RELATIVE EFFECTS OF DELAYED VERSUS IMMEDIATE REINFORCEMENT WITHIN AN INTERDEPENDENT GROUP-ORIENTED CONTINGENCY SYSTEM

by

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DISSERTATION ABSTRACT

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Title: Effects of Delayed Versus Immediate Reinforcement Within an Interdependent Group-Oriented Contingency System

The current study sought to add to the literature on applying interdependent group-oriented contingency systems with randomized components to academic performance. This study expanded previous work, which has only examined effects on elementary classrooms and students with disabilities, by implementing a similar intervention within a general education, secondary classroom. Given the restricted time that teachers have to learn and implement interventions, while simultaneously carrying out all their additional responsibilities in the classroom, it is necessary for school psychologists to consider these limitations when recommending interventions. In previous work involving interdependent group-oriented contingencies, the delivery of reinforcement has been relatively immediate. While this is an ideal arrangement, it may be infeasible for middle and high school teachers to ensure reinforcement of academic performance occurs immediately within the class period. This study examined whether the delivery of reinforcement can be delayed within an interdependent group-oriented contingency system and still improve the academic performance of students in the classroom, which will allow the teacher more time for evaluating the quality of student work and, in turn, impact the acceptability of the intervention.

One middle school, general education classroom served as the setting for this study. Academic performance data, including in-class work completion and accuracy rates, were collected class-wide and data on social behavior variables were gathered for 3 students exhibiting moderate to high levels of off-task behavior, based on teacher perception. An alternating treatments design was employed with two intervention conditions: one condition included immediate reinforcement and the other involved delivering reinforcement to students a day later. The interdependent group-oriented contingency intervention implemented included procedures for randomly selecting target behaviors, criteria, and reinforcers.

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CHAPTER I

OVERVIEW AND PROBLEM STATEMENT

In a professional development needs survey conducted by the American Psychological Association in 2006, classroom management and instructional skills were identified by teachers as their most pressing and important priorities. Specifically, teachers indicated the greatest interest in receiving training in strategies to reduce the impact of students' negative behaviors on the rest of the classroom (Coalition for Psychology in Schools and Education, 2006). These findings are of little surprise as classroom management has been consistently cited as one of the major contributions to teacher burnout and attrition (Ingersoll & Smith, 2003). The importance of reducing disruptive and off-task behavior in the classroom is not trivial, as these behaviors not only affect the learning opportunities of the student engaging in these behaviors, but also interfere with instruction and other students' opportunities to learn (Williamson, 2009). Cotton (1990) estimated that addressing disruptive or off-task behavior may take up as much as half of classroom time, significantly reducing the number of instructional minutes students receive. By preventing these problem behaviors from occurring, instructional time can be maximized, which benefits every student in the class. Doyle (1986) argues that the primary goal of classroom management is not only to reduce undesired behaviors or to create an orderly environment, but to positively impact student learning. To maximize educational outcomes for all students, schools should direct more attention to supporting effective classroom management.

Group-oriented contingencies are one type of class-wide intervention that have been extensively researched and applied in practice (Hansen & Lignugaris/Kraft, 2000;

Stage & Quiroz, 1997). In group-oriented contingencies, the same response contingencies are concurrently in effect for all individuals in the group (Litoe & Pumroy, 1975). This arrangement is advantageous as it minimizes teacher time and effort (Elliot, Turco, & Gresham, 1987), avoids singling out a particular student for individualized intervention (Skinner, Williams, & Neddenriep, 2004), and occasions the delivery of social approval and promotes cooperative behaviors as members of the group work to accomplish goals together (Skinner, Cashwell, & Dunn, 1996). In empirical studies, group-oriented contingencies have been most often applied in elementary settings (e.g. Speltz, Shimamura, & McReynolds, 1982) or with special education populations (e.g., Popkin & Skinner, 2004), and while there are demonstrations of effects at the middle and secondary level (e.g. Shapiro & Goldberg, 1986), the literature base is substantially smaller.

As much of the research on classroom management has been conducted in elementary settings and many educators perceive the strategies employed in earlier grades as less applicable to older students (Malmgren, Trezek, & Paul, 2005), there is a need for more research demonstrating effects of classroom management systems with middle and secondary students. This study seeks to add to the literature base documenting effects of group-oriented contingencies for general education, secondary students. Specifically, this study investigated effects of one type of class-wide intervention, an interdependent group contingency, on academic-related behaviors of middle school students. Within this contingency system, variations on delivery of reinforcement, comparing immediate to delayed reinforcement, and the use of randomly selecting contingency components, including target behaviors, criteria, and reinforcers, were explored.

CHAPTER II

LITERATURE REVIEW

While individualized behavioral interventions have been shown to be very effective in addressing problem behavior, class-wide interventions, or interventions used with the entire classroom, have the potential to be more efficient and cost-effective, as teachers address the behavior of all students in a similar manner (Carroll, Williams, & Hautau, 2006). Class-wide interventions can provide structure to a classroom and set the stage for effective teaching practices (Harlacher et al., 2006). Class-wide interventions can be very appropriate and effective whether problem behavior is exhibited by most students or by just a few, as it is likely that a group intervention will benefit all students in the class (Harlacher et al.).

Class-wide interventions involve manipulation of antecedents and/or consequences to encourage desired classroom behavior and reduce the probability of inappropriate behaviors occurring. Antecedent strategies address environmental factors that evoke problem behavior and are used to prevent undesired behaviors from occurring (Kern & Clemens, 2007). On a class-wide level, interventions targeting antecedent variables are intended to foster a classroom environment that is positive, orderly, predictable, and motivating (Sugai, Horner, & Gresham, 2002). Some examples of antecedent strategies that can be implemented across all students in the class include establishing clear classroom rules and expectations (e.g., Sugai et al.), providing multiple opportunities for students to respond (e.g., Carnine, 1976), incorporating choice and preference into the curriculum (e.g., Kern, Bambara, & Fogt, 2002), and presenting material that is matched to the instructional level of students in the classroom (e.g.,

Center, Deitz, & Kaufman, 1982).

Contingency manipulation consists of presenting or removing a stimulus following behavior, which either increases the future likelihood of an individual engaging in the same behavior (reinforcement) or decreases the likelihood of behavior occurring in the future (punishment) (Skinner, 1953; Obenchain, 2005). Class-wide interventions that primarily address consequences include token economies (e.g., Ziomke, 2003), response cost systems (e.g.,Trice & Parker, 1983), and group-oriented contingencies (e.g., Litoe & Pumroy, 1975).

Group-oriented contingency systems are one type of intervention that teachers can implement in their classrooms to simultaneously manage the behavior of multiple students or the class as a whole. Like all contingency management systems, group-oriented contingencies operate through the relation between a discriminative stimulus, an operant response, and a consequence (i.e., the three-term contingency; Skinner, 1953). When a discriminative stimulus is present (e.g., the teacher announces that a contingency is in effect during independent work), there is an increased probability that a response will be evoked, based on an individual's history of receiving reinforcement contingent on emission of that particular behavior. The effectiveness of group-oriented contingencies in reducing problematic behavior in the classroom has been repeatedly demonstrated (e.g., Barrish, Saunders, & Wolf, 1969; Darch & Thorpe, 1977; Davies & White, 2000; Fishbein & Wasik, 1981; Gresham & Gresham, 1982; Harris & Sherman, 1973; Lannie & McCurdy, 2007; Salend, Reynolds, & Coyle, 1989). Further, Stage & Quiroz's (1997) meta-analysis of interventions targeting disruptive classroom behavior indicated that group-oriented contingencies resulted in the largest average effect size when compared to

other intervention strategies.

The various ways group-oriented contingency systems might be used are discussed next. While there has been a substantial amount of evidence amassed over the last 50 years that attests to the effectiveness of implementing group-oriented contingency systems in the classroom, most of the research conducted in this area has emphasized social behavior outcomes (e.g., Barrish et al., 1969; Gresham & Gresham, 1982; Davis & White, 2000). As the current study targets academic responses, the following review of literature will focus on the less expansive evidence base related to improving academic performance through the use of the three types of group-oriented contingency systems: independent, dependent, and interdependent. It should be noted at the outset that a substantive body of work exists evaluating relative effects of the three different group-oriented contingency systems. In sum, this body of research documents positive effects of all three types of group-oriented contingency systems and there is insufficient evidence to suggest that one system is more effective then another (e.g., Alric, Bray, Kehle, Chafouleas, & Theodore, 2007; Lynch, Theodore, Bray, & Kehle, 2009; Ruedebusch, 1979; Speltz et al., 1982; Stewart & McLaughlin, 1986). Because the effectiveness of each type of group-oriented contingency system has been demonstrated, educators can focus on evaluating the advantages and limitations of each approach relative to the classroom under consideration to determine which type of intervention might best serve the needs of students while simultaneously addressing the practical constraints that exist within the classroom.

Independent Group-Oriented Contingencies

In independent group contingencies, individuals earn rewards based on their

performance alone (Gresham & Gresham, 1982; Theodore, Bray, Kehle, & DioGuardi, 2003). Grades awarded at school are one example of an independent group-oriented contingency, wherein the target behavior (e.g., homework accuracy), criterion (e.g., percentage correct), and reward (e.g., grade on assignment) are the same for all students in the class, and only students who meet the established criteria will be rewarded. This type of contingency is group-oriented because the target behaviors, criteria for reinforcement, and available rewards are held constant for all individuals in the group, and it is considered independent because only individuals who meet the common criteria earn rewards (Litoe & Pumroy, 1975).[1] Students report perceiving independent group-oriented contingencies as fair because the target behaviors, criteria, and rewards are the same for everyone in the class (Turco & Elliott, 1990). The effectiveness of independent group-oriented contingency systems in improving academic performance has been widely demonstrated, with most of this research conducted in the 1960s and 1970s (e.g., Ayllon & Roberts, 1974; Bijou, Birnbauer, Kidder, & Tague, 1966; Chadwick & Day, 1971; Haring & Hauck, 1969; Hopkins, Schutte, & Garton, 1971; Nolen, Kunzelman, & Haring, 1967; Wolf, Giles, & Hall, 1968). For example, Ayllon & Roberts (1974) implemented an independent group-oriented contingency system in a fifth grade classroom, employing a reversal design to determine effects of the intervention on reading assignment accuracy. Students received points based on their accuracy on assignments (e.g., five points for assignments that were 100% correct), which could be exchanged for rewards the next day. Across the 5 participants, increases in reading accuracy were accompanied by decreases

[1] In this review, the term *reward* is used to represent the actual consequences that are made available in group-oriented contingencies, whereas *reinforcement* will be reserved for describing the intended function these rewards serve (i.e. increasing the future likelihood that a particular behavior will occur).

in disruptive behavior when the intervention was in place. Although widely used, there is one important limitation to this type of group contingency system. It is entirely possible that some students rarely, if ever, will meet the performance criterion and therefore are prevented from accessing these rewards. As suggested by Cashwell, Skinner, Dunn, & Lewis (1998), students whose social or academic behavior consistently fails to meet criteria, and thus rarely earn rewards, may stop trying to attain goals and may actually reinforce the inappropriate behavior of other students. This becomes a more serious concern for students with disabilities who are denied opportunities based on the inability to perform at the same level as their peers without disabilities (Cashwell et al.).

Dependent Group-Oriented Contingencies

In dependent group contingencies, the consequence is delivered to the entire group based on the behavior of a single individual or a subset of the group (Gresham & Gresham, 1982). In this type of group-oriented contingency, everybody or nobody in the group receives the same rewards (Skinner et al., 2004). A dependent group-oriented contingency applied in a classroom might involve comparing a criterion (e.g., 80% accuracy on a homework assignment) to the performance of one selected student in the class; if the identified student's performance meets this criterion, then every child in the classroom accesses rewards. Because the behavior of an individual or a subset of the class determines the outcome for the entire group, dependent group-oriented contingencies are often accompanied by pressure from peers to meet goals when the identity of the target student is known by the class. As Cashwell et al. (1998) asserts, this has the potential to manifest itself in social reinforcement when an identified student meets criteria and punishment from group members when goals are not met. Additionally,

students and teachers often consider this type of arrangement unfair, as most students' access to reinforcement is not contingent on their own behavior, and all students are not required to meet the same criteria (Skinner et al.; Cashwell et al.).

Although a relatively large literature base documents effects of dependent group contingencies on social behavior (e.g., Carlson, Arnold, Becker, & Madsen, 1986; Kubany, Weiss, & Sloggett, 1971; Patterson, 1965), only a handful of studies have specifically examined effects of dependent group-oriented contingencies on academic behavior (Cocalis, 1972; Evans & Oswalt, 1968; Hamblin et al., 1971; Shapiro & Goldberg, 1986; Speltz et al., 1982). Across these studies, the dependent group-oriented contingency system was compared to independent or interdependent group-oriented contingencies (discussed later). Most of the findings on the relative effects of the three types of group contingencies have indicated that there were no differences in effectiveness across types of group contingency systems in improving academic performance (e.g., Shapiro & Goldberg, 1986; Speltz et al.). For example, Speltz, et al. compared relative effects of independent, interdependent and two variations of dependent group contingencies on the arithmetic worksheet accuracy of 4 target students with learning disabilities. All students were between the ages of 7 and 10 and were in the same classroom. An alternating treatment design was used and following baseline, the four contingency systems were implemented for exactly six days in a counterbalanced order. The independent group contingency condition involved delivering one point for each problem solved correctly during class, while the delivery of points in the interdependent condition was based on the average number of correctly solved arithmetic problems within small groups of students. For the two dependent group-oriented contingencies, one

condition involved identifying the target student to the group prior to intervention and the other condition made the target student known to the class once the work period ended, wherein a student name was randomly selected from a bag that contained names of all of the students in the class. Accuracy on arithmetic worksheets was measured for all phases. Results indicated that all four conditions were equally effective in improving academic performance and anecdotal observations indicated that in the dependent and interdependent group contingency conditions, students engaged, unprompted, in various types of "helping" behaviors, including attempts to keep each other on task, checking work for accuracy, sharing answers, and tutoring.

Interdependent Group-Oriented Contingencies

The third type of group-oriented contingencies is interdependent group contingencies, organized around the behavior of the group as a whole, wherein the performance of each individual contributes to the group achieving a goal (Gresham & Gresham, 1982). In schools, the group could mean the entire class or small subgroups of students within the class. Like dependent group-oriented contingencies, every member of the group or no member of the group receives reinforcement; however, in interdependent group-oriented contingencies, the criterion is based on some aspect of group behavior (Turco & Elliot, 1990). Often group behavior is represented by the average performance of the group, wherein, for example, if the average accuracy rate on a homework assignment for the group meets or exceeds a criterion established by the teacher, then every student in the group is rewarded. Interdependent group contingencies, by design, rely on the successful performance of all students to achieve goals (Skinner et al., 2004), which has been shown to promote positive social interactions among students (e.g., Davis

& Blankenship, 1996), cooperative behaviors (e.g., Gresham & Gresham, 1982), and spontaneous peer tutoring (e.g., Hamblin et al., 1971). Since common goals are provided, interdependent group-oriented contingencies set the stage for students to assist each other in performing well (Slavin, 1977).

There are several advantages of interdependent group-oriented contingencies. Rewards have the potential to be more varied, possibly including opportunities for the group, as the whole class or a sub-group of students, to engage in activities together, such as a field trip or game. This opportunity is less feasible within independent group-oriented contingencies, as opportunities for these types of rewards become more difficult to manage, and individual students not participating in the activity are likely to be disgruntled and embarrassed about being singled-out on their own lack of academic performance (Skinner et al., 2004). Contrasted with dependent group contingencies, interdependent group contingencies provide no public feedback about which students met the established criterion for academic work and which students did not, as reinforcement is delivered to the entire group based on the performance of that group as a whole (Skinner et al.). The group will not know which students' performance fell below the criterion, but will only be made aware of whether the performance of the group as a whole (i.e. average performance) met the established criterion.

Another advantage of interdependent group-oriented contingencies, when configured so that subgroups of students within a classroom work toward goals, is that this type of arrangement may support the social interaction of diverse groups of students that may not otherwise work together (Skinner et al., 1999). Students often form peer groups based on race, interests, socioeconomic status, and achievement and may not

otherwise pursue opportunities to associate with peers outside their immediate group (Skinner et al.). Research has shown that relationships between students from different ethnic and racial backgrounds improve when small, heterogeneous groups of students work together to learn academic material (Slavin, 1995). By working to achieve common goals, interdependent group-oriented contingencies provide the opportunity for students to collaborate, encourage, and work with other students that may not be members of their typical peer group. Moreover, while some rewards in the pool may be of low quality to one or more students, the social reinforcement that is likely to accompany a group's celebration of success can be a high quality reinforcer. This type of social approval can be especially salient for those students who rarely receive reinforcement for academic behavior, as the opportunity for accessing rewards based on academic performance may have a powerful influence on these students' efforts and attitudes toward academic work (Skinner et al., 2004).

Because of the advantages discussed above, interdependent group-oriented contingencies are generally considered by teachers, students, and school psychologists to be an acceptable school-based intervention (Elliot et al., 1987). It is crucial that when designing a classroom intervention, school psychologists and teachers work together to ensure that the intervention is implemented in the way it was intended, and that it is socially valid and acceptable to the teacher. Compared with individualized interventions, interdependent group-oriented contingencies may be considered more acceptable in some situations, as they are more efficient, don't require dramatic changes in teacher behavior, have the potential to require fewer resources and/or allow resources to be spread across more students, and actively involve peers in the behavior change process (Eliot et al.;

Skinner, et al., 2004; Wilson & Williams, 1973). Furthermore, because this type of intervention is likely to be considered as acceptable by teachers, there is an increased probability that it will be implemented with fidelity (Zins & Erchul, 2002).

A large literature base documents the effectiveness of interdependent group-oriented contingencies for decreasing disruptive behavior (e.g., Barrish, Saunders, & Wolf , 1969; Darch & Thorpe, 1977; Darveaux, 1984; Davies & White, 2000; Fishbein & Wasik, 1981; Harris & Sherman, 1973; Medland & Stachnik, 1972; Patrick, Ward, & Crouch, 1998; Robertshaw & Hiebert, 1973; Salend, Reynolds, & Coyle, 1989; Swiezy, Matson, & Box, 1992; Tingstrom, Sterling-Turner, & Wilczynski, 2006). In a seminal and oft-cited study Barrish et al. worked with a classroom of 24 fourth-grade students, many of whom had been referred for out-of-seat and disruptive behavior. The intervention involved dividing the class into teams and allocating a mark on the chalkboard when a member of the team broke the classroom rules. The team with the fewest marks, or both teams if neither team received more than five marks, received access to rewards. A multiple baseline across content areas design, including a reversal to baseline, was employed and out-of-seat and disruptive behaviors were recorded; marked decreases from baseline in both variables were demonstrated during the implementation of the intervention. Research documents that interdependent group-oriented contingencies are effective as well for decreasing out-of-seat and disruptive behavior (e.g., Davies & White, 2000; Harris & Sherman, 1973; Medland & Stachnik, 1972), and increasing desired behaviors, including (Robertshaw & Hiebert, 1973), compliant (Swiezy et al., 1992), and on-task behavior (Darch & Thorpe, 1977).

Effectiveness of interdependent group-oriented contingencies in improving academic-related behaviors. Though social behavior has been the primary target of interventions involving interdependent group-oriented contingencies, a number of studies have documented effects of interdependent group contingency interventions on academic-related behavior within the content areas of math (Bear & Richards, 1980; Hamblin et al., 1971; Hawkins, Musti-Rao, Hughes, Berry, & McGuire, 2009; Madaus, Kehle, Madaus, & Bray, 2003; Popkin & Skinner, 2003; Reinhardt, Theodore, Bray, & Kehle, 2009; Slogett, 1971; Speltz et al., 1982), social studies, (Lo & Cartledge, 2004); reading and language arts (Alric et al., 2007; Bear & Richards, 1980; Hamblin et al., 1971; Lynch et al., 2009; Popkin & Skinner, 2003; Reinhardt et al., 2009; Sharp & Skinner, 2004), and spelling (Hamblin et al., 1971; Madrid et al., 2007; Popkin & Skinner, 2003; Reinhardt et al., 2009; Shapiro & Goldberg, 1986). Five of these studies involved students with disabilities or were conducted within a special education setting (Alric et al., 2007; Lynch et al., 2009; Popkin & Skinner, 2003; Slogett, 1971; Speltz et al., 1982) and with the exception of three (Bear & Richards, 1980; Popkin & Skinner, 2003; Shapiro & Goldberg, 1986), all took place in an elementary school setting.

Because most of the evaluations of interdependent group-oriented contingencies have focused on elementary students or students with disabilities, there is a smaller evidence base, consisting of only two studies (Bear & Richards, 1980; Shapiro & Goldberg, 1986) that have provided support for the use of interdependent group-oriented contingencies in secondary, general education classrooms. Bear and Richards (1980) assessed effects of an interdependent group-oriented contingency on accuracy of written

assignments for 5 children in grades 5-8. Participants were selected based on teacher reports that these students were performing below expectations in English and math. To document functional control, and ABAB design was used and accuracy on daily written assignments in math and English was monitored during baseline and intervention phases, with the average weekly performance of every student recorded for each academic subject. When the interdependent group-oriented contingency intervention was in effect, rewards were delivered to all students in the class when the class average on daily and weekly assignment accuracy met or exceeded the daily criterion. All target students, as well as the five non-target students enrolled in the class, performed better on math-related assignments during intervention. Target students gained an average of 7 percentage points from baseline to intervention, while non-targeted students averaged a gain of 1.5 percentage points. For English, all target students and two of the five non-target students demonstrated obvious increases in performance during implementation of the intervention, albeit these increases were not as large as improvement in math accuracy; target students gained an average of about 3 percentage points and non-targeted students demonstrated increases in accuracy of only about half of a percentage point. Students and teachers reported that the intervention was acceptable, and the school elected to continue implementing the contingency system the following year without additional support from the researchers.

The second study involving the use of interdependent group-oriented contingencies with secondary, general education students (Shapiro & Goldberg, 1986) employed an alternating treatments design to compare effects of independent, dependent, and interdependent group-oriented contingencies on spelling accuracy of sixth grade

students in two general education classrooms. In the independent condition, any students who scored at or above 90% on the spelling test received five token economy points. For the interdependent condition, the class average on the spelling test had to meet or exceed 90%, and every student in the class would receive points. Finally, the dependent condition involved random selection of a student, and points were delivered to everyone in the class if the selected student score 90% or better on the spelling test. For purposes of analyzing the scores of 53 students in the study, students were divided into three groups (low, middle, high) according to their average accuracy rate during baseline. Based on visual analysis of the changes in spelling accuracy across conditions, the authors concluded that all three types of group-oriented contingencies resulted in substantial improvement, and that no differences in spelling performance were apparent across the various types of contingency systems. Across the three conditions, students in the lowest performing group averaged about 83% on spelling tests, an increase of almost 30 percentage points from baseline. Effects on average- and high-performing students were less drastic, with the middle group demonstrating about a 10 percentage point gain over baseline and the high-performing group showing a gain of about 5 percentage points from baseline to intervention conditions.

While these two studies provide support for the use of interdependent group-oriented contingency systems to improve academic performance of secondary, general education students, it is important to note that there are some limitations that may occur when implemented in practice. To help address some of the problems that may impact the effectiveness of a group-oriented contingency, a recent line of research has investigated procedural variations. These variations include the incorporation of randomly selected

reinforcers, target behaviors, and criteria.

Variations of Interdependent Group-Oriented Contingencies

One problem that may occur in group-oriented contingencies is that the reward may not hold the same value for all students. In such a situation, as Skinner et al. (1996) point out, a reward has the potential to function as a reinforcer for some students, but may have no effect or even punish the behavior of other students. In this case, when a reward is presented that may not be particularly salient for a student, it is possible that the student may intentionally "sabotage" the success of the group by performing poorly or attempt to reduce the value of the reward by ridiculing or belittling it (Cashwell et al., 1998). One way of addressing the problem of a chosen reward having idiosyncratic effects across the classroom is to employ a token economy, allowing every student to choose their own reward; however, this often becomes difficult for a teacher to manage, and as Skinner et al. (1996) mentions, there still remains a possibility that students may purchase, steal, or give tokens away. An alternative is to select rewards randomly from a menu of available options. Recent research has documented the usefulness and effectiveness of incorporating randomized reinforcers into group-oriented contingency systems targeting social behavior (e.g., Kelshaw-Levering, Sterling-Turner, Henry, & Skinner, 2000; Theodore et al., 2001) as well as academic behavior (e.g., Popkin & Skinner, 2001; Alric et al., 2007).

Random selection of reinforcers. Random selection of reinforcers typically involves the teacher drawing from a pool of possible rewards after it has been determined that a group's performance has met an established criterion. Essentially, when employing random selection of rewards, a teacher is implementing a concurrent schedule of

reinforcement, where on some occasions a reward will function as a positive reinforcer and at other times it will simply be a neutral consequence (Skinner et al., 2004). Variable schedules of reinforcement have been shown to produce increased responding as well as behavior that is more resistant to extinction, resulting in the maintenance of behavior changes after the delivery of reinforcement in faded or withdrawn (Ferster & Skinner, 1957). It is important that teachers ensure that within the pool of possible rewards exists at least one consequence that is considered reinforcing for each and every student in the group, and that no reward is especially aversive to any student (Moore, Waguespack, Wickstrom, Witt, & Gaydos, 1994). Researchers have speculated that random reinforcers may be more effective and more enjoyable for students than nonrandomized reinforcers (Rhodes, Jenson, & Reavis, 1992) and recent research has provided preliminary evidence that provides support for this assertion (Alric et al., 2007; Kelshaw-Levering et al., 2000; Lynch et al., 2009; McKissick, Hawkins, Lentz, Hailley, & McGuire, 2010; Madaus et al., 2003; Moore et al., 1994; Popkin & Skinner, 2004; Reinhardt et al., 2009; Theodore et al., 2001). For example, a study was conducted by Madaus et al. (2003) to examine the effectiveness of delivering "mystery motivators" to 5 students in fifth grade contingent on whether they completed their homework with at least 80% accuracy. The teacher randomly selected a mystery motivator from a bag and delivered rewards to students who achieved the goal of 80% accuracy. A multiple baseline across participants design was used with a reversal to baseline embedded. Four of the 5 participants demonstrated marked increases in homework completion, and 3 students showed improvement in accuracy when the intervention was in effect. Additionally, 4 of the students indicated that they enjoyed the intervention and all 5 students reported that they would like to use

the intervention again in the future.

Random selection of target responses and criteria for reinforcement. In addition to randomly selecting reinforcers, researchers have explored the use of random selection of target behaviors and criteria for reinforcement (e.g., Kelshaw-Levering et al., 2000; Lynch et al., 2009; Lannie & McCurdy, 2007). It has been hypothesized that when students don't know which target behavior will be selected, they are more likely to engage in all behaviors (Skinner et al., 2004). In order for students to maximize the likelihood that their group will access rewards after a target behavior is randomly selected, students will be more likely to work to attain a high level of accuracy when engaging in multiple academic behaviors.

Several studies of interdependent group-oriented contingency systems have randomized target behaviors, criteria, and reinforcers simultaneously (Coogan, Kehle, Bray, & Chafouleas, 2007; Hawkins et al., 2009; Kelshaw-Levering et al., 2000; Lynch et al., 2009; McKissick, et al., 2010; Murphy et al., 2007; Popkin & Skinner, 2003; Reinhardt et al., 2009; Theodore et al., 2001; Yarbrough, Skinner, Lee, & Lemmons, 2004). Of interdependent group contingency studies employing random selection of target behaviors, criteria, and reinforcers, a somewhat smaller body of work has investigated effects on academics (Lynch et al., 2009; Hawkins et al., 2009; Popkin & Skinner, 2003, Reinhardt et al., 2009).

Hawkins et al. (2009) examined incorporation of an interdependent group-oriented contingency system into class-wide peer-tutoring models, looking specifically at math performance. In this study, an interdependent group contingency was applied to one class of general education fifth grade students who typically worked in dyads to study

multiplication facts and then tested each other on 12 problems. A multiple-probe design, wherein introduction of the intervention was staggered over sets of multiplication problems, was used to evaluate effectiveness of the group contingency intervention by assessing students' multiplication fact accuracy rates once a week during baseline and intervention phases. Two components of the intervention were randomized: the target behavior and criteria. Each session, the teacher randomly selected one of the target behaviors, either receiving a stamp from the teacher for displaying appropriate tutoring behavior or answering all of the multiplication fact problems correctly; additionally, the criterion that student performance would be compared to was randomly selected, and involved the teacher selecting a number from 15-26 which corresponded to the number of students whose tutoring behavior resulted in a stamp or whose academic behavior resulted in 100% accuracy on multiplication problems. Results of the study suggested that the incorporation of an interdependent group-oriented contingency system into regular peer tutoring procedures was effective in improving accuracy on multiplication fact probes.

Lynch et al. (2009), Popkin and Skinner (2003), and Reinhardt et al. (2009) examined the use of an interdependent group-oriented contingency system employing random selection of target behaviors, criteria, and reinforcers in targeting academic performance outside of the context of a class-wide peer-tutoring model. Lynch et al. (2009) utilized random selection of rewards and criteria for reinforcement when comparing the relative effectiveness of independent, dependent, and interdependent group-oriented contingencies on improving homework completion and accuracy. Six students in fifth grade, all diagnosed with either a learning disability or a speech

impairment, received a journal and reading assignment to complete at home each night. In each type of contingency, presented within an alternating treatments design, students received rewards randomly selected by the teacher contingent on their own and/or peers' homework performance meeting criteria that was also randomly selected. Consistent with previous investigations comparing the effects of these three types of group-oriented contingencies, no differential effects were observed between the group contingencies. The teacher indicated that the intervention was acceptable and effective, that she would recommend it to other teachers, and continued to implement the intervention using the interdependent group contingency system after the conclusion of the study. All but two students in the classroom reported that the intervention was acceptable, and all students declared that they liked the teacher randomly selecting components.

Popkin and Skinner (2003), implementing an interdependent group contingency system during instruction in multiple content areas, targeted accuracy on the independent seatwork assignments of five students with serious emotional disturbance in a self-contained middle school classroom. A multiple baseline design across the three target content areas was utilized wherein rewards were delivered contingent on the class average meeting a randomly selected criteria. Subject areas (spelling, math, or English) and rewards were also randomly selected by the teacher. For students who performed well during baseline, their accuracy scores continued to remain high during intervention, while those students who performed poorly in baseline demonstrated dramatic improvements after the intervention was implemented. Expanding on Popkin and Skinner's (2003) study, Reinhardt, Theodore, Bray, & Kehle (2009) targeted homework accuracy of six fourth-grade students in a general education classroom. Similar to Popkin

and Skinner's (2003) procedures, a multiple baseline design across content areas was employed. Criteria on reading comprehension, spelling, and math homework assignments were selected according to baseline levels, and class averages as well as lowest and highest scores on assignments were included as potential target behaviors for selection. If the class met the randomly chosen criteria, the teacher would draw an index card from the "mystery motivator" box, and the class would receive the randomly selected reward the same day. Results indicate that the intervention was effective in increasing accuracy rates on homework of the six participating students, albeit, these effects varied across content areas, with the greatest effect noted for reading comprehension. In both the Popkin & Skinner (2003) and Reinhardt et al. (2009) studies, the teacher and students reported that they found the intervention acceptable and liked the randomization of components.

Of the 4 studies to date assessing the effectiveness of interdependent group-oriented contingency interventions using random selection of target behaviors, criteria, and reinforcers, all were conducted either with elementary students or students with disabilities. This works suggests that randomized components within interdependent group contingencies are effective in improving academic performance and have social validity for teachers and students. Research is needed, however, to assess effectiveness of randomized components with secondary students and in general education settings.

Delayed Reinforcement of Academic Behavior

In the four studies conducted to date investigating randomized components of interdependent group contingencies, feedback and/or reinforcement was delivered after only a brief latency following the end of the activity. In the study conducted by Reinhardt et al. (2009), random selection of criteria and rewards occurred soon after students turned

in their homework assignments in the morning and rewards were delivered sometime during that school day. In Lynch et al. (2009), rewards were always delivered at some point during the day in which the intervention took place. Popkin and Skinner (2003) informed students whether criteria for rewards had been met and what the randomly selected reward was shortly after the activity ended but the reward was delivered the following day. Identification of students who meet criteria for receiving a reward requires that assignments are graded before the school day ends. This may be feasible in a small class (e.g., under 6 students, as was the case in both the Popkin & Skinner and Lynch et al. studies); however, this becomes less realistic when a teacher is responsible for grading the work of 25 or more students in a general education classroom. For middle and high school teachers that have multiple classes of students, this becomes even more difficult. A teacher may only have one period with a group of students in class, and to assign work, provide instruction, and grade the work of every student within that hour is practically impossible. Though the teacher in the study conducted by Reinhardt et al. (2009) did correct homework assignments for a larger group of students, the teacher had only one class of fourth graders and had until the end of the school day to complete grading.

Delayed reinforcement is more realistic and applicable for use in school settings to address the practical constraints previously outlined. In schools, it is typical for students to receive delayed feedback and reinforcement for academic performance once teachers are able to review and grade work days or even weeks after it is completed. While delayed or intermittent reinforcement is often incorporated into intervention plans after initial improvement is demonstrated with immediate reinforcement of desired behavior, there has been some empirical support for the use of delayed reinforcement in

training response acquisition (Dickinson, Watts, & Griffiths, 1992; Schwarz & Hawkins, 1970; Stromer, McComas, & Rehfeldt, 2000). Additionally, the immediate consequences of social approval or disapproval that are often peer-delivered when group-oriented contingencies are in effect may operate by influencing peers' behavior, providing temporally proximal reinforcement of on-task and academic-related behaviors, while the delivery of additional rewards may occur at a later time (Crouch, Gresham, & Wright, 1985).

Purpose

The current study sought to add to the literature on interdependent group-oriented contingency systems for academic performance. As demands on teachers increase, it is a worthwhile endeavor to explore the use of efficient, socially acceptable approaches to supporting students in the classroom. Given the restricted time that teachers have to learn and implement interventions, while simultaneously carrying out all their additional responsibilities in the classroom, it is necessary for school psychologists to consider these limitations when recommending interventions. In previous work involving group-oriented contingencies, the delivery of reinforcement has been relatively immediate; while this is an ideal arrangement, it may be infeasible for middle and high school teachers to ensure reinforcement of academic performance occurs immediately within the class period.

This study sought to expand the literature in this area by extending the use of interdependent group-oriented contingency systems to secondary, general education settings. Within this class-wide intervention, random selection of multiple components of the contingency system, including target behaviors, criteria, and reinforcers, were

employed and the relative effectiveness of delayed reinforcement compared to immediate reinforcement was explored. This study examined whether the delivery of reinforcement could be delayed within an interdependent group-oriented contingency system while still improving the academic performance of students in the classroom.

CHAPTER III

METHOD

Setting

One middle school, general education classroom served as the setting for this study. The participating class consisted of 28 sixth grade students who were enrolled in a remedial math course. The teacher was identified by the school's behavior support team as 1) struggling with classroom management around work completion and off-task behavior and/or 2) having had expressed concerns or referred several students in their classrooms for engaging in off-task behavior and/or failing to complete assigned work. This classroom met the following pre-established inclusion criteria:

1. The participating classroom must be focused around an academic content area, such as math, language arts, science, or social studies. Observations and a review of permanent products conducted prior to initiating the study confirmed that moderate levels of off-task behavior were emitted by multiple students and that work completion and/or accuracy on in-class assignments was, on average, below 90%.
2. Within the classroom period, opportunities for independent and/or group work, resulting in some form of permanent product, must occur daily.
3. The participating classroom teacher could not be currently using any systematic contingency management program for rewarding work completion, on-task behavior, or work accuracy (with the exception of assignment grades).

Participants

Within the classroom, the teacher identified 3 students that he perceived as exhibiting moderate to high levels of off-task behavior. Parental consent and student assent was obtained for these students and direct observations conducted prior to beginning the study proper documented that moderate to high levels of off-task behavior was exhibited by the selected students. The teacher involved in the study was informed of the study's intent and procedures and was asked to sign a consent form in order to participate. Passive consent was obtained for the rest of the students in the classroom. A letter informing parents of the study's purpose and the potential use of their child's daily assignment performance data was sent home before the study commenced. For these students, work completion and accuracy data was recorded anonymously and reported using descriptive statistics. These consent and assent forms are attached in Appendix A and B.

Response Measures, Data Collection, and Inter-Observer Agreement

Task completion and accuracy served as the primary dependent variables and were recorded individually for each student in the class. All students in the class were assigned an ID number, and daily task completion and accuracy rates for each student were recorded using the ID number. No information that linked this data to student names was removed from the school. Task completion was measured by recording the percentage of a task that was attempted by the student. For worksheets and other tasks with a discrete number of items, the completion percentage was calculated by dividing the number of items with any attempted answer by the total number of items. Task accuracy was recorded by calculating the percentage of items completed accurately.

Work completion and accuracy were monitored daily throughout the study, and only class averages were reported in final data.

Data on the occurrence of academic engagement of the 3 target students was also collected daily using pen and paper for a 10-minute observation period, corresponding with the duration of independent/group work periods. Academic engagement was defined as: in seat; eyes oriented toward worksheet, teacher when providing directions, or group members when conversation is relevant to the task; working on assigned worksheet items or other appropriate activities if finished with worksheet, talking with group members or teacher about math-related topics. Non-examples include: out of seat to sharpen pencil, talking with peers about topics not related to math or the assignment, working on assignments for other classes, etc. Momentary time sampling was used to code academic engagement, wherein, at the beginning of each 10 s interval, observers indicated whether each target student was academically engaged at that moment.

Inter-observer agreement. Inter-observer agreement (IOA) on academic engagement was collected on 31% of observations. For these observations, 2 observers collected data simultaneously but independently. Agreements were scored when both observers mark an occurrence or non-occurrence during a given interval. Non-agreements were scored when one observer scores an occurrence and the other observer scores a non-occurrence (Kennedy, 2005). Criterion for IOA was set at 85% agreement. For total agreement, IOA was calculated as follows: (number of intervals in which coders agreed a response did or did not occurs/number of intervals) * 100. Occurrence-only agreement was calculated as: (number of intervals coders agreed a response occurred/intervals in which at least one coder scored a response) * 100 and non-occurrence agreement was

determined by: (number of intervals coders agreed a response did not /intervals in which either coder did not score a response) * 100.

Across all three conditions, total agreement across target students was 92.9% (range: 89.6% - 95.4%) and occurrence-only agreement was calculated as 87.6% (range: 81.3% - 89.0%), both averages exceeding the 85% IOA criterion originally proposed. Non-occurrence agreement was lower, at 75.0% (range: 54.6% - 92.1%). Table 1 displays averages by condition for total, occurrence-only, and non-occurrence only agreement.

Table 1

Average IOA Data, by Condition

	Baseline	Immediate R+	Delayed R+
Total agreement	95.4%	92.4%	90.2%
Occurrence only agreement	81.3%	88.7%	89.0%
Non-occurrence only agreement	92.1%	71.4%	58.8%

Some potential reasons for poorer non-occurrence agreement were that 1) the overall number of intervals in which one or both observers scored a non-response (i.e., not academically engaged) was much smaller than the number of intervals in which either observer scored a response in most sessions, resulting in the potential for just a few disagreements to drastically reduce the overall percentage of agreements, and 2) the definition used to code academic engagement, based on the teacher's guidelines, excluded some behaviors (e.g., sharpening pencils to complete worksheets, talking to non-group members about problems) that may typically be subsumed in being on-task; therefore, while articulated in the operational definition provided, it can be anecdotally noted that observers expressed confusion about these nuances after the first several IOA sessions.

Social validity and treatment integrity. A social validity questionnaire was completed by the teacher and students at the conclusion of the study (see Appendices D and E) to gather information about the acceptability of the intervention, perceived helpfulness of the contingency system in promoting work-related behaviors, and preference for the delayed or immediate reinforcement condition, and To ensure fidelity of implementation of the intervention, observers regularly documented whether the following core features of the intervention were implemented as intended: 1) the corresponding script was read to introduce the intervention condition in effect for that class period (i.e., delayed reinforcement or immediate reinforcement), 2) a list of student groupings was displayed and followed by the class, 3) a task was assigned to the class, with the expectation that students complete it by the end of the period, 4) following the work period, a target behavior, criterion, and reward was randomly selected, 5) rewards that groups earned were actually delivered, or plans for groups to receive rewards were specifically outlined. A checklist, attached in Appendix C., was used to indicate whether each of these features was or was not present during the observed session. Fidelity data were collected on 55% of intervention sessions and are reported in Table 2. The average fidelity score for the immediate reinforcement intervention condition was 93%, while the delayed reinforcement condition resulted in an average of 100%.

Table 2

Intervention Implementation Fidelity Scores

	Immediate R+	Delayed R+
	80%	100%
	100%	100%
	100%	---
Average across sessions	**93%**	**100%**

Experimental Design and Procedures

Following collection of initial baseline data, an alternating treatments design was employed in which 3 conditions were presented: baseline, immediate reinforcement, and delayed reinforcement. Order of condition presentation was determined quasi-randomly prior to initiation of the study. To facilitate equal presentation of conditions, and to minimize the potential for carryover effects, no more than 2 sessions of any one condition occurred concurrently, and intervention conditions were not implemented on consecutive school days (i.e., a day lapsed between the implementation of the delayed reinforcement condition and the immediate reinforcement condition).

Baseline. During baseline, the teacher was asked to conduct class as he typically would, including delivering instruction and responding to student behavior, maintaining his teaching style and directives throughout baseline. During this phase, there was no systematic delivery of reinforcement contingent on group performance. No seating assignments were typically provided in the participating class, and this arrangement was sustained throughout all baseline sessions. The teacher typically organized the schedule of the class so that the first portion of the period was spent addressing attendance-taking, submitting and returning homework assignments, and other "housekeeping" activities. Then, a brief amount of time was spent on instruction, where the teacher would review previously covered material and focus on going over the examples provided on the day's worksheet. Students were then given 10 minutes to complete this worksheet, and were permitted to work in pairs. At the end of the 10-minute work period, students turned in their worksheets to data collectors. Data collectors recorded accuracy and completion rates and returned worksheets before the end of the period.

Training and introduction of the intervention. Prior to implementation of the intervention, the researcher met with the teacher to provide training in the different conditions. Training covered the following: 1) assigning students to groups, 2) introducing each intervention condition (initially and then each day), 3) announcing when an intervention is in effect, 4) checking daily work completion and accuracy, 5) procedures for randomly selecting criteria and reinforcement, and 6) clarifying the role of the teacher and the roles of data collectors.

At the beginning of each work period, groups consisting of four students were formed based on stratified random assignment. More specifically, students were ranked ordered by their accuracy rates determined in baseline and divided into quartiles. One student from each quartile was assigned to a group, and each day, groups will be comprised of a different combination of students. The researcher developed a list of student groupings for each day of each intervention session and posted a seating chart at the front of the class. Upon entering the classroom, students were instructed to check this posting for their seat assignment.

The intervention was introduced to the class via a script. This script (see Appendix F.) outlined the procedures of the intervention and expectations for student behavior when the intervention is in effect. Two separate scripts were developed to correspond to each intervention phase, wherein one explicitly stated that contingent rewards will be delivered at the end of the class period and the other specified that rewards will be announced the next time the class meets. These scripts were read on the first day of each intervention phase and then shortened versions of these scripts were used on subsequent sessions of each condition. In addition to these scripts, a review sheet was

given to the teacher to serve as a reference for the procedures unique to each condition. A preference assessment was distributed to students prior to implementation of the intervention conditions. The teacher and researcher worked together to identify a list of tangible and intangible items/activities that students could earn. A list of 10 options was developed, and students were asked to independently rank items in order of preference. Based on these rankings, the researcher included five rewards that would be included in the pool, ensuring that the pool was organized so that each student had the potential to earn a reward that they ranked as their first or second choice.

Prior to the initiation of the study, the teacher agreed to responsibility for assigning worksheets, reading the script aloud to students, randomly selecting contingency components, and distributing rewards to groups. Data collectors were responsible for developing seating charts, scoring and returning worksheets, and providing rewards. This arrangement was implemented for the first three intervention conditions, but given time and logistical constraints, the teacher requested that roles be shifted. From then on, the researcher essentially implemented the intervention, reading the script aloud to students, randomly selecting contingency components, and distributing rewards during the immediate reinforcement condition.

Intervention. At the beginning of the work period, students were assigned to groups and later in the class period, a worksheet was distributed and students were instructed to work on the task. Prior to beginning the task, the contingency in effect was announced using the relevant script (see Appendix F.). The expectation was that students should be able to complete the assignment within the allotted 10-minute work period. At the end of the class period, each student turned in their own copy of the assignment,

regardless of whether they completed the task as a group or if they were unable to fully complete the assigned work. After students turned in assignments, data collectors checked for accuracy and completion, recorded class averages, group averages, and the range of accuracy and completion rates on these assignments. Class completion and accuracy rates were reported to students by either the end of the class or by next period, depending on the phase of intervention in effect.

Selection of target behavior, criterion, and reward occurred immediately following the collection and grading of work or at the beginning of the next class period, depending on the intervention phase in effect. The target behavior to be selected would either be work accuracy or completion, and a coin was flipped to determine which behavior would be targeted. A pool containing papers labeled with five percentages was selected from to identify the criterion that would be paired with the selected target behavior (e.g., if "accuracy" was determined by a coin flip and "80%" was pulled from the pool, then groups with an average accuracy rate of greater than 80% would receive reinforcement). The percentages that were included in this pool (Pool #1) were selected based on baseline rates of work accuracy; class-wide rates were calculated by taking the median classroom rates of accuracy obtained during the initial baseline phase. This value was included in Pool #1 in addition to increments 5%, 10%, 15%, 20%, 25%, and 30% higher, so that the baseline class average was the lowest criterion included in the pool. A second pool (Pool #2) contained papers labeled with the rewards selected from student preference assessments. After flipping a coin and drawing an item from Pool #1, a paper was drawn from Pool #2 to randomly select the reinforcer that will be delivered. Groups that met the selected criterion (drawn from Pool #1) for accuracy or completion (selected

by a coin flip) would then be given the randomly chosen reinforcer (drawn from Pool #2). The teacher would then continue the next session of the intervention, assigning a new task for the class and breaking students into assigned groups for that day.

Immediate reinforcement. In the first intervention condition, work completion and accuracy was calculated immediately after students turned in their assignments. To assist with scoring, data collectors determined and recorded how much of the assigned task was completed by each student (i.e., percentage of the task attempted by the student) and the accuracy of the task (i.e., percentage of items answered correctly). Then, consulting the list of group membership for the day that correspond with the assigned task, average work completion and accuracy rates were computed for each group. Group averages were announced and the target behavior and criteria were selected, with rewards delivered to groups before the class period ends.

Delayed reinforcement. The second intervention condition incorporated delayed feedback and delivery of rewards. In this condition, data collectors scored and recorded student work completion and accuracy rates once students turned in assignments, but the teacher waited until the beginning of the next class, the next school day, to announce group averages and randomly select target behaviors, criteria, and rewards.

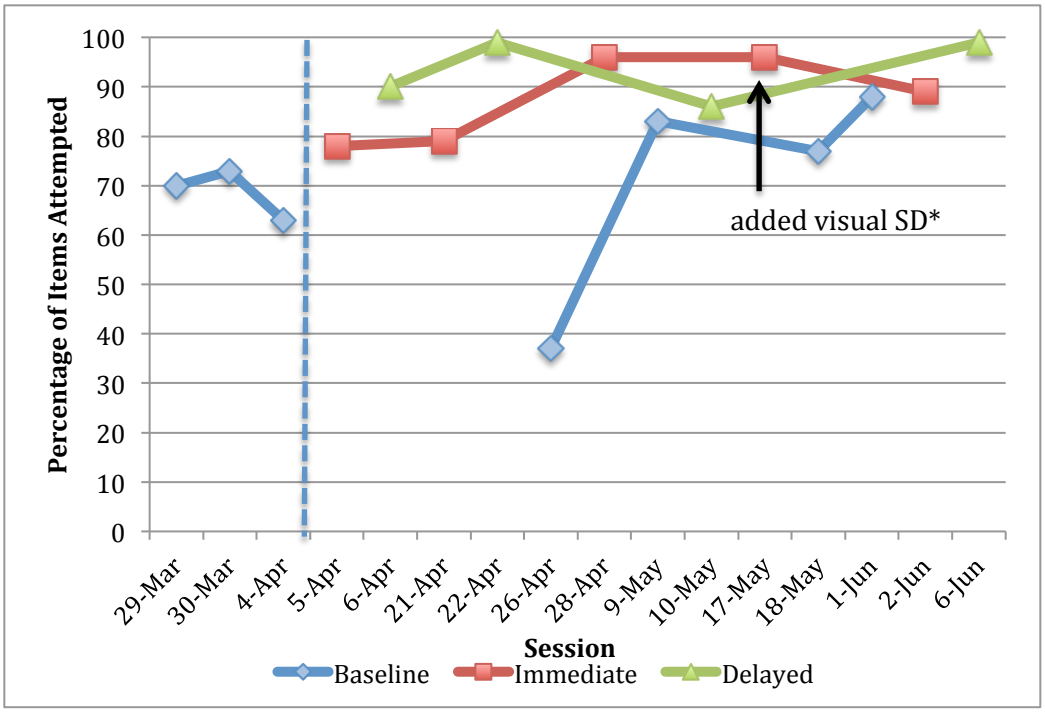
CHAPTER IV

RESULTS

Results are depicted in Figures 1-9. Figures 1-6 depict results obtained across the class and Figures 7-9 depict academic engagement outcomes for three target students.

Class-Wide Outcomes

Figure 1 displays the percentage of items students attempted to answer (i.e., completion) across baseline and intervention sessions. In the initial baseline, students attempted to answer a mean of 69% of items (range: 63% - 73%). When the alternating treatments design was implemented, the percent of items attempted increased across conditions including baseline; however, attempts remained slightly lower in baseline relative to the two intervention conditions. During baseline sessions, mean completion increased 3% relative to the initial baseline, but if only the last three points (when responding was more stable) of baseline are used, there is a 20% increase. 22% more items were attempted in the immediate feedback condition and 27% more were attempted in the delayed feedback condition relative to the initial baseline. Level, variability, and trend of the two intervention conditions were similar. Although differentiation between the continuing baseline and intervention conditions was maintained, there was little differentiation between the two intervention conditions. This could have been due to carry-over from one condition to the next (this hypothesis is partially supported by the increase in levels between the initial and continued baseline conditions, as well as the increasing trend of the continued baseline condition) however, and as is discussed later, alternative explanations related to the quality of the worksheets and classroom instruction also are important to consider.



*Note: to ensure clear specification of the contingency in effect for each session, a visual discriminative stimulus (i.e. a sign that was displayed on the overhead) was added because differentiation between conditions wasn't yet evident

Figure 1. Percentage of items students attempted to answer.

Figure 2 presents percentage of items answered correctly (i.e., accuracy). Overall, more variability was observed in accuracy relative to items attempted. Level remained constant in both intervention conditions, but an increase in trend was demonstrated in continued baseline relative to initial baseline. In the initial baseline phase, mean accuracy was 37% (range: 26% - 52%). Demonstrating an increase in level, the mean accuracy for the subsequent baseline sessions was 61% (range: 42% - 73%), a 65% increase over the initial baseline average. Once the intervention was implemented, accuracy increased 100% over initial baseline in the immediate reinforcement condition and 119% in the delayed reinforcement condition. It is evident that, compared to initial baseline, both intervention conditions produced higher accuracy percentages; however, accuracy simultaneously increased in subsequent baseline sessions, again suggesting the possibility

of carryover effects.

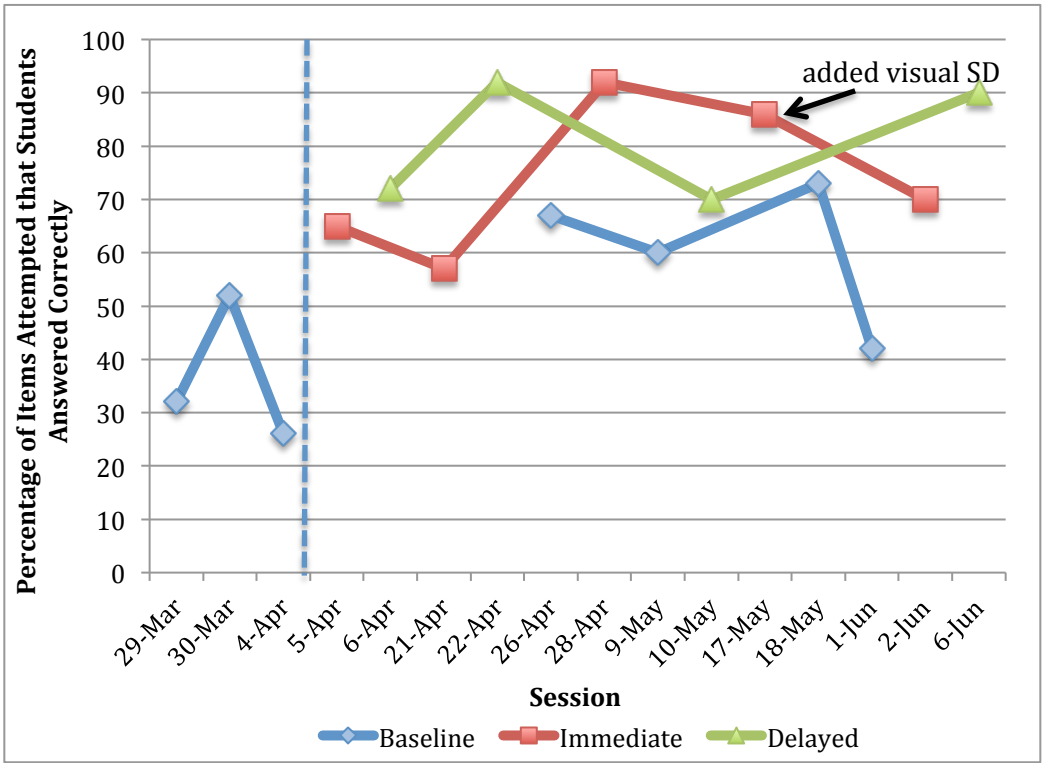


Figure 2. Percentage of items students answered correctly.

Instructional Variables

Anecdotal observations conducted after commencement of the study suggested that classroom-level variables, including quality and quantity of instruction and variability in worksheets, might have impacted the obtained results. To explore these hypotheses, data on length of worksheets and percentage of classroom time the teacher spent providing instruction were collected. Figures 3 and 4 depict the number of worksheet items students were assigned at each session. In Figure 3, these data are shown along with percent of items attempted and, in Figure 4, with the percentage of items completed accurately to allow for an examination of possible trends or co-variation. Visual inspection of these charts does not indicate a strong relation between number of worksheet items and percentage of items attempted or completed accurately. Figures 5

and 6 portray the percentage of items attempted and percentage of items completed accurately along with the percentage of classroom time the teacher spent providing instruction. The decision to collect data on instructional minutes wasn't considered until the eighth session, as length of instruction wasn't initially hypothesized as an influential variable likely to impact work accuracy and completion rates. Percentage of the class period spent in instruction was recorded, with instruction defined as: teacher explaining or modeling concepts, reviewing examples provided on the worksheet, presenting questions to the class, and responding to student questions about math content; additionally, instruction was coded when students provided answers or attempted answers to teacher-posed questions. While data indicate that a relatively small proportion of class time was spent on instruction (ranging from accounting for a minimum of 6% of the period to a maximum of 16%), trends in instructional minutes do not appear to co-vary with accuracy or completion patterns.

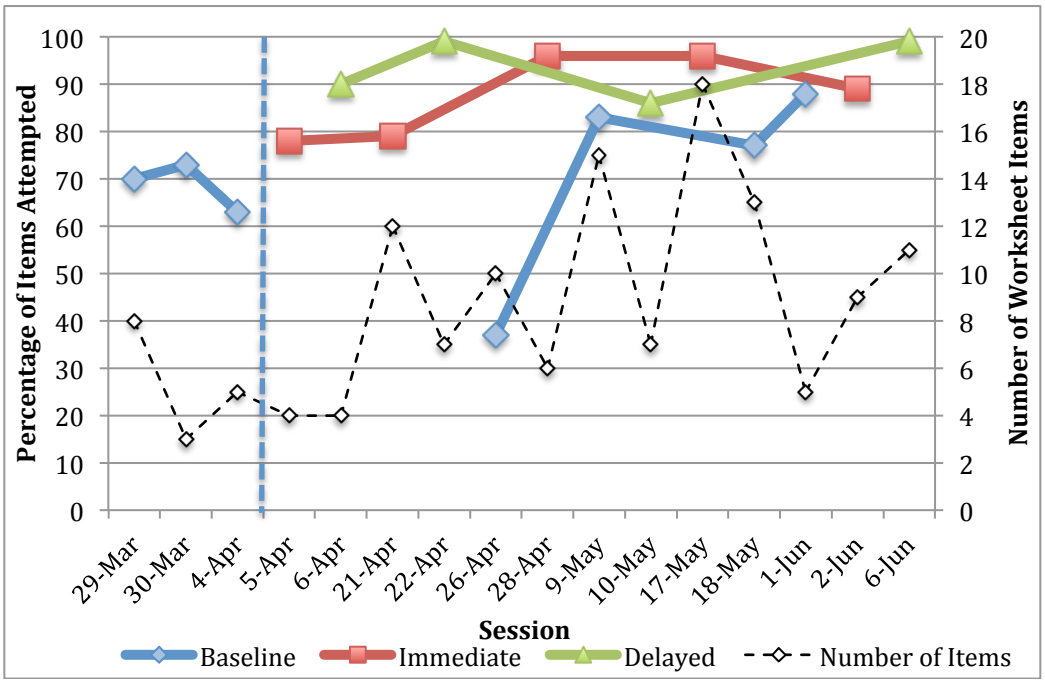


Figure 3. Number of worksheet items relative to average percentage of items attempted.

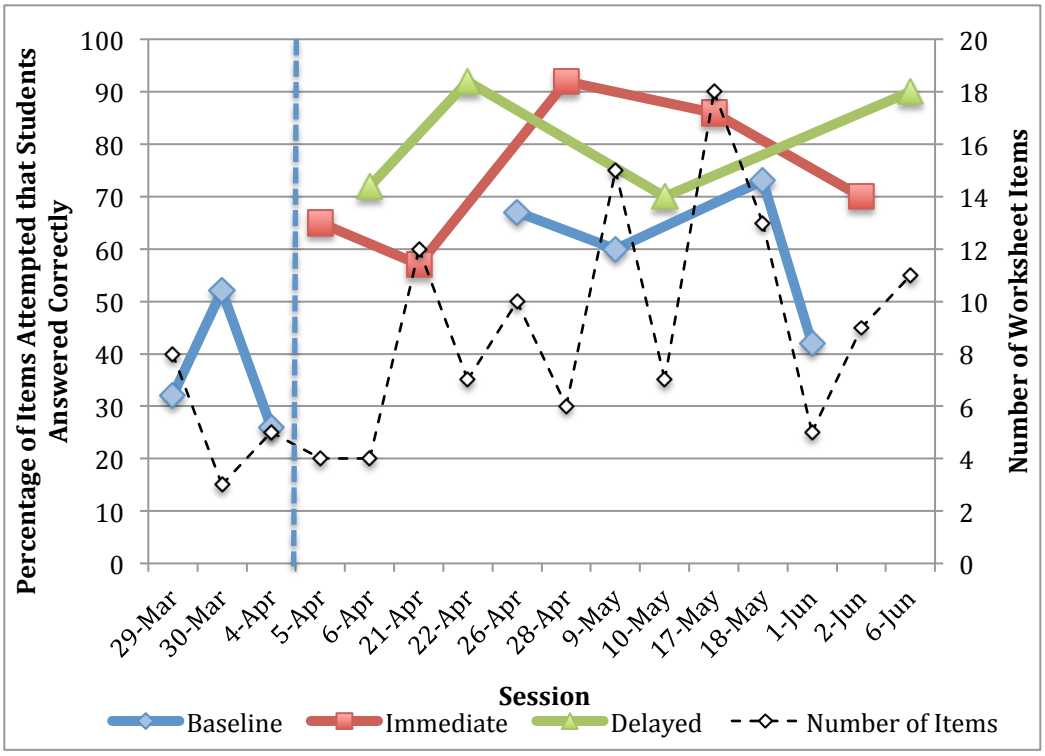


Figure 4. Number of worksheet items relative to average percentage of items completed accurately.

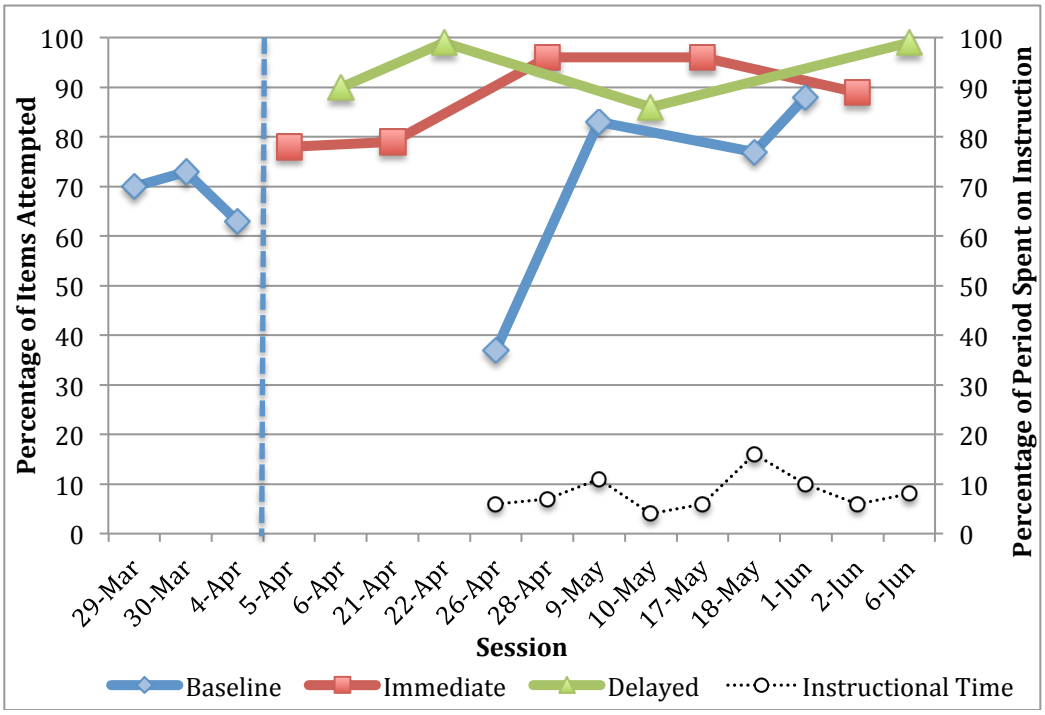


Figure 5. Number of instruction minutes relative to average percentage of items attempted.

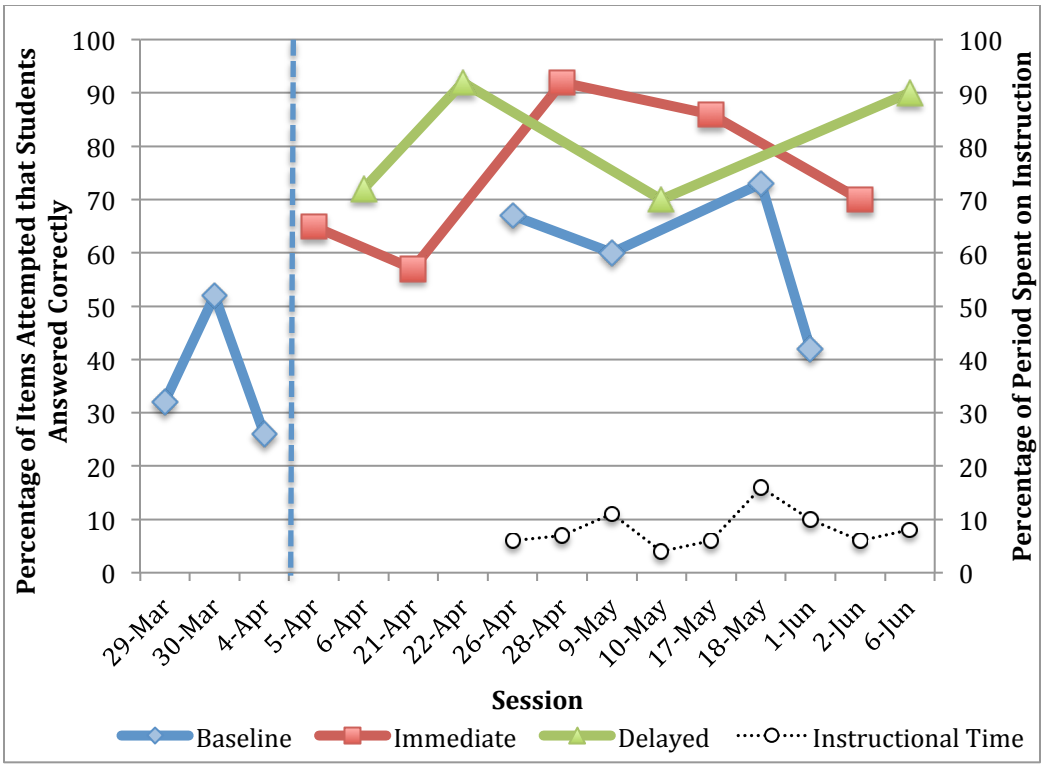


Figure 6. Number of instructional minutes relative to average percentage of items completed accurately.

Student Outcomes

Figures 7-15 display academic engagement across baseline and intervention sessions for the three target students identified by the teacher as likely to exhibit moderate to high rates of off-task behavior in class. A visual stimulus was added to the intervention in the 12th session of data collection in response to a general lack of stimulus control (little differentiation across conditions). The visual stimulus consisted of a sign, displayed at the beginning of the class and throughout the work period, that identified the condition in effect for the day (i.e., "no reward opportunity" for baseline, "rewards today" for the immediate reinforcement condition, "rewards tomorrow" for the delayed reinforcement condition).

Participant 1: Jesse. During baseline, the percentage of intervals in which Jesse

was academically engaged ranged from 11% to 39%. Once the intervention was introduced, there was no clear difference in percentage of intervals with academic engagement between the delayed and immediate intervention conditions; level, trend, and variability were similar across both intervention conditions. This is evidence to suggest higher engagement levels in both intervention conditions when compared to the baseline condition, especially after the visual prompt was added to the intervention. For Jesse, both intervention conditions differed markedly from level and variability of baseline. Figures 8 and 9 depict Jesse's academic engagement relative to the percentage of items he attempted and the percentage of items he completed accurately during each session. From these graphs, it is evident that the percentage of items that he attempted increased over baseline during both intervention conditions; however, this same trend was not demonstrated when examining the percentage of items he completed accurately. The relationship between academic engagement and work behaviors was also explored. Of the sessions in which Jesse attempted less than 50% of worksheet items, all four of these sessions indicated that he was academically engaged less than 50% of intervals. For those sessions in which Jesse answered less than 50% of items attempted correctly, Jesse was academically engaged less than 50% of intervals in three out of four of sessions.

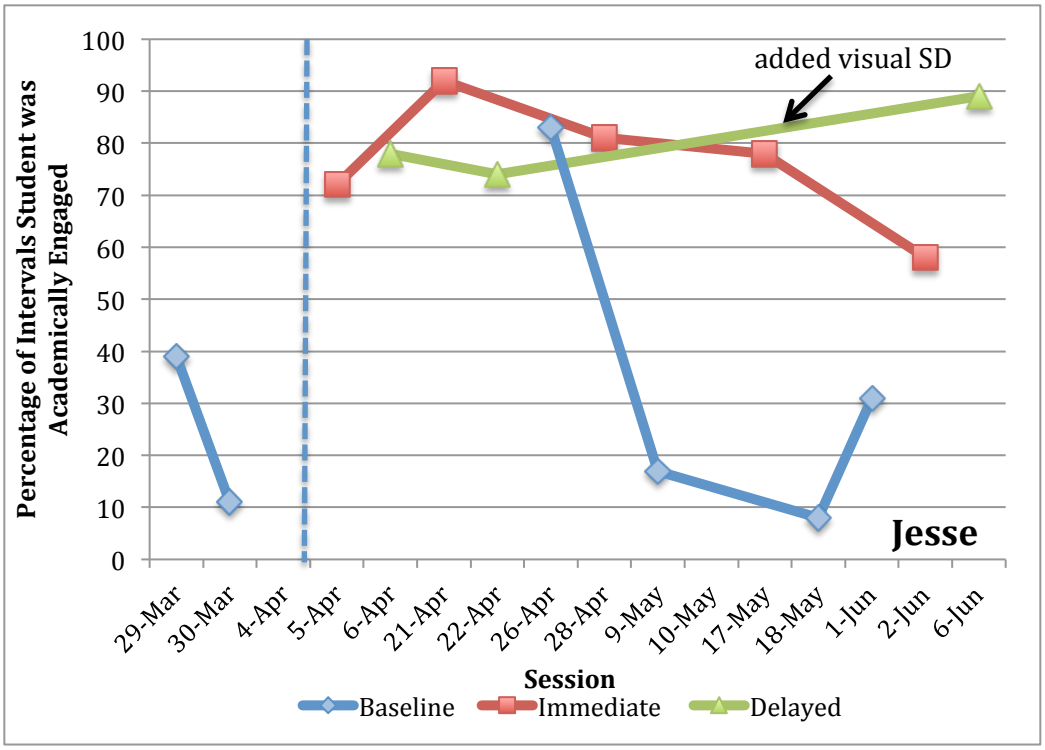


Figure 7. Percentage of intervals with academic engagement for Jesse.

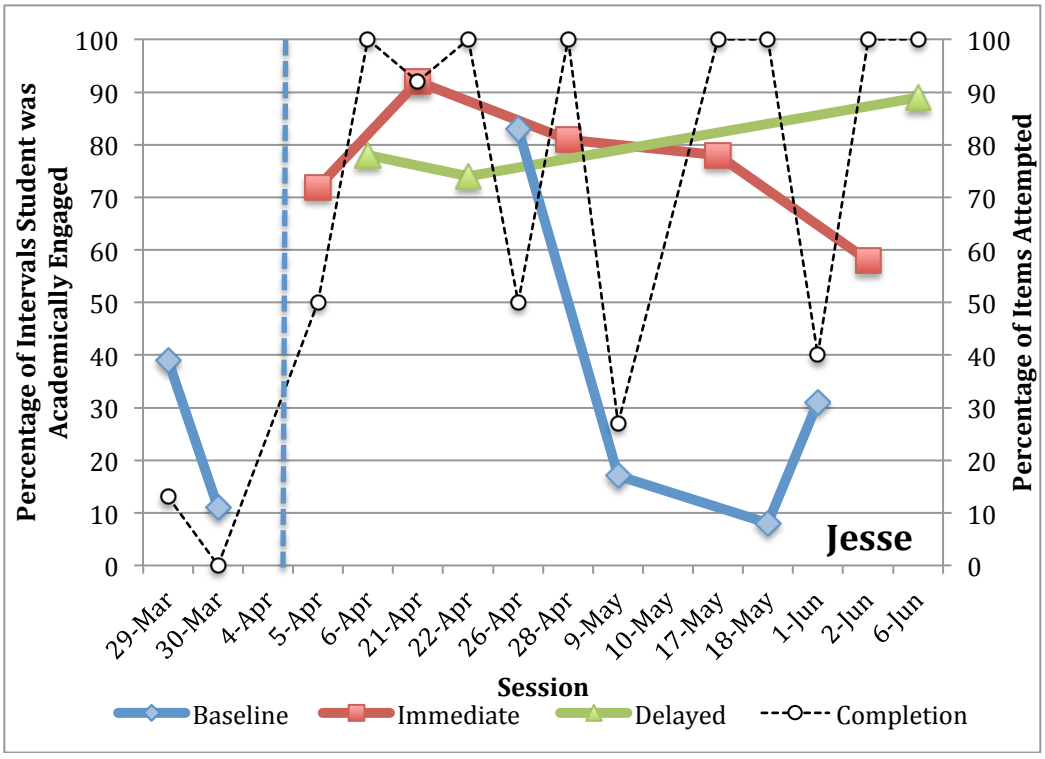


Figure 8. Percentage of intervals with academic engagement for Jesse relative to percentage of items attempted.

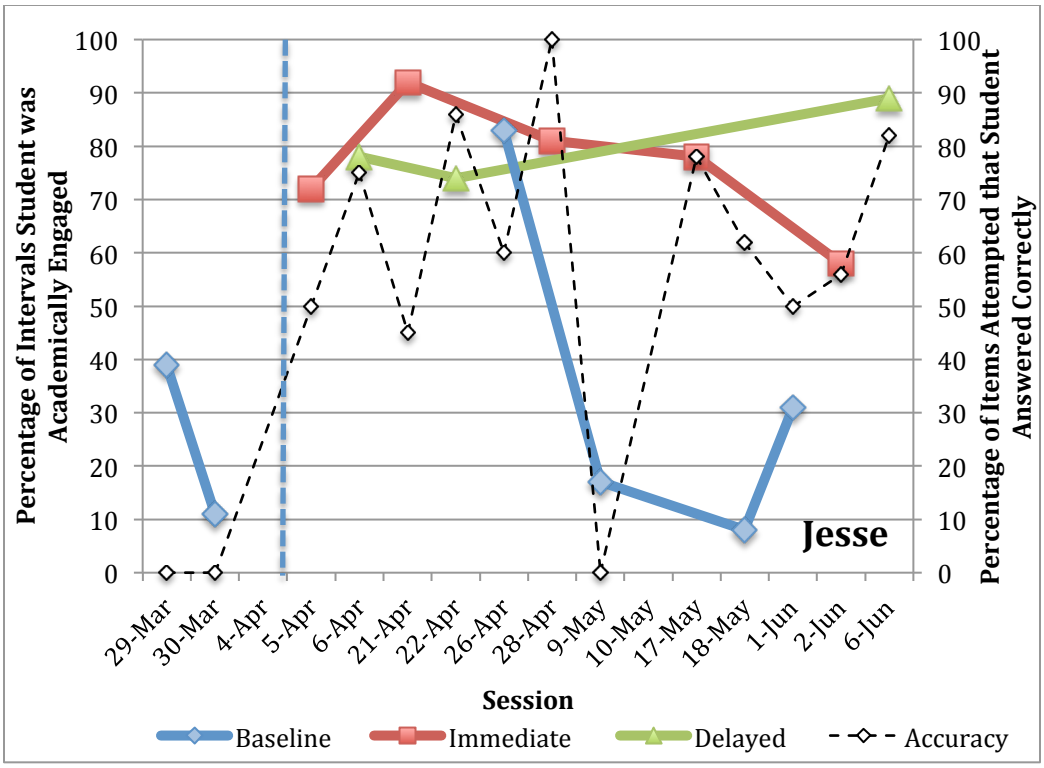


Figure 9. Percentage of intervals with academic engagement for Jesse relative to percentage of items completed accurately.

Participant 2: Delwyn. Delwyn's baseline levels ranged from 19% to 44% of intervals coded with academic engagement. As Delwyn was absent from class for all but one of the days in which the delayed reinforcement condition was in effect, no conclusions can be made about the relative effectiveness of the two intervention conditions. Comparing baseline levels of academic engagement to levels during the immediate reinforcement condition, it is evident that the intervention condition produced higher academic engagement for Delwyn. From examination of Figures 11 and 12, it is evident that the percentage of items that he attempted and the percentage of items that he completed correctly increased over initial baseline during both intervention conditions; however, this differentiation was not as clear during continued baseline sessions. A relationship between low levels of academic engagement and work behaviors was also

evident for Delwyn. Of the sessions in which Delwyn attempted less than 50% of worksheet items, all four of these sessions indicated that he was academically engaged less than 50% of intervals. Further, in six sessions Delwyn completed less than 50% of items correctly; in five of these sessions, Delwyn was academically engaged less than 50% of intervals.

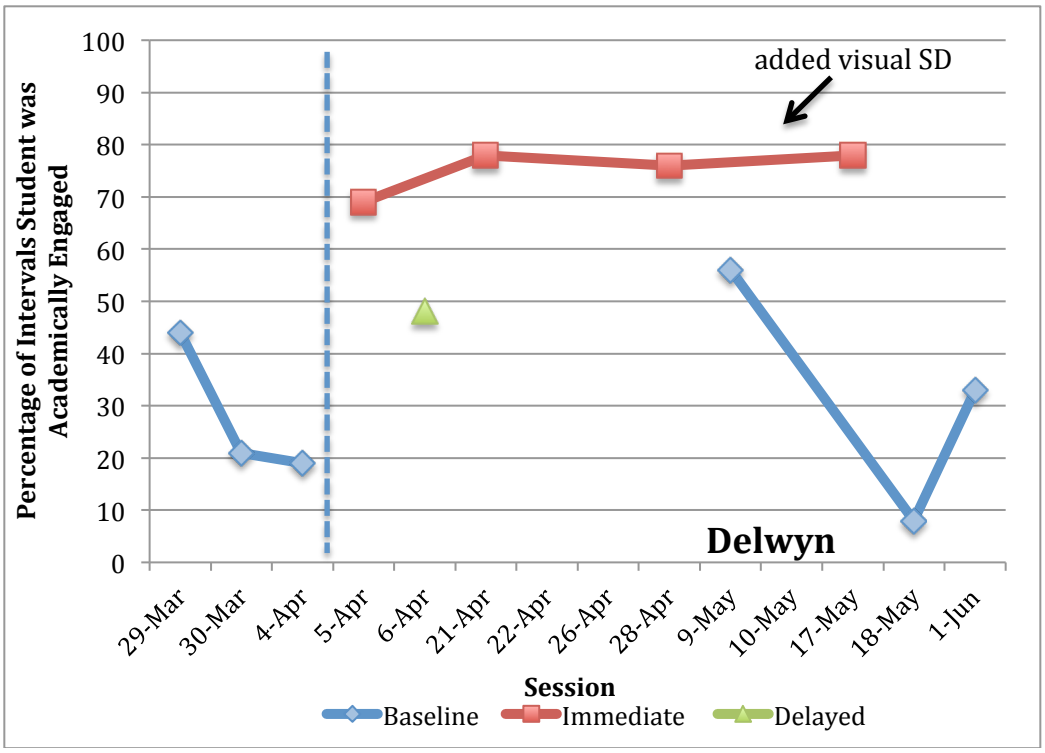


Figure 10. Percentage of intervals with academic engagement for Delwyn.

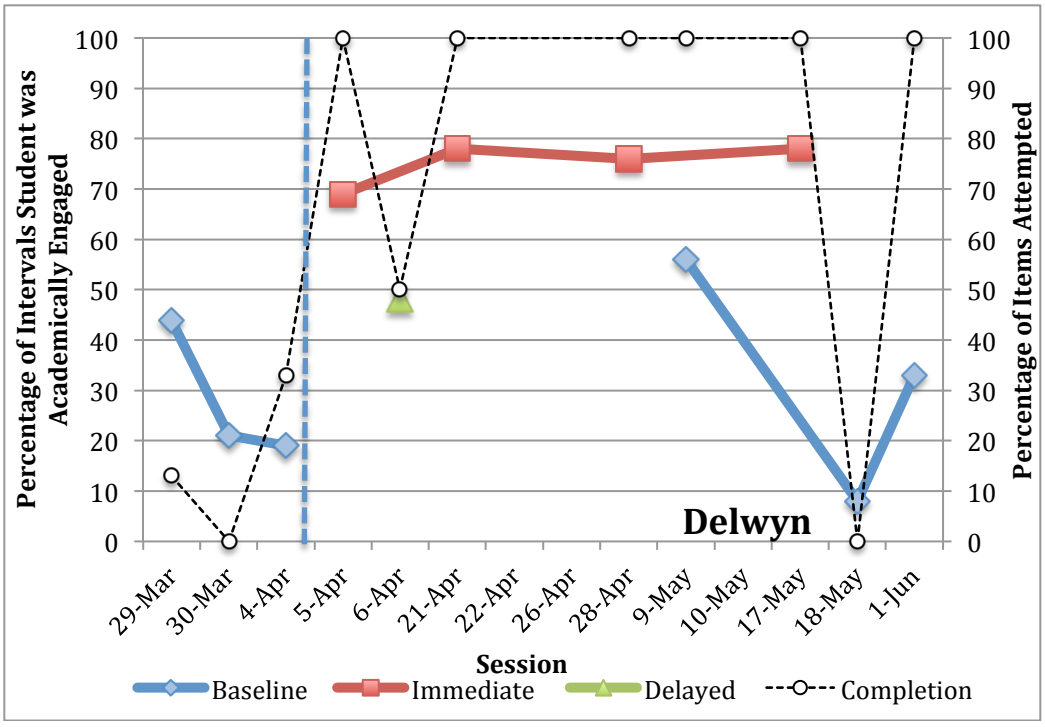


Figure 11. Percentage of intervals with academic engagement for Delwyn relative to percentage of items attempted.

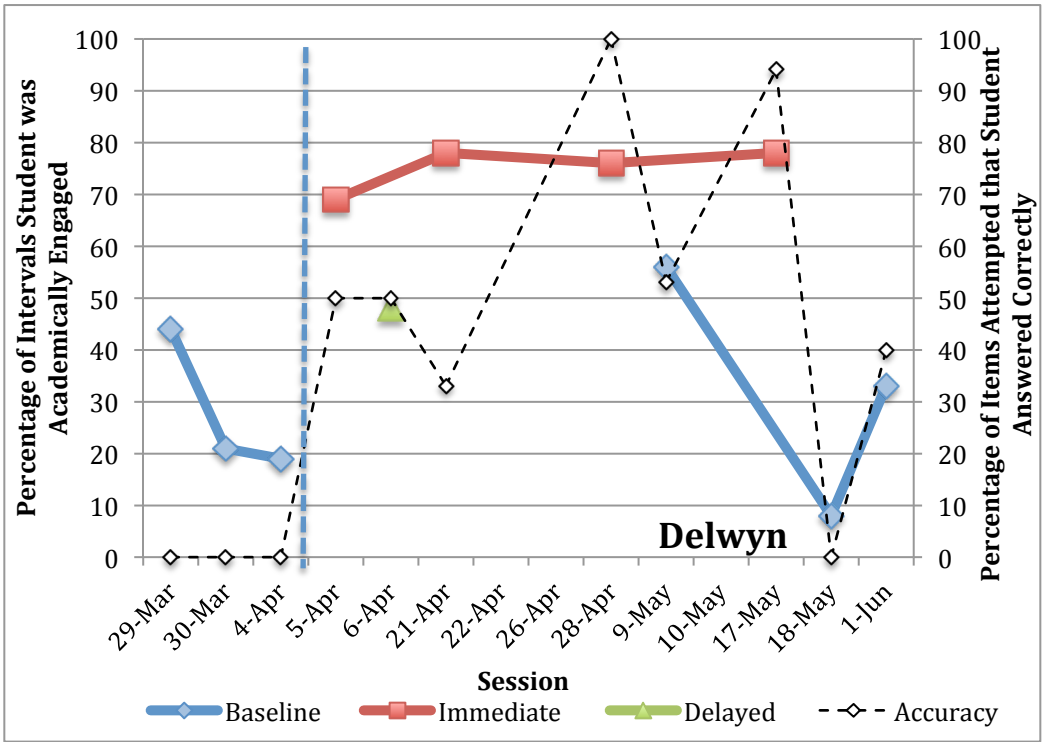


Figure 12. Percentage of intervals with academic engagement for Delwyn relative to percentage of items completed accurately.

Participant 3: Tex. Finally, for Tex, who initially demonstrated relatively high rates of academic engagement in baseline (range: 69% - 92%), data indicated that the intervention with delayed reinforcement resulted in levels of academic engagement that were lower than the intervention with immediate reinforcement. No differences could be determined between baseline and intervention with delayed reinforcement due to the variability in baseline during the alternating treatments portion of the study. Figures 14 and 15 depict Tex's academic engagement relative to the percentage of items he attempted and the percentage of items he completed accurately during each session. From inspection of these graphs, unlike Jesse and Delwyn, there is no evidence to suggest that the intervention sessions were effective in increasing the percentage of items attempted or completed correctly over baseline. Further, there is no clear relationship between work behaviors and academic engagement for Tex.

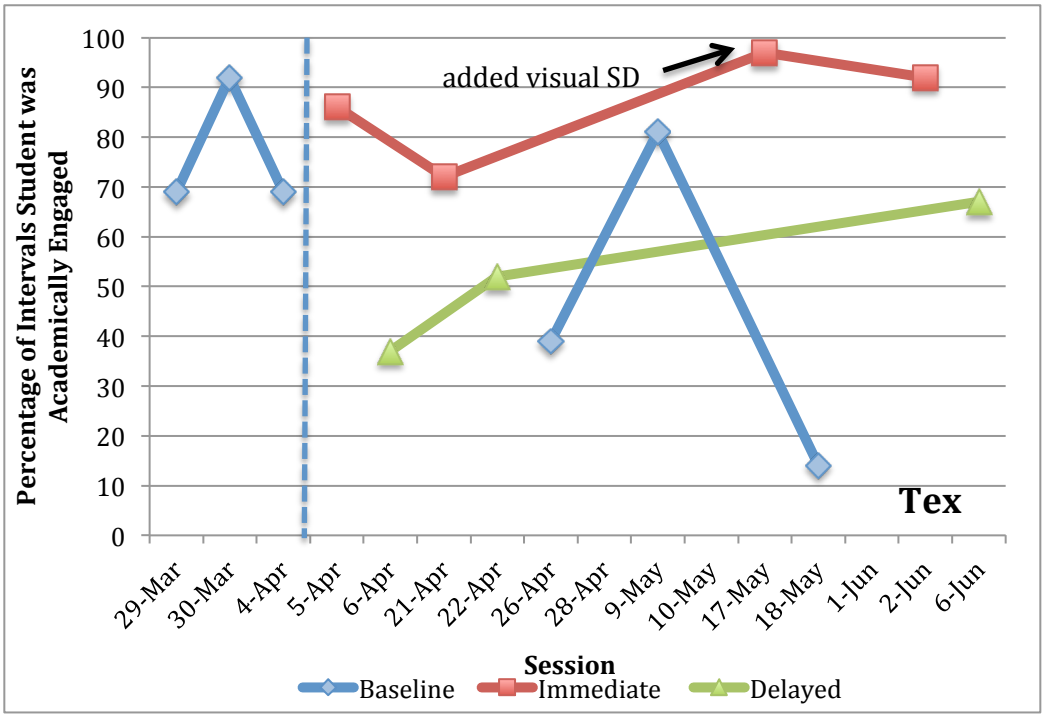


Figure 13. Percentage of intervals with academic engagement for Tex.

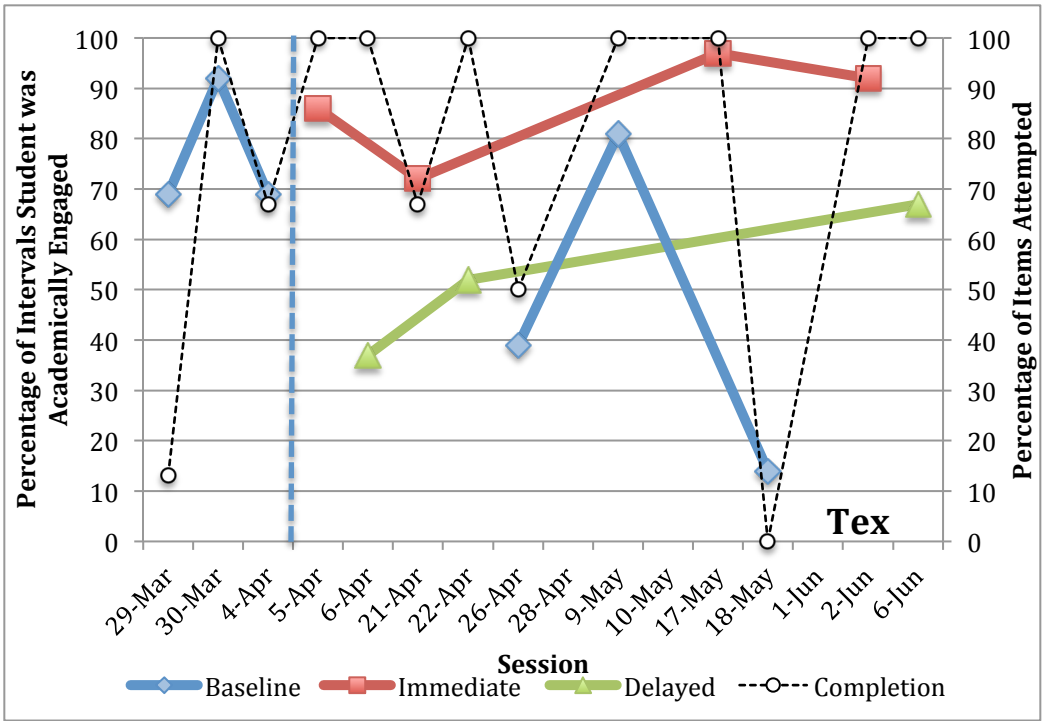


Figure 14. Percentage of intervals with academic engagement for Tex relative to percentage of items attempted.

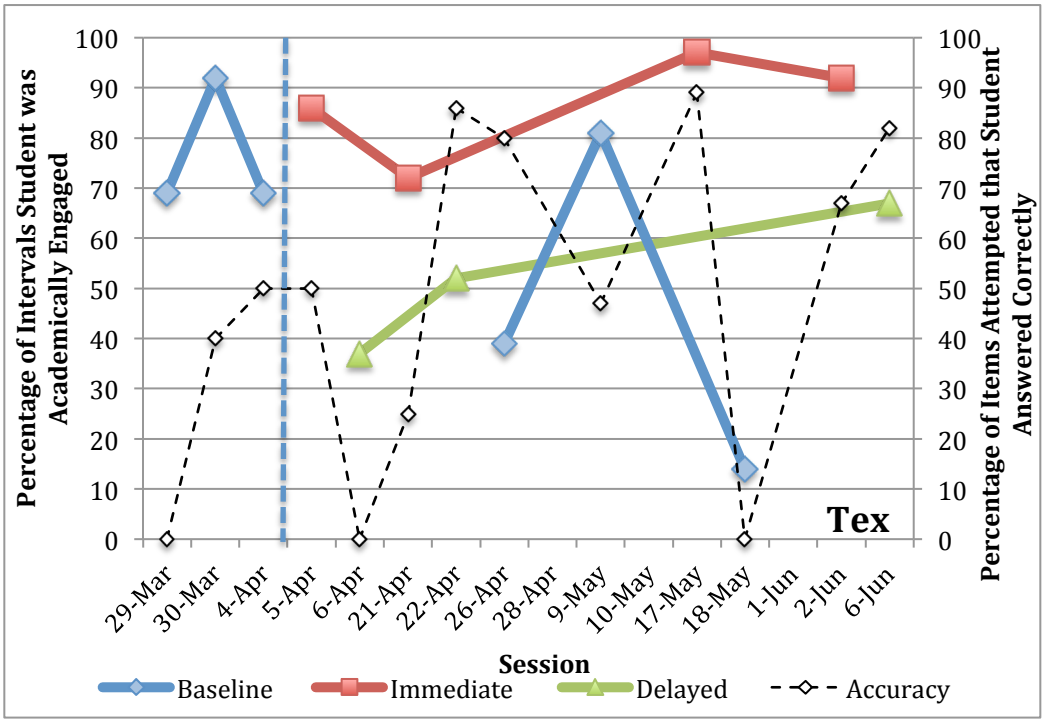


Figure 15. Percentage of intervals with academic engagement for Tex relative to percentage of items completed accurately.

Social Validity

Based on the social validity questionnaires completed by students at the conclusion of the study, students generally thought that "playing the game" was worthwhile and enjoyed participating in the intervention. Average ratings for each item on the student survey are displayed in Table 3. A rating of 1 or 2 indicates that the student *strongly disagrees* or *disagrees* with the statement, whereas a rating of 3 or 4 indicates that the student *agrees* or *strongly agrees* with the item. Additionally, students were asked what version of the intervention they liked most (i.e., delayed reinforcement or immediate reinforcement condition). 90% of the class reported that they preferred the intervention when rewards were delivered the same day.

Table 3

Student social validity questionnaire ratings.

	Average rating (scale: 1-4)
1. I enjoy participating in the game.	3.4
2. I think the game helped me work hard during class.	2.9
3. I liked the rewards that groups could earn for working hard.	3.3
4. I would like to play the game in the future.	3.3

A social validity questionnaire was also completed by the teacher. Based on his answers, it was clear that the immediate reinforcement condition was also preferred. When prompted to elaborate on this preference, the teacher stated that the same-day delivery of rewards didn't require any "…'carry over' needing attention next class", and mentioned that having observers take care of distributing rewards was more convenient overall. The teacher did indicate that he liked having students get same-day feedback on

their in-class work and that he felt the intervention increased students' level of focus and effort during the group work period.

CHAPTER V

DISCUSSION

The purpose of this study was to examine effects of an interdependent group-oriented contingency system, incorporating random selection of contingency components, on the academic behavior of general education, middle school students. Additionally, the relative effects of delayed vs. immediate reinforcement were explored. Results indicated that, for class-wide outcomes of percentage of items attempted and percentage of items completed accurately, there were increases during intervention conditions relative to initial baseline; however, a simultaneous increase during subsequent baseline sessions accompanied these findings. There may be several explanations for this phenomenon. First, because data were not collected continuously for all days school was in session (researchers were present between 1-3 days a week), the simple presence of data collectors after the intervention was introduced may help to explain potential carryover effects. While scripts were read at the beginning of each intervention condition, a sign displaying the name of the condition in effect was added in the 12th session with the intent to strengthen the perception of the stimulus (i.e., baseline, immediate reinforcement condition, or delayed reinforcement condition). In future studies, taking additional measures to ensure that students are aware of which condition is in effect should be made a priority (e.g., including a visual stimulus from the onset of the study, testing students by asking them which condition is in effect).

Another explanation for higher than expected completion and accuracy levels during continued baseline phases may be due to the fact that, prior to the commencement of this study, students did not get feedback on their worksheets. For data collection

purposes, worksheets had to be scored in baseline. It is possible that initial implementation of intervention, which provided worksheet feedback that was tied to additional reinforcers, may have influenced work accuracy and completion in subsequent baseline sessions. To reduce the likelihood of this occurring, it may have been advisable to withhold providing feedback on student worksheets during baseline (i.e., only record scores on data collection sheets but do not provide scores to students on their worksheets). This arrangement would then limit the feedback provided in baseline sessions and only involve delivering feedback in intervention conditions, wherein feedback is directly associated with external rewards. Another option for reducing instances of carryover in the future would be to explore the use of an alternative research design associated with less carryover risk (e.g., multiple baseline).

To explore other variables that may have impacted work accuracy and completion, the quantity of instruction and length of assigned worksheets were examined. While there were no clear associations between either of these variables and completion or accuracy rates, the documentation of instructional minutes indicated that a very small proportion of class time was spent on instruction. If students were not equipped with the requisite knowledge to successfully complete worksheets, it is likely that modifying reinforcement contingencies would fail to result in dramatic increases in work accuracy and completion. Given that the participating class was a remedial class comprised of students who have historically struggled with math, it is possible that academic skill deficits had a greater influence on completion/accuracy than motivation to complete the assigned task. The relatively small amount of class time spent on instruction may also have been insufficient in preparing students to complete worksheets.

Because of the numerous issues around potential skill deficits and lack of quality instruction, it is impossible to determine whether underlying skill deficits or lack of quality instruction contributed more than reinforcement contingencies to work completion and accuracy levels; therefore, results obtained from this study regarding effects on work completion and accuracy must be interpreted with extreme caution. Previous effectiveness studies in this area did not articulate similar potential confounds, and likely provide a better representation of the actual effects of using interdependent group contingencies in targeting academic-related outcomes. In future research, it is crucial that these factors are accounted for or systematically controlled, so that confident conclusions about intervention effects on academic-related outcomes can be made. Other investigations of interdependent group-oriented contingencies on academic variables incorporating random selection of contingency components (Hawkins et al., 2009; Lynch et al., 2009; Reinhardt et al., 2009; Popkin & Skinner, 2003) have only examined effects on accuracy and completion, whereas the current study also measured academic engagement as an outcome variable. For two of the three students, there was evidence to indicate that the interdependent group contingency (with and without delay) was effective in increasing engagement over baseline. Yet, findings regarding the relative effects of delayed vs. immediate reinforcement conditions on engagement were inconclusive. When examining the relative effectiveness of baseline and intervention conditions on work accuracy and completion of these students, it was evident that, for two of three students, work accuracy and completion improved over baseline. Further, for these two students, trends indicated that low levels of academic engagement accompanied low percentages of items attempted and completed accurately.

Limitations and Future Directions

There are several limitations to this study. As previously noted, quantity and quality of instruction were not controlled, and may have substantially impacted the results of the study. Future research in this area should either control instructional variables or systematically examine the impact of these factors on academic outcomes. A second limitation to this study is the limited timeframe and data collected. Given that the study took place in the last two months of the school year, there were numerous interruptions that accompanied the conclusion of the school year that impacted the ability to collect data (e.g., state testing, field trips, assemblies). Further, collecting additional data in both intervention phases would have been preferable to more confidently assess whether differentiation between conditions could be achieved. The delayed reinforcement condition was only put into effect for four sessions, and due to target student absences, limited data was collected on engagement in this condition. For example, as Delwyn was present at school for only one of the delayed reinforcement conditions, no judgment about the relative effectiveness of this condition compared to the immediate or baseline condition could be made. Further, the latency between sessions may have impacted outcomes. On some occasions, data would be collected up to three times a week, whereas for other weeks, due to various logistical constraints (e.g., state testing, scheduling conflicts) more than a week would lapse between data collection sessions. The general lack of consistency in this regard, especially when coupled with other disorganized features inherent in the participating classroom, may have impacted the ability to demonstrate stable stimulus control.

Third, classroom management issues often interfered with instructional and

independent work time, impacting the logistics of intervention implementation and reward delivery. On several occasions, disruptions to the progression of the class period (e.g., student misbehavior, lack of organization) resulted in the class beginning worksheets later in the class period, affecting the amount of time that data collectors had to score worksheets and deliver rewards. On two occasions, there was not enough time left in the period for the class to complete worksheets, and data collection and intervention implementation could not take place. Once, the period ended before data collectors had a chance to score worksheets. While all three of these instances were not accounted for in the present data, the inconsistency in intervention delivery is a serious limitation to note. Future research should ensure that the structure of the class period allows adequate time to fully deliver the intervention at each session. A fourth limitation is that, due to the multi-component, packaged nature of the intervention studied, it is impossible to determine which features were responsible for impacting accuracy, completion, and academic engagement. A component analysis could be undertaken in the future to explore which aspects of the intervention were functionally related to outcomes (e.g., seating chart and group assignments, random selection of reinforcers).

Fifth, this study only examined whether the intervention affected in-class work. Further investigation into whether this type of intervention could generalize to impacting homework accuracy/completion, test scores, or grades would be warranted. A sixth limitation is that the current study utilized data collectors to score worksheets, select contingency components, and deliver rewards. In practice, teachers would likely need to be able to manage all of these activities without assistance. While this arrangement allowed for the immediate reinforcement condition to be examined, it would be important

to determine whether teachers would be willing and able to do this on their own. Finally, variation in the extent to which groups worked collaboratively and/or engaged in discussion about worksheet items was anecdotally noted. While rewards were delivered contingent on group performance, it would be hypothesized that students would be more likely to work together to increase work completion and accuracy of the group as a whole. In future studies, quantifying the level of interaction among group members would provide information about the impact of this type of intervention on cooperative learning behaviors and spontaneous peer tutoring. Additionally, if measured, the linkage between the occurrence of group collaboration behaviors and academic outcomes could be explored.

Conclusion

This study sought to investigate whether adaptations to an interdependent group-oriented contingency arrangement, designed to make the intervention more acceptable, appealing, and practical to implement, would lead to improvements in academic-related outcomes of general education, middle school students. Outside of this study, a large literature base exists attesting to the effectiveness of using interdependent group-oriented contingencies in the classroom, both in targeting social behavior and academic behavior. As classroom management continues to be an area that teachers indicate as a priority, it is important that efficient, feasible classroom management interventions are identified and applied in practice, and continued exploration and identification of teacher-friendly approaches to classroom management should be made a research priority.

APPENDIX A

STUDENT CONSENT FORMS

Informed Consent to Participate in a Research Study
Parent/Guardian/Family/Student Consent

Relative Effects of Delayed versus Immediate Reinforcement within an Interdependent Group-Oriented Contingency System

Your son/daughter is invited to participate in a study conducted through the University of Oregon designed to evaluate a classroom management intervention. The study will be conducted by Cristy Coughlin, under the supervision of Cynthia Anderson, from the University of Oregon's College of Education. The purpose of the study is to examine the effects of a classroom management intervention designed to help students complete assignments in class. This intervention will involve students working in groups to achieve goals for in-class work completion and accuracy. Students will receive teacher-identified rewards if the average performance of their small groups of students meets these goals. Your son/daughter was selected as a possible participant in this study because staff at his or her school believes he or she may benefit from support in completing classwork. The study will begin in January 2011 and end in June 2011.

To evaluate effects of the classroom management intervention, participation by your son or daughter would involve:

- Participation in the classroom "game", along with all other members of the class.

To conduct the study, researchers from the University of Oregon will complete the following activities:

- Conduct direct observations of your child in his or her classroom to collect data on social and academic behavior.
- Collect information about your child's in-class work completion and accuracy, which will be recorded and reported anonymously.

Your child will not be identified in written or professional presentations of the results of this study. Every effort will be made to organize information using altered names, and professional presentations will never refer to your child by name. In addition, all information will be kept in a lockable location and destroyed after the study and holding period are complete. There remains, however, a small risk that your student may be identified as a participant in this study.

There is a distinct likelihood that your student may benefit from participation in the study. Students will be given the opportunity to work with their peers to achieve academic-related goals, and encouragement and rewards will be provided when students work together to meet these goals.

Your consent to your child's participation in the study is voluntary. Your decision whether or not to allow your child to participate will not affect your relationship with the school district or the instruction your child receives in his or her school. If you allow your child to participate, you are free to withdraw your consent and terminate your child's participation in the study at any time without penalty.

Prior to your child's participation in the study, we will also ask your son/daughter if he or she give their assent to participate. Their assent will be necessary for participation in the study.

If you have any questions, please feel free to contact Cristy Coughlin at (616) 446-6503, or Cynthia Anderson at the University of Oregon (346-2671). If you have questions regarding your rights as a research subject, contact the Office of Human Subjects Compliance, University of Oregon, Eugene, OR 97403, (541) 346-2510. You have been given a copy of this form to keep.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Parent/Legal Guardian _____
Signature _____ Date_____
Name of Child _____

Informed Consent to Participate in a Research Study
Parent/Guardian/Family/Student Consent

Relative Effects of Delayed versus Immediate Reinforcement within an Interdependent Group-Oriented Contingency System

Your son/daughter is invited to participate in a study conducted through the University of Oregon designed to evaluate a classroom management intervention. The study will be conducted by Cristy Coughlin, under the supervision of Cynthia Anderson, from the University of Oregon's College of Education. The purpose of the study is to examine the effects of a classroom management intervention designed to help students complete assignments in class. This intervention will involve students working in groups to achieve goals for in-class work completion and accuracy. Students will receive teacher-identified rewards if the average performance of their small groups of students meets these goals. Your son/daughter was selected as a possible participant in this study because he/she is a member of the Ms./Mr. _____'s class, where the intervention is taking place. The study will begin in January 2011 and end in June 2011.

To evaluate effects of the classroom management intervention, participation by your son or daughter would involve:

- Participation in the classroom "game", along with all other members of the class.
- Responding to an informal survey about how much he/she liked playing the game.

To conduct the study, researchers from the University of Oregon will complete the following activities:

- Collect information about your child's in-class work completion and accuracy, which will be recorded and reported anonymously. No information that may link your child's name to his/her classwork or survey data will be removed from the school or revealed to the public.

Your child will not be identified in written or professional presentations of the results of this study. Every effort will be made to organize information using altered names, and professional presentations will never refer to your child by name. In addition, all information will be kept in a lockable location and destroyed after the study and holding period are complete. There remains, however, a small risk that your student may be identified as a participant in this study.

There is a distinct likelihood that your student may benefit from participation in the study. Students will be given the opportunity to work with their peers to achieve academic-related goals, and encouragement and rewards will be provided when students work together to meet these goals.

Your consent to your child's participation in the study is voluntary. Your decision

whether or not to allow your child to participate will not affect your relationship with the school district or the instruction your child receives in his or her school. If you allow your child to participate, you are free to withdraw your consent and terminate your child's participation in the study at any time without penalty.

If you choose NOT to have your child participate in this study and NOT have his/her in-class assignment information released to the University of Oregon, please read and sign the attached form and return the form to your child's teacher.

If you have any questions, please feel free to contact Cristy Coughlin at XXX-XXXX, or Cynthia Anderson at the University of Oregon (XXX-XXXX) If you have questions regarding your rights as a research subject, contact the Office of Human Subjects Compliance, University of Oregon, Eugene, OR 97403, (541) 346-2510. You have been given a copy of this form to keep.

I **do not** want my child to participate in the classroom management intervention study.

Parent/Legal Guardian _____
Signature _____ Date_____
Name of Child _____

APPENDIX B

TEACHER CONSENT FORM

Informed Consent to Participate in a Research Study
Parent/Guardian/Family/Student Consent

Relative Effects of Delayed versus Immediate Reinforcement within an Interdependent Group-Oriented Contingency System

You are invited to participate in a study conducted through the University of Oregon designed to evaluate a classroom management intervention. The study will be conducted by Cristy Coughlin, under the supervision of Cynthia Anderson, from the University of Oregon's College of Education. The purpose of the study is to examine the effects of a classroom management intervention designed to help students complete assignments in class. This intervention will involve students working in groups to achieve goals for in-class work completion and accuracy. Students will receive teacher-identified rewards if the average performance of their small groups of students meets these goals. You were selected as a possible participant because you have expressed interest in implementing classroom management interventions or have identified concerns about multiple students' off-task behavior and/or failure to complete classwork.

If you choose to participate in the study, researchers will ask you to complete the following activities:

- Facilitate implementation of the intervention, introduce "the game" to classroom using scripts, and participate by randomly selecting criteria to be applied to students' daily work assignments
- Meet with the researcher to discuss features and procedures of the intervention
- Develop brief tasks for students to complete, ideally lasting for 15-20 minutes, for each session of the study, as well as an answer key for researchers to reference when scoring student work
- Identify rewards for academic work that are feasible to deliver and attractive to students
- Following the conclusion of the study, respond to a brief survey about your attitudes and opinions toward how well the intervention worked in your classroom

Researchers from the University of Oregon will:

- Conduct direct observations of participating students in their classrooms to collect data on social and academic behaviors.
- Score students' in-class work assignments, recording and reporting academic data anonymously; no identifying information that links student data to names will be removed from the school

Neither you nor the students will be identified in written or professional presentations

concerning this study. Every effort will be made to organize information using altered names, and professional presentations will never refer to you or your students by name. In addition, all information will be kept in a lockable location, and destroyed after the study and holding period are complete. There remains, however, a small risk that you may be identified as a participant in this study.

There is a distinct likelihood that your students may benefit from participation in the study. Students will be given the opportunity to work with their peers to achieve academic-related goals, and encouragement and rewards will be provided when students work together to meet these goals. Additionally, the intervention may benefit the teacher by assisting in providing a structure for managing students' work-related behaviors. Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with the school district. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions, please feel free to contact Cristy Coughlin (XXX-XXXX) or Cynthia Anderson at the University of Oregon (XXX-XXXX) If you have questions regarding your rights as a research subject, contact the Office of Human Subjects Compliance, University of Oregon, Eugene, OR 97403, (541) 346-2510. You have been given a copy of this form to keep.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Print Name_____
Signature _____
Date_____

APPENDIX C

FIDELITY CHECKLIST

Observer Name: _____
Date: _____ Condition in Effect: Delayed Immediate

Core Features of Intervention	**Observed?**	
	Yes	No
Teacher read the corresponding script to introduce the intervention condition in effect for that class period		
Teacher posted and/or read off names of students randomly assigned to groups for that day		
Teacher assigned a task to the class, with the expectation that students complete it by the end of the period		
Following the work period, the teacher randomly selected a target behavior, criterion, and reward		
Reinforcement was delivered, or plans for groups to receive rewards were specifically outlined.		

Please provide a brief description of the assignment given in class today:

_____

_____

If applicable, identify randomly selected components below:

Randomly Selected Components
Target behavior:
Criterion:
Reinforcer:

APPENDIX D

TEACHER SOCIAL VALIDITY QUESTIONAIRRE

1a. The time and effort required to implement the intervention **with immediate feedback** was acceptable.

Strongly Disagree	Disagree	Agree	Strongly Agree

1b. The time and effort required to implement the intervention **with delayed feedback** was acceptable.

Strongly Disagree	Disagree	Agree	Strongly Agree

2a. I feel that the intervention **with immediate feedback** was effective and beneficial to students in the class.

Strongly Disagree	Disagree	Agree	Strongly Agree

2b. I feel that the intervention **with delayed feedback** was effective and beneficial to students in the class.

Strongly Disagree	Disagree	Agree	Strongly Agree

3a. I would consider continuing implementation of the intervention **with immediate feedback** in the future.

Strongly Disagree	Disagree	Agree	Strongly Agree

3b. I would consider continuing implementation of the intervention **with delayed feedback** in the future.

Strongly Disagree	Disagree	Agree	Strongly Agree

4a. I feel my students enjoyed participating in the intervention **with immediate feedback**.

Strongly Disagree	Disagree	Agree	Strongly Agree

4b. I feel my students enjoyed participating in the intervention **with delayed feedback**.

Strongly Disagree	Disagree	Agree	Strongly Agree

5. Please indicate which features of the intervention you liked ***most:***

6. Please indicate which features of the intervention you liked ***least.***

7. Circle the version of the intervention that you liked best:

Immediate Feedback:
Delivering rewards the **SAME** day,
at the end of the class period

Delayed Feedback:
Delivering rewards during the
NEXT class period

Why did you like this version best?

APPENDIX E

STUDENT SURVEY

Please provide your honest answers to the questions below. Your answers will be kept anonymous. The results of this survey will help us see what things we should change and keep when we try out the study guide game in other middle school classrooms. Thanks! ☺

1. I enjoy participating in the game.

Strongly Disagree	Disagree	Agree	Strongly Agree

2. I think the game helped me work hard during class.

Strongly Disagree	Disagree	Agree	Strongly Agree

3. I liked the rewards that groups could earn for working hard.

Strongly Disagree	Disagree	Agree	Strongly Agree

4. I would like to play the game in the future.

Strongly Disagree	Disagree	Agree	Strongly Agree

5. Please indicate which features of the game you liked ***most:***

_____

_____

_____

6. Please indicate which features of the game you liked ***least.***

_____

_____

_____

7. Circle the version of the game that you liked best:

Receiving rewards the **SAME** day,
at the end of the class period

Receiving rewards during the
NEXT class period

Why did you like this version best?

APPENDIX F

TEACHER SCRIPTS

Introducing the intervention, **immediate reinforcement,** ***first session:***

Today we are going to try something new to help you and your classmates complete your math worksheets. We'll be playing a game that will involve earning rewards based on your own and your classmates' work during this period. To play the game, I will divide the class into groups of four students. Then you will work on your worksheets alone or with your assigned groups, for the 10-minute period. I will let you know when there are two minutes remaining in the work period and then when time is up. After the work period ends, everyone will turn in a copy of their own completed worksheet, and your work will be scored.

Then, I will flip a coin to determine if rewards for today will be based on **work completion** or **work accuracy.** For work completion, we'll look at the average number of items on the worksheet that your group was able to complete; for work accuracy, we'll look at the average number of items that your group answered correctly. I will draw a number out of this box (*show box*) to learn what the goal will be for today. For example, if the number drawn from the box is 85% and we are focusing on accuracy, then any groups scoring higher than 85% correct will earn a reward. You are probably wondering what the reward is. Remember voting on rewards before spring break? I wrote the activities we selected onto slips of paper and they are in this box. The reward to be earned will be determined by selecting a slip of paper from this box. What questions do you have?

Introducing the intervention, **immediate reinforcement, *subsequent sessions:***

Today we are going to play a game while we complete our math worksheets again. Remember, rewards are earned based on your own and your classmates' work during this period. First, I will divide the class into groups of four students, and then you will work on your worksheets for 10 minutes. I will let you know when there are two minutes remaining in the work period and then when time is up. After the work period ends, everyone will turn in a copy of their own completed worksheet, and your work will be scored.

Then, **before class ends,** I will flip a coin to determine if the focus is on work completion or work accuracy**,** and will pull a percentage from the first pool. Once the goal for your group's work is determined, I will draw a piece of paper from a second pool that will determine the reward that groups who met this goal will receive. **Remember, we will be scoring your work and randomly selecting goals at the end of TODAY'S period.** Are there any questions?

Introducing the intervention, **delayed reinforcement, *first session:***

Today we are going to play a game while we complete our math worksheets again. This game will involve earning rewards based on your own and your classmates' work during this period. To play the game, I will divide the class into groups of four students, and then you will work on your worksheets for 10 minutes. I will let you know when there are two minutes remaining in the work period and then when time is up. After the work period ends, everyone will turn in a copy of their own completed worksheet, and your work will be scored.

At the beginning of TOMORROW's class, I will flip a coin to determine if rewards will be based on **work completion** or **work accuracy.** For work completion, we'll look at the average number of items on the worksheet that your group was able to complete today; for work accuracy, we'll look at the average number of items that your group answered correctly today. I will draw a number out of this box (*show box*) to learn what the goal will be. For example, if the number drawn from the box is 85% and we are focusing on accuracy, then any groups scoring higher than 85% correct will earn a reward. The reward to be earned will be determined by selecting a slip of paper from this box, which contains rewards that you ranked ordered before spring break. **Remember, for today, I will be randomly selecting goals and groups will get rewards at the beginning of TOMORROW's class.** What questions do you have?

Introducing the intervention, **delayed reinforcement, *subsequent sessions:***

Today we are going to play a game while we complete our math worksheets again. Remember, rewards are earned based on your own and your classmates' work during this period. First, I will divide the class into groups of four students, and then you will work on your worksheets for 10 minutes. I will let you know when there are two minutes remaining in the work period and then when time is up. After the work period ends, everyone will turn in a copy of their own completed worksheet, and your work will be scored.

Then, **at the beginning of TOMORROW's class**, I will flip a coin to determine if the focus is on work completion or work accuracy**,** and will pull a percentage from the first pool. Once the goal for your group's work is determined, I will draw a piece of paper from a second pool that will determine the reward that groups who met this goal will receive. **Remember, for today, I will be randomly selecting goals and groups will get rewards at the beginning of TOMORROW's class.** Are there any questions?

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