katie Scott
University of Tennessee, Educational Psychology and Counseling
Knoxville, TN 37996
(336) 580-0526
kcrabtr3@vols.utk.edu

<u>Check One</u>

_______ I DO agree to allow my child to participate in this research.

_______ I DO NOT agree to allow my child to participate in this research.

Child's Name: ______________________________________

Signature: ____ Date: __________________
Parent or Legal Guardian

Appendix H

Student Assent Form

My name is Katie Scott and I am a graduate student in the Ph.D. School Psychology Program at the University of Tennessee. I am studying academic performance and would appreciate your help. If you decide to help, you will participate in the *Academic Reward Game*.

If you choose to help, you can quit at any time by letting me or your teacher know you wish to quit and you will be allowed to do work assigned by your teacher. You will not be punished for choosing to quit the study.

If you agree to participate, please mark the space next to "yes." If you do not want to participate in the study, please mark the space next to "no" and your teacher will give you something else to work on while we do this study. Please write your name on the line below.

Thank you for your help.

Sincerely,
Katie Scott

_____ yes

_____ no

Name:____ Date:____________________

Appendix I

Teacher Consent Form

Dear Teacher,

My name is Katie Scott, and I am a graduate student in the School Psychology Ph.D. program at the University of Tennessee. I would like to conduct research in your classroom during the 2015-2016 school year under the supervision of my advisor, Dr. Christopher H. Skinner, a professor at the University of Tennessee. The purpose of my study is to enhance academic performance within the classroom via group contingency models utilizing randomized, unknown criteria. I will be evaluating the effects of group contingencies on percentage of math morning work correctly completed. The target behavior will be academic performance on the independent morning math work assignments. Prospect Elementary School principal, Mr. Jake Jones has agreed to participate in these procedures designed to enhance academic performance.

If you agree to participate, I will be collecting data on assignments that remain part of your typical classroom agenda. I would like for you to present the procedures to the class a *Math Academic Reward Game* in which students will be informed that they have the opportunity to earn rewards based upon their performance on morning math assignments. Students will be told that either everyone in the classroom or no one will receive the reward based on either the class performance on the assignment or a "mystery table" performance. This academic contingency will easily be incorporated into your class structure. I will provide all materials needed for your classroom and I will meet with you to go over the system, practice the procedures, and answer any questions you have about the system before implementation in your classroom.

I will collect the data from the classroom each day for approximately 5 weeks. I will quietly enter the classroom each day and either score or record the percentages from the math assignments. You are free to request that my involvement in the classroom be discontinued at any time with no penalty to you or the participating students.

No risks for teachers or students are anticipated from this study other than those ordinarily encountered in the classroom. Your name will not be recorded on any of the materials in this study. Instead, your identity will be recorded as "Teacher of Classroom." Student participants' names will not be on the data forms, as I am not collecting data on individual students. In addition, students' names will be entered onto a separate sheet and assigned a code number for survey responses. Again, students' names will NOT be revealed.

Participation in this study is voluntary, which means that you do not have to participate and can stop at any time without penalty. Although results of our research may be shared with others through professional publications or presentation, your name or the names of your students will never be revealed.

Enclosed is a copy of this letter for your records. If you agree to participate in this research, please complete the section below on one copy of this letter and return it to me. Your signature indicates that you have read and understand the information above, that you willingly agree to participate, and that you may withdraw at any time and discontinue participation without penalty. If you have any questions about this consent form or this study, please feel free to contact my faculty advisor, Christopher Skinner at (865) 974-8403, or myself (Katie Scott) at (336) 580-0526 **before** you sign this form.

Thank you for your time and consideration,

Katie Scott, M.S.
University of Tennessee
Educational Psychology and Counseling
Knoxville, TN 37996
(336) 580-0526

Check One

_______ I DO agree to participate in this research.

_______ I DO NOT agree to participate in this research.

Name: _____________________________________

Signature: ___________________________________ Date: __________________

Teacher

Appendix J

Blount County Approval Letter

Director of Schools

Rob Britt

831 Grandview Drive
Maryville, TN 37803
(865) 984-1212
Fax: (865) 980-1002

~Educational Excellence For All Students~

Katie Scott
Doctoral Student
University of Tennessee

June 15, 2015

Dear Ms. Scott,

May this letter document permission for you to conduct your group contingencies research project at Prospect Elementary School during the 2015-16 year as part of your degree requirements at the University of Tennessee, under the supervision of Dr. Christopher Skinner. As noted in the research project description, neither students nor the school should be identified in your study. Parents will need to be provided with an opportunity for consent. Please work directly with Mr. Jake Jones (principal) in the drafting and dissemination of the consent document so that he will be informed about the process and responses. Teacher participation in any research is voluntary, and all activities (including classroom projects) of the school are under the direct supervision of the principal.

Feel free to contact me if you need additional documentation of this approval.

Sincerely,

Jane Morton

Jane Morton, Ed.D.
Supervisor of 6-12 Instruction
Director of Schools designee for research approval

CC: Dr. John Dalton, K-5 Instructional Supervisor

~Uncompromising Educational Service~

Appendix K

Principal Letter

Prospect Elementary School
1535 Burnett Station Road
Seymour, TN 37865
(865) 980-1565

Remembering our Heritage . . . Building our Future

Jake Jones, Principal

June 15, 2015

Dear Mrs. Scott,

The research design evaluating group contingencies using unknown criteria appears to be educationally valid. I give my permission for you to conduct this study under the direction of Dr. Christopher Skinner. After reading the procedures regarding the intervention, I am confident in supporting this research. Furthermore, I am assured that student assent will be obtained and every effort has been made in which to ensure safety of those participating students. I am also ensured that the names of all participants and the participating school district will be kept confidential. I hereby give my permission for this research to be conducted at Prospect Elementary School.

Thank you,

Jake Jones, Principal
Prospect Elementary School

Achieving through Technology

Appendix L

UTK IRB Approval Letter

THE UNIVERSITY of TENNESSEE
KNOXVILLE
Office of Research & Engagement
INSTITUTIONAL REVIEW BOARD (IRB)

1534 White Ave.
Knoxville, TN 37996-1529
865-974-7697
fax 865-974-7400

June 23, 2015

Katie Scott
UTK - Educational Psychology & Counseling

Re: UTK IRB-15-02334-XP
Study Title: The Effectiveness of Interdependent Group-Oriented Contingencies using Randomized Criteria on Academic Performance in a First-Grade Classroom

Dear Ms. Scott:

The Administrative Section of the UTK Institutional Review Board (IRB) reviewed your **application** for the above referenced project. It determined that your application is eligible for **expedited** review under 45 CFR 46.110(b)(1), categories (5) and (7). The IRB has reviewed these materials and determined that they do comply with proper consideration for the rights and welfare of human subjects and the regulatory requirements for the protection of human subjects. Therefore, this letter constitutes full approval by the IRB of your application version 1.0 as submitted. Approval of this study will be valid from June 23, 2015 to June 22, 2016.

In the event that subjects are to be recruited using solicitation materials, such as brochures, posters, web-based advertisements, etc., these materials must receive prior approval of the IRB. Any revisions in the approved application must also be submitted to and approved by the IRB prior to implementation. In addition, you are responsible for reporting any unanticipated serious adverse events or other problems involving risks to subjects or others in the manner required by the local IRB policy.

Finally, **re-approval** of your project is required by the IRB in accord with the conditions specified above. You may not continue the research study beyond the time or other limits specified unless you obtain prior written approval of the IRB.

Sincerely,

Colleen P. Gilrane

Colleen P. Gilrane, PhD
Chair
UTK Institutional Review Board

Vita

Katelyn Scott was born in Greensboro, North Carolina and grew up in Summerfield, North Carolina. She graduated with a B.A. in Psychology and a Minor in Sociology from Wake Forest University in 2012. In 2012, Katelyn entered the University of Tennessee's School Psychology Ph.D. Program. She graduated with an M.S. in Applied Educational Psychology from the University of Tennessee in December of 2014. Katelyn will receive her Ph.D. in School Psychology in August 2017 following completion of a year-long internship with Tennessee Internship Consortium in Knoxville, TN.