Use of an Interdependent Group Contingency to Improve Homework Completion, Homework Accuracy, and Achievement of High School Students with Disabilities

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USE OF AN INTERDEPENDENT GROUP CONTINGENCY TO IMPROVE HOMEWORK COMPLETION, HOMEWORK ACCURACY, AND ACHIEVEMENT OF HIGH SCHOOL STUDENTS WITH DISABILITIES

By

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Dissertation submitted to the Graduate Faculty in Educational Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2014
This manuscript has been read and accepted for the Graduate Faculty in Educational Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

USE OF AN INTERDEPENDENT GROUP CONTINGENCY TO IMPROVE HOMEWORK COMPLETION, HOMEWORK ACCURACY, AND ACHIEVEMENT OF HIGH SCHOOL STUDENTS WITH DISABILITIES

By

Maria C. Kennedy

Advisor: Professor Marian C. Fish

Homework is a frequently utilized teaching strategy in elementary and secondary classrooms. The completion of homework has been shown to have a strong positive effect on students’ academic achievement across content and ability levels. Moreover, research suggests a stronger positive relationship between homework and achievement at the upper grade levels. Numerous interventions, both at home and at school, have been employed to increase students’ level of homework completion and/or accuracy. The present investigation employed a single-subject reversal design to examine the effectiveness of an interdependent group contingency, with randomized components, on the homework completion, homework accuracy, and the academic achievement of a special education class of high school students. Results demonstrated that the intervention improved homework completion performance of these students, but with inconsistent gains in accuracy. However, academic improvements were made for the majority of students when the intervention was employed and there was a significant effect of the treatment from the baseline to the intervention phases. The teacher found the intervention to be acceptable for use in the classroom and valuable in changing homework behavior. Lastly, data from a student satisfaction survey found that students liked the intervention itself and felt it helped them to complete their homework.
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Chapter I: Introduction

Homework is typically defined as tasks assigned by teachers to be finished by students during non-school hours (Cooper, 1989a). Homework is characteristically completed at home, but some have noted that it can be finished in school settings, such as after-school programs. The use, effectiveness, and benefits of homework have long been debated in the United States (Simplicio, 2007). Literature related to this controversial topic has been documented over the past 80 years, as early as 1927, and homework has gone in and out of favor throughout this time (Cooper & Valentine, 2001). However, since the 1983 Nation at Risk report (National Commission on Excellence in Education), homework has been considered as a way to improve the academics of students, citing that “…students in high schools should be assigned far more homework than is now the case” (p. 2). This viewpoint has persisted, as homework is a frequently used teaching strategy across grade levels and most teachers consider homework important to the learning process (Muhlenbruck, Cooper, Nye, & Lindsay, 1999; Simplicio, 2007).

Those supportive of assigning homework to students purport there to be positive academic and nonacademic benefits of its completion. According to a significant review conducted by Cooper (1989b), these may include: immediate achievement and learning benefits (e.g., better understanding, curriculum enrichment), long-term academic gains (e.g., better study habits), nonacademic skills (e.g., improved attitude toward school, greater self-direction, self-discipline, organization), and parental and family benefits (e.g., greater parental appreciation of and involvement in school). Most importantly, completing homework has been linked to students’ academic achievement across age and ability levels (Cooper, Robinson, & Patall, 2006; Keith & Page, 1985).
A review of national data found that students who were assigned homework performed at a higher academic level when compared to those students who were not assigned homework, indicating a positive link between homework and academic achievement (Keith, Keith, Troutman, Bickley, Trivett, & Singh, 1993). Furthermore, completing homework in the secondary grade levels has been found to have a stronger positive relationship with achievement than at the primary grade levels (Cooper, 1989b; Cooper et al., 2006; Cooper, Lindsay, Nye, & Greathouse, 1998; Keith, 1982; Keith & Cool, 1992). Using a large-scale path analysis, Keith (1982) found that next to intellectual ability, time spent on homework had the largest direct path to high school seniors’ grades. Keith (1982) further found that more time spent on homework had a compensatory effect for lower ability students, allowing them to display academic performance that was almost equal to their higher ability peers. More recent evidence reinforces the positive and significant relationship between the homework students complete and their achievement (Cooper et al., 2006). In making a case for homework, Marzano and Pickering (2007) qualitatively reviewed the homework research and found mostly positive and statistically significant relationships between the amount of homework students complete and their achievement. Thus, the authors posit that it would be imprudent for teachers to ignore this link and not assign homework.

While the positive relationship between homework and academic achievement is substantiated by the research, completing homework can be problematic for countless students and homework completion rates in the secondary schools have been found to be quite low (Schellenberg, Skok, & McLaughlin, 1991). These completion difficulties tend to increase when referencing students with learning or other disabilities (Epstein, Polloway, Foley, & Patton, 1993; Langberg, Arnold, Flowers, Altaye, Epstein, & Molina, 2010). Students with disabilities
face problems/difficulties ranging from poor motivation (Cooper et al., 1998), problems with organization (Bryan, Nelson, & Mathur, 1995; Epstein, et al., 1993), negative attitudes towards homework (Bryan & Nelson, 1995), to teachers assigning homework that is not matched to students’ appropriate skill level (Salend & Schliff, 1989).

Due to the homework-achievement link, numerous interventions have been implemented to increase rates of homework completion and/or accuracy. While it is important to develop effective interventions for all students, it becomes increasingly significant for those students that have been identified as having disabilities (Bryan, Burnstein, & Bryan, 2001), particularly those at the secondary level when homework is that much more important (Cooper et al., 1998; Cooper et al., 2006). Some homework interventions have focused on involving parents (Rhoades & Kratochwill, 1998; Sheridan, Eagle, Cowan, & Mickelson, 2001) while others have focused on intervening in the school (Miller, Duffy, & Zane, 1993). School based interventions appear to be advantageous over home, as they are less intrusive and can be monitored by teachers. Some examples of school interventions include individual student behavioral rewards (Schellenberg et al., 1991), self-monitoring of homework (Trammel, Schloss, & Alper, 1994), and goal setting (Miller & Kelley, 1994). However, most of these school interventions target individual students, which requires a great deal of resources and is neither time nor cost-effective (Litow & Pumroy, 1975).

One type of intervention that can be used in the classroom to target the whole class is a group contingency, where the same target behaviors and criteria for reinforcement are used for all members of the group (Skinner, Skinner, & Sterling-Turner, 2002). There are three categories of group contingencies: independent, dependent, and interdependent (Litow & Pumroy, 1975). Independent group contingencies utilize the same behaviors, criteria for
receiving a reward, and consequences for all students; however, each student earns the reinforcemen
t conditional on their own behavior (Litow & Pumroy, 1975). This type of group contingency is easy to
develop, explain, and implement (Skinner et al., 2002), but does not take individual student differences into account and can inadvertently promote a social class system, as those students who do not receive reinforcement may influence other’s behavior (Skinner, Cashwell, & Dunn, 1996). Dependent group contingencies differ from independent, as they reinforce the group based on the performance of one or a few students who meet the criteria (Litow & Pumroy, 1975). These are advantageous, as they use peer social reinforcement to aid in behavior change and lower peer competition (Gresham & Gresham, 1982) but also put a great deal of pressure on the students upon whom reinforcement is dependent (Popkin & Skinner, 2003) and may increase the likelihood of peer pressure and ridicule (Skinner et al., 1996).

Interdependent group contingency, the third type of group contingency, does not have the disadvantages of the first two. This type of group contingency occurs when every student in the class earns a reinforcing reward if all students attain a specific level of performance (Litow & Pumroy, 1975). Hence, students are interdependent on each other to gain reinforcement. Interdependent group contingencies have been shown to be efficacious in improving many academic and behavioral problems, including: increasing overall academic performance (Popkin & Skinner, 2003); increasing reading skills (Sharp & Skinner, 2004); improving spelling skills (Shapiro & Goldberg, 1986); decreasing classroom noise levels (Schmidt & Ulrich, 1969); and reducing disruptive behavior (Theodore, Bray, & Kehle, 2004).

As mentioned, interdependent group contingencies are used to target a whole group, which makes them a practical and efficient intervention for use in the classroom (Litow & Pumroy, 1975). Interdependent group contingencies have been shown to be even more effective
when randomizing the components of the intervention (Theodore et al., 2004). One way to do so is to randomize the criterion that must be met to obtain the reinforcer, or reward. When randomizing criteria for the reward, students often modify their behavior because they are unaware of what they will be evaluated on to earn the reward. In addition, randomizing the rewards themselves can make an interdependent group contingency more effective. When rewards are randomized, the element of surprise increases and the likelihood a student will deliberately ruin the contingency due to an undesirable reinforcer decreases (Skinner, et al., 1996). Kelshaw-Levering, Sterling-Turner, Henry, and Skinner (2000) found that randomizing multiple components was more effective in reducing inappropriate behavior than randomizing rewards alone.

Only a few published studies have employed a group contingency of any type to increase homework completion and/or accuracy. Olympia, Sheridan, Jenson, and Andrews (1994) used a single-subject design to investigate the efficacy of student-managed group contingencies, finding overall gains in homework completion and accuracy, but inconsistent improvement in accuracy. Lynch, Theodore, Bray, and Kehle (2009) conducted a comparison study of the three types of group contingencies, to see which was most effective in increasing homework completion and accuracy rates of a self-contained fifth grade classroom of students with disabilities. Results showed that although there were no significant differences between each group contingency intervention for increasing homework completion rates of students, but interdependent contingencies yielded slightly better accuracy rates. Theodore, Dioguardi, Hughes, Aloiso, Carlo, and Eccles (2009) used an interdependent group contingency (with randomized components) to improve the spelling homework performance of a class of elementary school
students. The intervention appeared to have some impact on completion rates, but a significantly greater effect on increasing spelling homework accuracy.

Further, Reinhardt, Theodore, Bray, and Kehle (2009) investigated the use of a randomized interdependent contingency (randomizing both criteria for reinforcement and rewards themselves) with elementary school students to increase homework accuracy rates, showing that this contingency was able to improve the accuracy of homework performance. A recent dissertation by Ralston (2011), utilized a dependent group contingency across three general education middle school math classrooms to increase homework completion and accuracy. Results were mixed, with some classes increasing their completion and accuracy rates and others not increasing at all or even decreasing in their rates.

The present investigation explored the use of a teacher implemented interdependent group contingency, with random criteria for reinforcement and random reinforcers, on homework completion and accuracy rates, as well as academic achievement, of a class of high school special education students. Since prior research has shown homework to be increasingly beneficial for students at the secondary level, it is imperative to identify easily administered and effective interventions to increase homework rates on the high school level. This study examined the feasibility of such an intervention in a special education self-contained classroom of 12 high school students. The intervention’s overall effectiveness was examined through the use of a single subject withdrawal design, using homework completion, homework accuracy, and academic achievement (i.e., grades) as dependent measures.

In sum, based on the above discussion, this study attempted to answer the following research questions: (1) Does an interdependent group contingency with randomized components improve homework completion rates for high school students with disabilities?; (2) Does an
interdependent group contingency with randomized components improve homework accuracy rates for high school students with disabilities?; and (3) Does an interdependent group contingency with randomized components improve academic performance for high school students with disabilities?
Chapter II: Literature Review

This chapter will provide a detailed overview of the homework literature, including the purpose and importance of completing homework, the struggles and added benefits of completing homework for those students with disabilities, and various interventions that have been employed to remedy homework problems for students. This chapter will also detail the research related to group contingencies and the use of group contingencies to increase homework completion and/or accuracy rates. Following this review, the rationale and hypotheses for the current study are presented.

Homework

Homework is most typically defined as tasks assigned by teachers to be finished by students during non-school hours (Cooper, 1989a). Researchers and educators alike have long debated the potential benefits and drawbacks of homework. The proponents of homework contend that practicing at home will increase the understanding and retention of material that is learned during school (Cooper & Nye, 1994), indirectly improve study skills (Alleman & Brophy, 1991), help develop independent and responsible habits such as self-direction, self-discipline and organization (Cooper, 1989a), and instill in students the lesson that learning can take place at any time, not just during school hours (Cooper et al., 2006). Others have cited the negative effects that homework can have, such as the loss of interest in academic material, denial of access to leisure time and community activities, parental interference (e.g., pressure to complete homework and perform well), and cheating (Cooper et al., 2006). Regardless of these proposed benefits and drawbacks, the use and practice of the assignment of homework has been consistent throughout American education history (Cooper & Valentine, 2001; Simplicio, 2007).
According to a review conducted by Kahle and Kelley (1995) there are several important elements that homework assignments should include, which relate to higher levels of homework completion and accuracy. Specifically, teachers should provide clear and specific instructions for homework, should be sure that their students have the necessary prerequisite skills to complete the homework, and if possible, should individualize the assignments according to student needs. Further recommendations suggest that schools review teacher homework policies to determine that teachers are routinely checking homework (Keith & Page, 1985) and involve parents in the process whenever possible (Keith et al., 1993). A review of the homework literature and interventions conducted by Olympia, Sheridan, & Jenson (1994) identified various characteristics of good homework programs. They note that homework should have a clear purpose, should begin with instructions to result in a specific product, should be able to be completed within a reasonable time frame with a high degree (at least 80%) of success, and that there should be a variety of assignments that are assigned regularly with prompt feedback. It is important to keep these recommendations in mind when reviewing the research on homework, or any homework intervention.

Research has shown that the amount of homework that is typically assigned to students varies from study to study and is especially dependent on the way in which the question is asked and if the respondent is a student, teacher, or parent (Cooper et al., 2006). One early report found that students at the secondary level spent less than one hour a day on homework (Turvey, 1986). More recently, the National Assessment of Educational Progress (Campbell, Reese, O’Sullivan, & Dossey, 1996) cited that 15% of 9-year-olds, 37% of 13-year-olds, and 39% of 17-year-olds reported completing more than one hour of homework each day.
It also appears that older students are assigned more homework. The National Center for Education Statistics (U.S. Department of Education, 2008) published a report that used longitudinal data (from the Early Childhood Longitudinal Study, Kindergarten class of 1998-99; ECLS-K) to analyze the amount of reading and mathematics homework teachers expected students to complete in the first, third and fifth grades. In general, teachers expected their students to complete more homework as they advanced in grade. When investigating this from the parent perspective, the percentage of parents who indicated their child completed homework five or more times a week increased as children aged, from 38% of those in the first grade, 47% in the third grade, and 51% of those in the fifth grade. Thus, it appears that teachers do indeed assign more homework as students rise in grade level.

American students have often been criticized for spending less time engaged in academic tasks than those from other nations, both during school and non-school hours (Chen & Stevenson, 1989). An innovative study conducted by Chen and Stevenson (1989) compared homework patterns and attitudes across two American cities, two Chinese cities, and one city in Japan. Results showed that both Chinese and Japanese students spent more time on homework and had better attitudes toward homework than American students. The study also found that the longer homework assignments in non-American cultures correlated with higher achievement scores. The authors postulated that one way American students could begin to close the achievement gap with Japanese and Chinese students is through increased time spent on homework.

While some educators and parents may feel homework is an added pressure that our students do not need, but research speaks to the contrary. A national survey of parents found that only 10% of parents felt that their child had too much homework, while 64% thought their child
was receiving the right amount, and 25% actually believed their child was not receiving enough homework (Public Agenda, 2000).

It is clear that most educators and parents see homework as an important part of the academic workload, especially given the finding that most students receive at least an hour of homework a night (Campbell, et al, 1996; Turvey, 1986). It has also been postulated that more homework assigned will help American students compete with an increasingly competitive international student body (Chen & Stevenson, 1989), and increase academic engagement. However, researchers often argue about the potential advantages and disadvantages that go along with completing homework. To determine whether homework confers more advantages or disadvantages, the purpose and role behind the assignment of homework needs to be examined more closely.

**Purpose of Homework**

It is imperative to explore teachers’ reasons or purposes for assigning homework, as well as students’ reasons for completing homework. Muhlenbruck et al., (1999) found that the majority of teachers view homework as crucial to the learning process itself. Epstein and Van Voorhis (2001) found 10 general purposes for completing homework, both instructional and non-instructional. These include: practice, preparation, participation, personal development, parent–child relations, parent–teacher communications, peer interactions, policy, public relations, and punishment. While these are 10 general purposes behind completing homework, other studies have revealed additional instructional purposes and various perspectives for the assignment and completion of homework.

**Academic engagement.** According to Becker and Epstein (1982), one of the most popular reasons teachers assign homework is to provide the opportunity for students to review
and then practice the subject matter that was covered in class. Not surprisingly, one study found that the majority of homework is designed and assigned by teachers at most grade levels so students will finish class work or practice skills (Polloway, Epstein, Bursuck, Madhavi, & Cumblad, 1994). Homework is a large component of the total time spent on task engagement; indeed, prior research has found that American students spend approximately 20% of their academic engaged time on homework (Cooper & Nye, 1994; West Chester Institute for Human Services Research, 2002). Thus, a frequent rationale of homework is to increase the amount of time students are engaged in academic tasks, in order to provide added opportunity for learning (Paschal, Weinstein, & Walberg, 1984).

**Age differences.** There may be different purposes behind assigning homework for different age groups, but the research in this area is limited. Some have suggested that homework in the early grades should develop positive attitudes toward academics, allow appropriate parent involvement, and reinforce learning of simple skills taught in class (Cooper, 1989a; Cooper et al., 2006). For students in the secondary grades, homework might serve a different purpose, such as working toward improving standardized test scores and grades (Cooper et al., 2006).

To explore these potential differences, Muhlenbruck et al. (1999) surveyed over 80 teachers about their homework practices and examined responses between lower grades (2 – 4) and upper grades (6 – 10), as well as students’ achievement scores. When investigating the utility of homework, scores for time management skills were significantly different, suggesting that elementary level teachers may assign homework to teach necessary time management or review class material. In contrast, middle and high school level teachers may assign to help students review and learn subject matter and/or enrich class lessons. Based on this, teachers may assign
homework at the elementary level for a different purpose than at the secondary level. However, more research is needed in this area, as very few studies have investigated these differences.

**Parent perspectives.** Homework may also be viewed as a tool to increase parental involvement in school practices. Parental involvement has often been investigated as a key factor in student achievement, especially in the younger grades. Although the body of research of parental involvement is vast, a meta-analysis of quantitative research conducted by Fan and Chen (2001) found that the relationship between parent involvement and achievement is strong for global indicators such as grade point average. A different study found that parents view assisting their child with homework as one way they can enhance his or her achievement (Epstein, 1986). Homework has often been a way in which parents can involve themselves with their child’s academic achievement and success.

Involving parents in the homework process has been seen to increase student completion of homework, accuracy of homework, student achievement, or all three factors (Patall, Cooper, & Robinson, 2008). Hoover-Dempsey et al. (2001) reviewed research across all grade and subject areas regarding parental involvement in homework, and reported that parents typically become involved because they believe they should be, their involvement will have a positive effect, and teachers would like them to be involved. The researchers found that parents were able to provide a variety of supports to their children, including structure, oversight, modeling, meta-strategies, interaction, reinforcement and instruction. Lastly, one study (Balli, Demo, & Wedman, 1998) found that the majority of students reported that they did better in school at least some of the time when they received help with homework from a parent(s). While parent viewpoints and involvement are often critical to the homework process, it is also imperative to
investigate the reasons students have to do work, and which groups of students are more likely to spend time on and complete homework.

**Student perspectives.** Looking through a different lens to view the purposes of homework, Xu (2005) used a factor analysis to investigate 920 middle and secondary students’ reasons for doing homework. Results showed that both intrinsic rewards (doing homework to develop a sense of responsibility, learn to work independently, learn study skills, develop good discipline, and reinforce school learning) and extrinsic reasons (doing homework to gain teacher, family, and peer approval) related positively to the use of homework management strategies, while just intrinsic rewards were related to a lower frequency of incomplete homework.

In a similar, but qualitative study, Bempechat, Li, Neier, Gillis, and Holloway (2011) interviewed high and low-achieving ninth graders from low socioeconomic households about their homework expectations. Results indicated that although both higher and lower achieving students had common threads about what type of homework was not enjoyable (e.g., worksheets), high achieving students completed homework regardless of the task enjoyment and were more learning oriented toward homework completion. In contrast, low achievers were more disengaged and not committed to completing homework.

Overall, there appear to be numerous instructional and non-instructional purposes behind homework (Van Voorhis, 2001), including additional time spent on learning and engagement in academic tasks (Paschal et al., 1984; Polloway et al., 1994) or parental involvement (Hoover-Dempsey et al., 2001; Patall et al., 2008). Further, there may be a different purpose behind homework assignments at different grade levels, with teachers assigning homework to younger students to teach time management or review material and to older students to learn subject matter (Muhlenbruck et al., 1999). Both middle and high school students have reported that they
think that homework is necessary and that it helps them develop academic skills and increase achievement (Xu, 2005). Nonetheless, the relationship between homework and academic achievement is controversial, with some finding the two to be closely related, while others finding the connection to be weak.

**Academic Achievement**

Many studies have found homework to have a strong relationship with achievement (Cooper et al., 2006; Keith, 1982; Keith & Cool, 1992), and there is empirical evidence to support teachers’ use of homework to elevate the academic achievement of students, especially those at the secondary level (Cooper, 1989b; Cooper et al., 2006; Keith, 1982; Keith & Cool, 1992; Muhlenbruck et al., 1999; Paschal, Weinstein, & Walberg, 1984). In an early comprehensive study, Keith (1982) used a large-scale path analysis to determine the effects of time spent on homework on high school seniors’ achievement measured by their grades. Using a sample that was drawn from 20,364 high school seniors from the ‘National Center for Education Statistics’ (NCES) High School and Beyond (HSB) longitudinal study survey data, six variables were investigated: race, family background (SES), ability, field of study, time spent on homework, and grades. Results indicated that more time spent on homework had a higher positive effect on students’ grades, and next to ability (divided into three categories -- lower 25%, middle 50%, and upper 25%), homework had the largest direct path to grades, regardless of race or SES. Further, time spent on homework had a compensatory effect across all three ability levels. A weakness in the research was that both variables under most scrutiny (i.e., times spent on homework and grades) were from student self-report and could be therefore fairly unreliable. To follow-up on this study, Keith (1988) used additional path analyses to reanalyze the HSB data set, this time using achievement tests as the outcome variable as opposed to a self-reported
outcome variable. Holding ethnicity, family background, gender, quality of instruction, motivation, and ability constant, results again indicated a direct positive effect from study time to achievement tests, although the path coefficient was small.

Another early synthesis of research conducted by Paschal et al. (1984) investigated the effects of homework and homework strategies on the academic achievement and attitudes of elementary and secondary students. The review found 15 studies that contained sufficient statistics for analysis and effect sizes were calculated for each. Results indicated that there was a positive effect between homework and achievement, with the greatest effects for fourth and fifth grade students. It should be noted that larger achievement gains were found for homework that the teacher graded or commented on, but overall, assigned homework produced a greater effect on achievement than no homework.

Cooper (1989b) and colleagues (2006) conducted two significant reviews of the homework literature. In his first synthesis of the research, Cooper (1989b) conducted a comprehensive review of the homework effectiveness literature to investigate the link between homework and achievement. As part of this synthesis he classified studies into separate groups. The first group of studies included those that examined the achievement of students who were given homework compared to those who were not. In this set, 14 of the 20 studies produced effects favoring homework, showing a high effect for high school students, a moderate effect for junior high students, and no effect for elementary aged students. In another group of studies, correlations were created between the amount of time students reported spending on homework and their achievement levels. Findings of 43 out of the 50 studies (86%) showed those students who reported completing more homework had higher achievement scores, with a strong grade-level effect. Results indicated an almost zero correlation for elementary school, a small
correlation for middle school ($r = .07$), and the highest for high school ($r = .25$). This provides additional evidence for a relationship between homework and academic achievement, especially at the high school level.

More recently, Cooper et al. (2006) conducted a large-scale review of the later literature. The authors applied narrative and quantitative techniques to conduct a synthesis of research completed from 1987 to 2003 on the effects of homework on academic achievement. The authors collected both unpublished and published research from a wide variety of sources, while maintaining stringent inclusion criteria. To be included, studies needed to have (a) estimated the relationship between a measure of student’s homework to a measure of achievement or achievement-related outcome, (b) assessed students in K through 12th grade in the United States, and (c) contained enough information to allow for a calculated estimate of the homework-achievement relationship. While the authors found flaws in the majority of studies, which often yielded wide and varied results, overall, homework had a positive effect on measures of academic achievement, with only one study reporting a negative effect. More specifically, out of the 69 correlations found from 32 studies, 50 showed positive and 19 showed negative correlations between time spent on homework and academic achievement (with time on homework reported by student or parent). Correlations were moderated by students’ grade level, with a significantly stronger correlation for secondary school students’ compared to elementary school students. In addition, when students reported time spent on homework, correlations were more strongly related to achievement compared to parent reports.

Similarly, Keith and Cool (1992) found analogous results when using structural equation models to investigate the factors that contribute to high school students’ achievement, controlling for confounding background variables. The researchers used a large sample of high school
students from two years (when students were sophomores and seniors) of the (NCES) High School and Beyond Longitudinal Study. Results showed that next to the large direct effects of intelligence and academic coursework, homework had the next largest direct effect on achievement.

The abovementioned studies have been large-scale syntheses; however, there has been a plethora of other more recent research that specifically investigates the academic benefits of homework. Cooper et al. (1998) explored the relationship between achievement and homework assigned by teachers, assignments completed by students, and attitudes about homework. This study was unique because researchers distinguished between the quantity of homework that teachers assigned and the proportion of homework that students completed. Researchers used the Homework Process Inventory (HPI) to assess aspects of homework practices and procedures from students, parents, and teachers, in both the lower (2-4) and upper grades (6-12) and compared them to both a state standard norm-referenced achievement assessments, as well as grades. In general, lower-grade students’ composite measure of time spent on homework had a near zero correlation with the measure of achievement and was significantly negatively correlated with class grades. Conversely, students in upper-grades showed a significant positive relationship between time spent on homework and grades. It should be noted that student reports of how much homework the teacher assigned were usually unrelated to achievement, but student reports of how much homework they completed were related to achievement. Again, this relationship was stronger at the upper grades than lower grades.

Another group of researchers, Keith, Diamond-Hallam, and Fine (2004) examined the differences between completing homework in school versus at home on high school grades, using data from the National Education Longitudinal Study (NELS). Structural equation
modeling (SEM) demonstrated a small indirect effect of in-school homework on Grade Point Average (GPA). Those students who completed more in-school homework also completed more out-of-school homework, which in-turn led to higher grades. The path from in-school homework to grades (12th grade GPA) was small and insignificant (.01), but the path from out-of-school homework to grades (12th grade GPA) was statistically significant and rather large (.28). A limitation of this study was that there was no operational definition of in-school versus out-of-school homework on the survey the students completed and it was up to their discretion to make the judgment, which could have confounded the results.

Thus, there is evidence to suggest that completing homework is related to students’ academic achievement across ability levels (Keith & Page, 1985), but disagreements exist over how much time spent on homework is needed to be effective. Using a systematic research synthesis, Cooper and Valentine (2001) found little correlation between homework and test scores for students in the elementary years, but found this relationship to be positive and strong in the secondary school years. For high school students, a positive relationship between time on homework and achievement did not appear until at least one hour of homework was assigned per week, but continued until the highest interval of homework was assigned. Similarly, Cooper et al. (2006) also found that homework is positively correlated to achievement for high school students after one hour of homework was completed and this relationship was found for even smaller amounts of time for middle school students (i.e., less than one hour per night).

Despite the positive evidence to support the use of homework, others have found the relationship to be inconsistent. Critiques of homework suggest that it lacks professional supervision, thus allowing children to practice their mistakes without professional supervision (Paschal, Weinstein & Walberg, 1984). Additionally, Trautwein (2007) argues that homework
can be associated with achievement at two levels, at the class level and at the student level. Trautwein also challenged the idea that time on homework is related to improvements in achievement; rather, it is the homework behavior, such as effort spent on homework. To further investigate this possibility, Trautwein (2007) completed three separate studies and used multilevel regression and hierarchical linear modeling (HLM) to assess the relationship between homework and achievement at the class and student levels. Results indicated a positive relationship between schools that assigned more homework and achievement scores, as well as the relationship between students who complete homework and achievement. However, it was effort on homework, not time spent on homework that was related to higher achievement. Despite this study, there is a paucity of research in this area, and further research needs to be conducted on students’ time on homework compared to effort and their respective relationships to achievement.

It is evident that completing homework is positively related to students’ academic achievement (Keith & Page, 1985). This relationship is particularly prominent at the secondary grade levels (Cooper et al., 1998; Cooper & Valentine, 2001), where homework has a direct path to high school grades (Keith et al., 2004) while having a compensatory effect for lower ability students (Keith, 1982). The predominant findings from the large base of research is that time spent on homework has a positive relationship with students’ academic achievement or grades, especially at the secondary level (Cooper et al., 2006; Cooper & Valentine, 2001). Time engaged in completing homework is obviously important for general education students, but also for those students enrolled in special education (Bryan & Burstein, 2004). Thus, it is imperative to consider if there are any differing effects of completing homework on students who have a disability.
**Homework and Students with Disabilities**

Being engaged in academics and the learning process is not only central for general education students, but also those students enrolled in special education. O’Melia and Rosenberg (1994) suggest that being actively engaged in learning is a strong indicator of achievement among students with mild disabilities. However, students with disabilities have noted difficulty completing homework assignments. Bryan and Burstein (2004) reviewed the research and suggested that the problem with homework completion may stem from two causes, characteristics about the students (e.g., poor organizational skills, reduced motivation, difficulties with listening comprehension) or teacher faults when creating assignments (e.g., work that is too difficult, not ensuring that students record assignments properly or have materials). These problems have been repeatedly reported across the literature relating to students with disabilities.

The research on homework and students with disabilities often includes those students with learning disabilities, behavior problems, or attention problems (Epstein et al., 1993; Langberg et al., 2010; Polloway, et al., 1992; Soderlund & Bursuck, 1995). Students with learning disabilities typically exhibit more homework problems than their peers (Bryan & Nelson, 1994; Epstein, et al., 1993). Some have noted that over half of students with learning disabilities have difficulty completing homework assignments (Polloway et al., 1992). In addition, these problems tend to increase during the secondary years. Earlier research has noted that when students with learning disabilities enter into high school, they spend less time completing homework than their classmates (Deslandes, Royer, Potvin, & Leclerc, 1999).

It has been well documented that teachers, as well as parents, believe that students with learning disabilities have many issues when asked to complete homework, such as organization problems, memory, attention to task, and skill deficits (Bryan et al., 1995; Epstein et al., 1993).
Bryan et al. (2001) found that these difficulties apply not only to students when recording assignments and taking materials home, but also when organizing themselves to do the work, following through to complete the homework, and then remembering to take it back to school. Some other studies have shown that students with learning disabilities are at-risk for other problems that may negatively impact their completion of homework. When surveying those students with learning disabilities and their typical peers about their homework, Salend and Gajria (1995) found that disabled students identified with practices that were related to homework completion difficulties. These included problems allocating time to complete homework, maintaining attention to homework, losing interest in homework, as well as weak study skills (Salend & Gajria).

Just as those students who struggle with learning have difficulty completing homework, so too do those students who struggle with emotional or behavioral disorders. Soderlund and Bursuck (1995) surveyed a random sample of special education teachers working with adolescent students identified as having behavior disorders and compared their responses to responses from teachers with students that were non-disabled. The results showed that teachers of students with behavioral disorders endorsed many more problems with homework than similar aged adolescents without behavior problems. Further, when parents of these students responded to a similar survey, they too had more concerns about homework problems than other parents.

Similar problems with homework completion have been noted for students with attention-deficit/hyperactivity disorder (ADHD; Epstein et al., 1993). Using parent reports on the Homework Problem Checklist (HPC), Power, Werba, Watkins, Angelucci, and Eiraldi (2006) investigated differences between elementary through middle school age students who were referred to an evaluation and treatment program for ADHD and those in general education.
Results suggested that there were two areas of homework problems for students with ADHD. The first related to homework problems observable to parents (e.g., inattention, avoidance, anxiety related to homework completion, etc.) and the second area related to problems that are observable to both parents and teachers (e.g., failure to accurately record assignment, and/or complete and submit homework).

Comparable to Power et al. (2006), Langberg et al. (2010) reviewed HPC survey data of over 500 parents with elementary aged students diagnosed with ADHD. The authors found that those students in the higher elementary grades have the highest level of homework problems and those students diagnosed with ADHD and learning disabilities have significantly more homework problems than children with ADHD alone. Further, there appeared to be a higher correlation between homework problems and the inattention symptoms of ADHD, compared to low to moderate correlations between homework problems and hyperactive and impulsive symptoms. Thus, students with disabilities have much difficulty completing homework, be it because they are not writing it down correctly, are avoiding it, or have problems completing it due to learning or attention deficits.

**Interventions to Increase Homework Completion and Accuracy**

Although time spent on homework is important, it has been postulated that homework completion (e.g., the actual amount of homework that is completed) has a stronger relation to academic performance than time spent on homework alone. As noted by various researchers, homework does not actually fulfill any purpose if students do not complete these assignments (Cooper et al., 1998; Keith, 1986). In their study, Cooper et al. (1998) reviewed the actual amount of homework that students completed and how it related to achievement. Findings
established a relationship between greater homework completion and report card grades and achievement-test scores, in both the lower and upper grades.

Regrettably, failure to complete homework is a common issue, especially for students at the secondary level. One study in particular documented the homework completion for 50 high school students and found that on average, one fourth of those students did not complete their homework each day (Schellenberg et al., 1991). Importantly, Polloway et al. (1992) noted that this rate could increase to over 50% for students with learning disabilities. It is difficult to pinpoint the exact reasons behind students at the secondary level not completing homework. There are various reasons why students do not complete their homework, such as low motivation, evasion of any academic work outside of the school, and/or poor study habits (Anesko & O'Leary, 1982). It could also stem from a learning or attention problem, home or parental circumstances, low motivation or other reasons (Paschal et al., 1984).

Strategies used to increase student homework completion have been widely investigated and debated by researchers, educators, parents, and students. It has been found that the strategy of merely assigning more homework hoping to increase student completion is not a worthwhile strategy, as students who currently do little homework are not likely to spend more time and effort simply because more homework was assigned (Corno, 1996). Since homework problems are prevalent in the general population (Anesko, Schoiock, Ramirez, & Levine, 1987), preventive and remedial interventions are very useful (Miller & Kelley, 1994).

Although the majority of studies have focused on increasing students’ rates of homework, it goes without saying that homework that contains a large number of errors would not be beneficial to student’s achievement or other academic learning. While there are limited studies
that have targeted both homework completion as well as accuracy, many others have not
included homework accuracy as a target in their interventions.

To initially explore this area, Harris and Sherman (1974) investigated the effects of an
intervention on sixth grade students with histories of answering questions incorrectly in class.
When these students were given homework each night, they completed the homework, but
inaccurately, which led to only modest improvements in correctly answering questions during
class. However, when accurate homework completion was rewarded with consequences, (e.g., if
80% or more of homework was accurate, the student could leave class early), both the amount of
homework that was completed accurately and a measure of student classroom performance were
higher when compared to when there were no such consequences. The authors replicated these
results in another phase of the experiment, indicating that homework assignments can improve
academics in the classroom, but only when assignments are completed to a high degree of
accuracy.

A number of approaches have been used to increase homework completion and accuracy
for both special and general education students, including: involving parents in the homework
process; implementing individual student strategies, such as goal setting, cooperative learning, or
self-management strategies; and utilizing classroom-wide strategies, including behavioral
contracts and contingencies (Bryan & Burstein, 2004). The majority of these strategies fall
within ‘typical’ and accepted education practices and are well-known to the fields of general
education and special education. While different interventions demonstrate pluses and minuses,
they need to be further explored to understand the true benefits of each.

**Parent involvement and training.** There has been a strong focus on involving parents in
the education process, which has been seen both in schools themselves and documented through
the research. For instance, a meta-analysis of parental involvement conducted by Fan and Chen (2001) found that parental involvement is related to academic achievement. More specifically, they found a stronger relationship to exist when parents held high aspirations or expectations for their children to succeed in school and a weaker relationship between the level of parental supervision at home and achievement. Therefore, it is especially important for parents to have high expectations for their children, more so than physically being involved in the achievement process.

More recently, Patall et al. (2008) conducted a meta-analysis to investigate if parental involvement in homework was positively related to their children’s educational performance. They found that those studies that trained parents in how to involve themselves in their children’s homework correlated to higher rates/levels of homework completion and fewer homework problems. When looking at a specific relationship to achievement, the authors found some evidence to support involvement for elementary and high school students (not middle school).

In another study examining the relationship between parental involvement and achievement of adolescents, Jeynes (2005) specifically investigated if parental involvement and family structure were related to the academic achievement of high school students. Using the National Education Longitudinal Survey (NELS) data set it was found that family structure (coming from an intact family) was the greatest predictor of academic achievement. In addition, parents speaking with their children about school and being present at school functions were also positively related to achievement. Interestingly, checking homework had either no effect or a negative effect on academic achievement for adolescent students.
Since prior research has found parental involvement in homework to be beneficial to homework completion, much research has been conducted on specific ways to strengthen this home-school relationship. Balli et al. (1998) investigated the effects of increasing family involvement in math homework for middle school students by randomly assigning three intact math classes with the same teacher into three groups. Group 1 students were given no prompts to involve family members; group 2 students were prompted to involve family members through verbal reminders and written directions on homework about how to involve family; and group 3 students were prompted to involve family members (same as group 2) and family members were prompted to be involved (through families writing comments to a feedback section and parent signature located on the homework). The two groups that received involvement prompts showed high levels of family involvement, as family members from groups 2 and 3 were significantly more involved with math homework than group 1; however, higher levels of family involvement were not associated with higher student achievement and no significant differences of math post-test means were found between the groups.

Typically, the goals of parent training interventions are to raise parents’ knowledge and skills at promoting homework or other academic skills in the home (Olympia, Sheridan, & Jenson, 1994). Anesko and O’Leary (1987) employed parent training in behavioral methods in order to help them manage their elementary school child’s homework difficulties and increase completion of homework. Parents in the treatment group reported significantly fewer homework problems compared to parents in the control group at post treatment. Yet, when the control group was treated in the same manner, no significant gains were reported. In addition, the researchers did not look at whether this intervention actually increased homework completion.
Rhoades and Kratochwill (1998) examined the effectiveness of a parent homework training program for elementary students’ with homework completion problems, using a multiple baseline design across participants. Findings showed (a) improved student work completion (at post-treatment students completion rates rose to within normal limits, higher than 87%), (b) an 80% accuracy rate across intervention, (c) increased student compliance with homework (as reported by parents in a weekly log and on a homework questionnaire), and (d) following intervention, slight improvements to student’s quarterly grades. While findings are promising, the use of a single subject design needs replication to increase confidence in findings, and some outcome measures did not possess appropriate psychometric qualities.

More recently, Van Voorhis (2011) studied the effects of a two-year family involvement homework program, Teachers Involve Parents in Schoolwork [TIPS], on family attitudes and student achievement in the elementary and middle grades. This involved a specific homework protocol that consisted of weekly assignments that involved a family member in some type of discussion or interaction. When compared to a control group, there were no significant differences found between the time spent on homework, but after two years of the TIPS program students scored higher on standardized tests when compared to the control group. When examining both student and family experiences with homework, students in the TIPS program rated their feelings significantly higher (i.e., more positive) than control students. This was also seen when families evaluated their feelings. Although both rated their feelings as “ok”, the TIPS group was significantly higher than the control group.

Another parent involvement technique that has been widely researched has been Conjoint Behavioral Consultation (CBC), where a consultant will engage parents and teachers in a collaborative problem-solving process to improve on a particular problem (Sheridan, Meegan, &
Eagle, 2002). Sheridan et al. (2001) found that CBC can be an appropriate means to address and improve on various academic, behavioral, and social issues of students. There has been preliminary work investigating the positive effects of CBC on improving homework completion and accuracy (Galloway & Sheridan, 1994). As part of a recent dissertation, Beck (2013) added an online Electronic Daily Report Card (EDRC) to a CBC model to increase homework completion rates of seven fifth and sixth grade students. Results were promising, as all students had improvements in homework completion and decreased problematic homework behaviors on the Homework Problems Checklist (HPC), both after the intervention and at follow-up. While the effects of CBC have been positive, more investigation is needed to determine the effectiveness of this method on consistently increasing homework problems, especially of those students with disabilities.

Although, parent involvement and training can be effective in aiding students with their homework completion, there are numerous drawbacks to this approach. As mentioned, Patall et al. (2008) conducted a synthesis of the research and found both positive and negative effects of parental involvement in homework. Positive attributes of this involvement include acceleration of the learning process, a positive affect toward learning, increased communication between the parent and child, as well as increased communication between the parents and teacher. Conversely, the authors found parental involvement in homework can, at times, interfere with learning, have emotional costs and tensions between the student and family members, as well as demonstrate an increased difference between high and low achievers. Furthermore, many parents have difficulty implementing interventions consistently and correctly, which may result in the discontinuation of such interventions (Olympia, Sheridan, & Jenson, 1994). Parents may also feel unprepared to help with homework, and may need additional information concerning
homework expectations than teachers consistently provide for them (Kay, Fitzgerald, Paradee, & Mellencamp, 1994).

Although parental involvement has been shown to be related to academic success in children, other types of involvement (e.g., high expectations) rather than parent intervention at home (e.g., checking homework or parental supervision) may have a stronger relationship to school success, especially for high school students (Fan & Chen, 2001; Jeynes, 2005). It is therefore necessary to look at other ways to intervene in the homework process inside the school.

**Self-management interventions.** Self-monitoring procedures, which occur when a student systematically observes his or her own behavior and records occurrence/nonoccurrence of a target behavior (Kazdin, 2001), have been used to increase homework completion. Trammel et al. (1994) conducted a study that explored the use of self-recording, evaluation, and graphing to increase the completion of homework by middle and high school students diagnosed with learning disabilities. The self-monitoring phase increased assignment completions across students, which was maintained during self-graphing and goal-setting phases. Classroom teachers reported improvement in homework attitudes, and parents were satisfied with the results. However, since this was a single subject design, replication is necessary to generalize these results and statistical analysis is needed.

Goal setting, where students set performance goals against their present performance level, is a type of self-monitoring that has been effective in many areas of academic achievement. Miller and Kelley (1994) investigated the use of goal setting and contingency contracting to improve homework accuracy and time on-task rates while completing homework. Four parent-child dyads with a history of low homework accuracy (below 80%) and average achievement in math and reading were included in a reversal (ABAB) and multiple baseline design, where each
parent was individually instructed in goal setting and contingency contracting, including the rationale, provision of materials, discussion, practice, and performance feedback. The intervention substantially improved all subjects’ homework accuracy rates. However, on-task rates improved for only two subjects, as they demonstrated clear increases in the percentage of on-task behavior during treatment and marked decreases during baseline.

Toney, Kelley, and Lanclos (2003) compared the effects of a student self-monitoring homework intervention to a parent monitoring homework intervention for middle school students with homework problems. Thirty-seven middle school students and their parents were randomly assigned to one of three experimental groups: (1) parental monitoring treatment; (2) self-monitoring treatment; or (3) wait-list control group. Scores on a homework problem checklist significantly improved for both interventions when compared to the control sample, but were not different from one another, with the parents in the parental monitoring group responding more positively than parents in the self-monitoring group, but these differences were not significant.

While self-management has had mixed results, another area that has recently been investigated to determine its effectiveness on homework completion is having students work in cooperative groups to complete homework.

Cooperative learning. Peers can have an effect on students’ academic and social behavior, and therefore may be utilized to help with various academic and class wide problems. One such peer intervention is the use of cooperative learning. Generally speaking, cooperative learning involves small groups of students working together and helping one another master academic material or learn a specific task (Slavin, 1991). This has become an increasingly popular method to increase homework compliance in schools, especially at the secondary level.
O'Melia and Rosenberg (1994) explored/examined the effect of a structured cooperative homework team intervention (students would grade and correct homework assignments as a cooperative group) on the homework completion, accuracy, and proof reading skills of middle school students with mild disabilities. When compared to a control group, the researchers found that there was a significant difference at post treatment in the amount of homework completed and percent correct on homework, but there was no significant pre/post difference between the two groups on a standardized math measure. Grade level was a mediating factor in this study, as the intervention was less effective for 6th graders than it was for 7th and 8th graders.

On the college level, Kaufman, Felder, and Fuller (2000) investigate the effects and usefulness of cooperative learning homework teams combined with a peer rating system. All students completed their homework in cooperative learning teams and then each member of the team rated how well other members satisfied their responsibilities of the group. The authors then converted these ratings to calculate an individual rating for each student and then explored the relationship between ratings and grades. Although not specifically comparing the use of cooperative learning to increase homework, results indicate that those groups that were rated higher (meaning were successful cooperative groups) correlated positively with test grades.

Hsiung (2010) used cooperative learning in an engineering college course for both in-class assignments and homework assignments. Students were randomly assigned to a learning condition, either cooperative or individualistic. Those students in the cooperative learning condition completed classwork and homework in mixed ability groups (homework group was supervised), while those in the individualistic group completed all assignments alone. After the course was completed, results indicated that those students in the cooperative learning group accomplished a significantly higher level of academic success than those in the individualistic
groups. This included higher scores on the unit tests assigned during class and the homework tests taken during homework time.

Although cooperative learning appears to be effective for homework practices, the majority of the research is at the college level, where teachers have more control of their classroom and can manipulate how students complete their homework.

**Behavioral based strategies.** There have been some empirically supported strategies that teachers have used to increase homework completion across students in elementary schools, both those with and without disabilities. When reviewing prior research on homework strategies for improving spelling and math homework, Bryan and Sullivan-Burstein (1998) found that when teachers systematically implemented pre-selected homework strategies in their elementary school classrooms, there was an increase in completion rates for students with learning disabilities and average-achieving students with homework problems. These strategies included giving students’ real life examples plus reinforcements, using homework planners, and graphing homework completion. In general, strategies such as these are not seen as widely researched within the high school population, where homework has been seen to have the largest effect on high school academic performance.

Research suggests that one of the most reliable ways to generalize the results of an intervention is the use of natural contingencies and reinforcements available in the environment (Stokes & Baer, 1977). However, it can be difficult at times to maintain academic gains through natural reinforcement for all students, thus it is at times indispensable to reorganize the environment to provide other reinforcement for students. Rewards have been consistently used to improve the completion of homework, as well as the accuracy of homework. As previously mentioned, Harris and Sherman (1974) used consequences to reinforce accurate homework for
sixth grade students. Results showed that providing a positive consequence (leaving class early) after students have accurately completed homework, not only increased the number of students who completed their homework, but also the accuracy of this homework. Although there was no treatment integrity or other integrity measures, this was an important study to demonstrate the power of rewards.

Similar to Harris and Sherman (1974), Miller et al. (1993) used a contingent reward for middle school students when using accurate self-correction of math homework errors, to increase both student accuracy and achievement. When the reward was given, accuracy in self-correction of homework improved. The mean of the first baseline was 5.8% for self-correction inaccuracy and dropped to 1.4% during the intervention of reinforcement. When switching back to baseline, inaccuracy means rose to 5.1%, and then dropped to .9% during the intervention. Homework achievement, as shown through the mean accuracy of completed assignments also improved. The first baseline mean accuracy was 77% and then 83% during the first reward phase, while the second baseline was 79% and then improved to 89%.

Schellenberg et al. (1991) also studied the effects of rewards on homework completion, but they used contingent free time on the homework completion of 50 high school students. Results indicate that the frequency of homework completed by students increased with the use of the free time contingency. This was shown substantially during the second free time phase of the intervention. Students indicated a general acceptance of free time as a consequence. However, some students felt that the time required for homework was greater than the reward. Therefore, the three minutes that the authors used may not be enough incentive for some students to complete their homework.
Moreover, Ryan and Hemmes (2005) used an alternating treatments design to assess if a contingency of extra points provided for submitting homework would have an effect on homework completion for college students. Results indicated a higher mean percentage of both completed homework assignments and quiz grades for those groups that were awarded points. Further, this study was replicated in another college classroom, which had similar results, as students submitted homework assignments more often when they were being rewarded with points, but quiz scores were minimally affected (Rehfeldt, Walker, Garcia, Lovett & Filipiak, 2010).

Due to the perceived benefits of homework, numerous strategies have been utilized to improve homework practices of students. Strategies to increase compliance can be mediated by parents, teachers, or students themselves. These have included parental involvement (Anesko & O’Leary, 1987; Balli et al., 1998l; Rhoades & Kratochwill, 1998; Van Voorhis, 2011), self-monitoring (Trammel et al., 1994), goal-setting (Miller & Kelley, 1994), behavioral based rewards (Harris & Sherman, 1974; Miller et al., 1993; Ryan & Hemmes, 2005; Schellenberg et al., 1991), and others. Even though many interventions have been effective in improving homework, the majority focuses on individual students. These are both time consuming for teachers and make little impact on the class as a whole.

Group Contingencies

One type of behaviorally based intervention that can be used to target the whole class is a group contingency, where the same target behaviors, criteria, and reinforcement are used for all members of the group (Skinner et al., 2002). In a review of classroom group-oriented contingencies, Litow and Pumroy (1975) described background and support for their use and a definition of the three specific group-oriented contingency systems: independent, interdependent,
and dependent. Theodore, Bray, Kehle, and DioGuardi (2003) further delineated each type of group contingency and discussed the effectiveness and advantages of each.

**Independent group contingencies.** Independent group contingencies utilize the same behaviors, criteria for receiving a reward, and consequences for all students; however, each student earns the reinforcement conditional on their own behavior (Litow & Pumroy, 1975). It is important not to confuse an independent group contingency with an individual contingency. As Theodore et al. (2003) note, an individual contingency is managing consequences for individual students, while an independent group contingency applies the same consequence and rewards to the entire class, but contingent upon the individual performance of each student. For instance, if a teacher wants to reward completion of math problems with free time using this type of group contingency, then free time activities for each class member would be contingent on each student’s individual performance of completing 20 of 30 math problems on a test. Students who did not reach this level, would not receive free time. This type of group contingency is easy to develop, explain, and implement (Skinner et al., 2002), but does not take individual student differences into account. It can inadvertently promote a social class system, as those students who do not receive reinforcement may influence others’ behavior by praising and socially rewarding inappropriate behavior (Skinner et al., 1996).

**Dependent group contingencies.** Unlike independent group contingencies, dependent group contingencies reinforce the group based on the performance of one or a few students who meet the criteria (Litow & Pumroy, 1975). Using the previous example, in this type of contingency free-time for the entire class would be contingent upon one of the students being able to complete 20 of 30 arithmetic problems. If that specific student did not reach this level, no class member would receive free-time activities. These contingencies are advantageous, as they
use peer social reinforcement to aid in behavior change and lower peer competition (Gresham & Gresham, 1982). However, they also put a great deal of pressure on the students upon whose performance the reinforcement is dependent (Popkin & Skinner, 2003), and increase the likelihood of peer pressure and ridicule (Skinner et al., 1996).

**Interdependent group contingency.** One type of group contingency that does not have the disadvantages of the first two, are interdependent group contingencies. In this case, every student in the class earns a reinforcing reward if all students attain a specific level of performance (Litow & Pumroy, 1975). Students are interdependent on each other to gain reinforcement. Using the same example, free time activities for the entire class would be contingent upon each student successful completing 20 of 30 math problems on a test or a class average of 20 to 30 problems completed. Failure to meet this level of performance by the entire class would result in no individual receiving free time. Establishing the set criteria to gain reinforcement can be completed in several ways. For instance, a teacher can have all students meet the criteria as a whole, average the class performance, set a minimal standard that each student must meet, implement a high standard that the class or certain percentage of the class much achieve, or divide the class into teams (Theodore et al., 2003). No matter which method is utilized, the performance of each student is a significant contributor to attaining the criterion that was set.

The interdependent group contingency is advantageous, as teachers address the behavior of the entire class with only one contingency plan (Gresham & Gresham, 1982). In addition, peer rejection, jealousy, or retaliation is non-existent in the interdependent group contingency, since access to reinforcement is provided to either all or none of the students in the class (Skinner et al, 2002). Further, when a students’ peers perform well, the likelihood of that student
receiving reinforcement actually increases (Popkin & Skinner, 2003), thus allowing for the entire class to strive for a common goal (Skinner et al., 2002).

Elliott, Turco and Gresham (1987) asked fifth grade students, teachers, and school psychologist to rate the acceptability of all three types of group contingency interventions (using a hypothetical situation). The students rated the interdependent contingency to be mildly acceptable (along with the other two forms), and teachers and school psychologists rated the interdependent as acceptable (along with the independent, but not the dependent). There are also disadvantages associated with this type of contingency. Skinner et al. (1996) and Theodore et al. (2003) maintain that students who follow the classroom requirements may become frustrated if they do not earn the reinforcement because the class as a whole was not successful. The authors also note that some students may intentionally undermine the contingency because they enjoy ruining the chance of the class receiving reinforcement. Lastly, if the reinforcer is not liked, it may not produce the desired change in behavior and some students may sabotage the contingency program.

**Effectiveness of Group Contingencies**

Group contingency systems are a type of behavior modification that have been effective in reducing inappropriate and off-task behavior, as well as increasing academic skill areas. They have been shown not only to be effective, but also efficient. A number of studies have compared the three contingency types, with varying results. An early study conducted by Gresham and Gresham (1982) compared the interdependent, dependent, and independent group contingencies in controlling disruptive behavior of children diagnosed with mental retardation. Gresham and Gresham found that group contingency systems are effective in reducing disruptive behavior, with interdependent and dependent contingencies being more effective, when compared to the
independent contingency. The authors also indicate the advantages of these reward systems; for example, teachers should find group reinforcement much more efficient and this intervention will free up their time to teach and facilitate group work. Further, it allows for peers to model pro-social behavior within the classroom.

Shapiro and Goldberg (1986) also compared these three types of contingencies to evaluate their effectiveness, but the authors investigated their utility in improving the spelling performance of upper elementary aged students. Using a single subject alternating treatment design, the researchers found that all three were effective in increasing spelling skills of these students and there was no definitive superiority of one over the other.

Theodore et al. (2004) further studied the comparative effects of interdependent, dependent and independent group contingencies. Their study specifically focused on reducing disruptive behavior of high school students in a self-contained special education classroom. Similar to Shapiro and Goldberg (1986), Theodore et al. (2004) utilized an alternating treatments design to study the effects of these three types of contingencies across three students. During the independent group contingency, each student was responsible for his or her own behavior and reinforcement was delivered based on the individual performance of each student (to those that received five or fewer checks). In the interdependent group contingency, all students had to have five or fewer checks in order to earn reinforcement. Lastly, for the dependent group contingency, the teacher wrote each student’s name on a piece of paper and randomly selected a name from a jar. Reinforcement of the entire class depended on if the student whose name was selected had five or fewer checks. Results found that all three contingency types greatly reduced disruptive behavior in all participants. There were no substantial differences found between the three types
of contingencies, as disruptive behaviors decreased to an average 3% for the independent phase, 2% for the interdependent phase, and 2% for the dependent phase.

Consequently, all three studies found that the interdependent and dependent group contingencies were slightly more efficacious over independent when reducing disruptive behavior. Considering the effectiveness of group contingencies on behavior, Heering and Wilder (2007) investigated the effects of a dependent group contingency on increased on-task behavior in the general education classroom. The researchers employed a multiple baseline design across both a third grade class (31 students) and fourth grade class (33 students), where the teacher reported difficulty managing student behavior. The intervention took place during mathematics instruction. Data on the dependent variable (on-task behavior) was collected using 40 minutes of momentary time sampling (15 second intervals), where observers monitored on-task behavior of a specified row of students and then at the end of the interval switched to a new row (selection done at random prior to intervention). Students received reinforcement contingent on being on-task at four randomly determined moments during the class period. At the end of the 40-minute interval, if students were on task for 75% or more of the observed intervals, the entire class received the reinforcement. In general, on-task behavior increased. Unfortunately, it is not clear that this on-task behavior will actually translate to improved academics, and on-task data for individual students were not collected and thus cannot be compared.

Coogan, Kehle, Bray and Chafouleas (2007) studied the effects of a multi-component intervention. More specifically, an interdependent and unknown dependent group contingency that involved self-management, peer feedback, and randomization of reinforcement criteria and reinforcers, was implemented to decrease disruptive behavior for five 12-year old students. In this intervention, a group of students was given a self-monitoring board that was divided into two
colored sections (blue and green) with five pushpins attached to the green section. If a group member exhibited any inappropriate behavior, a student had to move the pin from the green to the blue section. Individual students also completed self-monitoring data and were instructed to place a check on a sheet if they caused a pin to be moved for their group. Reinforcement was based upon group performance or individual performance. There were three jars on the teacher’s desk; the first one contained criteria for reinforcement (group or student), the second contained all students’ names, and the third contained potential rewards. When results of the interventions were compared, Coogan et al. (2007) found that student’s individual and average percentage of disruptive intervals decreased substantially during the intervention phases of the study. Additionally, large effect sizes of 1.88, 1.36, and 1.30 were found for three students, and larger effects sizes of 2.24 and 2.26 for two of the students were also noted. There was an overall increase in mean percentage of disruptive intervals between the first and second intervention phase. This type of increase may have resulted from the students’ dissatisfaction with removal of intervention during the second baseline. Students reported neutral attitudes toward the intervention, and the teacher had positive ratings and positive verbal feedback.

Although the dependent group contingencies were supported by some studies, further research has identified the interdependent group contingencies as extremely efficacious in improving many academic and behavioral problems. Schmidt and Ulrich (1969) conducted one of the earlier studies on the effectiveness of this specific type of contingency on behavioral issues. The authors found that treating the class as a whole and reinforcing the entire class with extra gym time when their noise level decreased was an effective intervention. More recently, Campbell and Skinner (2004) investigated the use of an interdependent group contingency with explicit timing (dubbed the Timely Transitions Game or TTG) on decreasing transition times for
a class of sixth grade students. In this study, the teacher timed five transitions and at the end of the day the teacher randomly selected one transition and one criterion. The class had to complete the selected transition in less time than the selected criterion to earn a reward. Results found decreases in transition time after implementation of the intervention, for an overall average reduction of 1.5 hours per week, when compared to the transition time before use of the intervention.

A similar intervention was utilized at the high school level to decrease problem behavior. Christ and Christ (2006) used an interdependent group contingency paired with a digital scoreboard (to provide ongoing feedback) to decrease student disruptions and reduce teacher reprimands of disruptive student behaviors. In this case, the scoreboard was utilized to provide automated positive feedback, including digital reward tokens to students. The positive feedback was only interrupted when students engaged in disruptive behaviors. Results found that the intervention was effective in reducing the rate of disruptive behavior and teacher corrections.

This type of intervention has also been used to improve various types of academic performance (Popkin & Skinner 2003; Shapiro & Goldberg, 1986; Sharp & Skinner; 2004). As previously mentioned, using an alternate treatments design, Shapiro and Goldberg (1986) compared the three different types of group contingencies in improving spelling skills of two classes of sixth grade students. Results indicated that all three treatments were effective; however, students had higher acceptability ratings of the independent group contingency over the interdependent and dependent. A similar study found that the use of an interdependent group contingency with five middle school students classified with an emotional disturbance was able to increase each student’s performance on measures of English, mathematics, and spelling (Popkin &, Skinner, 2003).
Sharp and Skinner (2004) found that the use of an interdependent group contingency was also effective in increasing reading skills of a class of second grade students. Using a variation of two types of interdependent group contingencies, the researchers found that the mean number of passing reading tests scores increased from .67 at baseline to 7.5 during the intervention, which was found to yield a large and positive effect size.

Interdependent group contingencies have thus been shown to be efficacious in improving many behavioral and academic problems within the classroom. This type of intervention has been effectively used to decrease classroom noise levels (Schmidt & Ulrich, 1969) and reduce disruptive behavior (Theodore et al., 2004), as well as increase overall academic performance (Popkin & Skinner 2003), augment reading skills (Sharp & Skinner, 2004), and improve spelling skills (Shapiro & Goldberg, 1986).

**Randomization of Group Contingency Components**

Although group contingencies have been found to be extremely effective in both behavioral and academic areas, these interventions have been shown to be even more valuable when the various components of the intervention are randomized (Theodore, et al., 2004). This randomization can be done in a two ways. One such way is to randomize the criterion that must be met to obtain the reward. When randomizing criteria for the reward, students often modify their behavior because they are unaware of what they will be evaluated on to earn the reward.

Another way to randomize is through randomly choosing the reward students will earn. This may help increase the effectiveness of the contingency, as the element of surprise increases and the likelihood that a student will deliberately ruin the contingency due to an undesirable reinforcer decreases (Skinner et al., 1996). This process is deemed a mystery motivator and is effectively the same as using a randomized reinforcer as a method of delivering contingent
rewards to students. The majority of studies that studied the effectiveness of a mystery motivator intervention have done so with individual students, groups of students, or a whole class of students to decrease problem behavior (Kowalewicz & Coffee, 2013; Murphy, Theodore, Aloiso, Alric-Edwards, & Hughes, 2007).

For instance, Kowalewicz and Coffee (2013) studied the effectiveness of a mystery motivator intervention to decrease disruptive behavior of eight classes of general education elementary classrooms. Results found that the intervention was effective in lower rates of behavior across all classrooms, and the majority (seven out of eight) teachers reported the strong acceptability of the intervention. Similarly, Murphy et al. (2007) employed a mystery motivator with an interdependent group contingency with a class of preschool students to reduce descriptive behavior, again results found the intervention to be effective in lower rates of behavior for all nine students. While most have used this intervention in elementary schools, Schanding and Sterling-Turner (2010) investigated the use of a mystery motivator in a high school classroom to decrease disruptive behavior. Comparable to its use in an elementary school, results showed that the intervention decreased class behavior problems overall, with a decreased in disruptive behavior in the three targeted students.

Randomization of the group contingency has also been shown to improve academic behavior. For instance, Alric, Cray, Kehle, Chafouleas, and Theodore (2007) compared independent, interdependent, and dependent group contingencies with randomized reinforcers or mystery motivators on reading fluency for elementary school students. In the independent group contingency condition, rewards were based on students’ own performance relative to set criterion, while in the interdependent group contingency; rewards were based on the average of the whole class’s reading relative to criterion. Lastly, in the dependent group contingency,
rewards were based on the selection of one student’s performance, where no one knew which student would be selected. All three conditions used a random drawing of reinforcement, so students were not aware what they were working toward until after they met their criterion. Effects sizes were calculated across participants, and found that all three group-contingencies had a moderate positive effect in increasing reading fluency. The authors also found mixed results as to which contingency was most effective for increasing fluency; however, all students did appear to benefit from at least one type. Additionally, students rated their participation positively, as did the teacher.

There have also been a few studies to study mystery motivators as a tool to increase homework behavior. For instance, Moore, Waguespack, Wickstrom, & Witt (1994) utilized intermittent or random reinforcement through the use of a mystery motivator, to target homework completion and accuracy rates of two classes of elementary school studies. When students handed in homework they were able to color a square on a chart, and if a mystery motivator symbol was revealed, a reward from a menu was provided. While results were more exploratory, as an AB design was utilized and a functional relationship could not be established, results showed that both homework completion and accuracy rates increased for participants in both classrooms.

Madaus, Kehle, Madaus, and Bray (2003) studied the effects of a mystery motivator intervention to increase homework completion and accuracy of five fifth grade students. The authors used five students with a history of homework problems as participants in an ABAB design with multiple baselines. In the intervention phase, each student had his or her own mystery motivator chart. There were 22 intervals on the chart and the researcher randomly selected 18 intervals and placed the letter ‘M’ (to indicated mystery motivator) in the interval,
hidden by a piece of construction paper. If homework was completed with at least 80% accuracy, students could earn a reinforcer. Results indicated that all of the students, except for one, demonstrated improvements in completed math homework and three students showed improvement from initial baseline in terms of accuracy, including the one student who did not show completion improvements. The teacher rated the treatment as neutral to acceptable, and students indicate that the intervention was fun, helped with homework grades, and had enjoyable reinforcers.

More recently, Ferneza, Jabot, & Maheady (2012) used a mystery motivator game (through the use of an interdependent and dependent group contingency) with a small group of general education high school students. If all (100%) of students completed homework assignments, the teacher randomly graded one student’s assignment and if that assignment was at least 85% accurate, the entire class earned a mystery motivator. Results found that there were immediate increase in student homework accuracy and all students had increases in their homework averages when the game was in use.

An innovative approach to the use of group contingencies is randomization; that is, ensuring criteria reinforcement and the reinforcers themselves are unidentified to the students. Research has shown that when using random components of the group contingency, encouraging results in the decrease of behavior problems (Kowalewicz & Coffee, 2013; Murphy et al., 2007; Schanding & Sterling-Turner, 2010), increases in academic performance (Alric et al., 2007), or increases in homework completion have been found (Ferneza et al, 2012; Madaus et al., 2003; Moore et al., 1994).
Randomization of the Interdependent Group Contingency

The randomization of multiple components (e.g., reinforcers and criteria to receive reward) of the interdependent group contingency has also been explored as a means to increase the effectiveness of the intervention on target behaviors (Kelshaw-Levering et al., 2000; Lynch et al., 2009; Reinhardt et al., 2009). Kelshaw-Levering et al. (2000) investigated the effects of adding randomizing reinforcers to an interdependent group contingency in decreasing disruptive behavior. Participants were 12 second-grade students in a general education class in which a multiphase time-series (ABACBC) design was employed to measure the effectiveness of the interdependent group contingency on decreasing the behavior problems of the students. First, an interdependent group contingency with randomized reinforcers was used to determine if simple randomization of reinforcers would account for any differences. Second, an interdependent group contingency with all components randomized was implemented. Using the latter method, students would not know the criteria for earning reinforcement because it would change from period to period depending on what was drawn at random from jars. Findings showed that both randomizing multiple components and simply randomizing reinforcers within interdependent group contingency can lead to behavior change compared to baseline data. Results also indicated that randomization of multiple components was slightly more effective than randomizing reinforcers alone. Limitations were that students were only observed for brief periods of time and the teacher picked a student to draw from the jar, thus, the opportunity to be called on may have been reinforcing in and of itself.

Overall, Kelshaw-Levering et al. (2000) found that randomizing criteria can improve disruptive behavior; when students are not aware of the specific criteria to earn a reinforcer, they adjust their behavior in order to attain something that will be appealing, even though it is still
unknown. Similar results were seen in a study conducted by Theodore, Bray, Kehle, and Jenson (2001), where the reinforcing contingency and the reinforcers themselves were randomized to decrease disruptive behavior for five adolescent students in a self-contained classroom. The students were told they needed to behave appropriately (measured through fewer than 5 check marks for disruptive behavior) to earn possible reinforcers. At the end of the period, the teachers randomly chose a slip of paper from a jar labeled “criteria”, which held the randomized criteria (e.g., the performance of the whole group, the student with the highest performance, etc.). If the criterion was met (the student(s) had five or fewer checks) all the students were rewarded and the teacher randomly selected a reinforcer from another jar, labeled “reinforcers.” The study used an ABAB design. Findings showed significant decreases in the disruptive classroom behavior after the intervention was implemented. Large effect sizes were found for four of the five students in the study. Furthermore, students reported that they ‘liked’ the intervention and the teacher was very satisfied with the nature of the intervention and the results.

Research has thus shown that randomizing the components of interdependent group contingencies can be extremely effective (Kelshaw-Levering et al., 2000; Theodore, et al., 2004). This is true both for reducing behavioral issues within a classroom, but also for increasing homework completion/accuracy rates, which will be detailed below.

**Group Contingencies and Homework**

To date, there have only been a handful of studies that have investigated whether group contingencies can be employed in the classroom to successfully raise homework completion and/or accuracy rates. The first published study, conducted by Olympia, Sheridan, Jenson and Andrews (1994), employed a group contingency as an intervention to increase math homework completion and accuracy rates for middle school students. These researchers used a single
subject design (ABAB) to compare two student-managed group contingencies, combined with cooperative learning and self-management (self-monitoring, self-instruction, and self-reinforcement). Overall, 12 of 16 students produced at least 20% more homework during treatment compared to baseline. Improvements in homework accuracy were not as evident as with completion and tended to be variable, with only a negligible difference (3%) in accuracy across the two groups. Limitations included subject selection, with the researcher assuming that participants had homework performance deficits not academic skill deficits, but this was not tested directly, so some participants may have had skill deficits as well.

More recently, there have been a few studies that applied the use of a group contingency to increase homework rates. To compare the effects of the three types of group contingencies, Lynch et al. (2009) used a single subject alternating treatment design to evaluate which was most effective in increasing homework completion and accuracy rates of a self-contained fifth grade classroom of students with disabilities. This study also used randomly selected criteria for reinforcement and utilized mystery motivators to randomize the rewards. The authors found that all three of these contingency systems were equally successful in increasing homework completion and accuracy of the students. When examining homework accuracy, while all three contingencies resulted in improvements, the interdependent contingency was slightly more efficacious than the other two. It is important to note that on rating scales, the teacher reported a high level of satisfaction with this intervention and students reported they liked the group contingency interventions.

Further, a dissertation (Ralston, 2011) specifically looked at the effects of a dependent group contingency, with randomized components, on homework completion and accuracy rates of general education middle school students, using a multiple baseline design across three math
classes. Results were mixed across three classes for completion and accuracy rates, as some classes improved and others did not. One class showed negative effects for completion rates and two others found negative effects for homework completion rates. However, results were looked at on a class level, not on the individual student level. In addition, students did rate the intervention as acceptable and indicated they enjoyed the intervention. Thus, results were not as strong using the dependent contingency alone.

Building on the results from Lynch et al. (2009) that found the interdependent group contingency to be the most effective in increase homework rates, Theodore et al. (2009) investigated the use of a randomized interdependent group contingency to improve the spelling homework performance of a class of elementary school students. This study used homework goals that were randomly chosen (e.g., everyone completed spelling homework, class average was 85%, etc.) and if the class as a whole met this goal they would receive a random reinforcer (e.g., 10 minutes of free time, popcorn party, etc.). There were 21 students in the class and results showed that this interdependent group contingency, coupled with randomized components, was able to marginally increase homework completion rates, from an average of 89% to 98%. Theodore et al. (2009) indicated that the students had high levels of completion at baseline, which led to only modest gains during the intervention. More importantly, the intervention appeared to have a more significant effect on spelling homework accuracy, as all of the students, except for one, improved their accuracy; 10 students demonstrated large effect sizes (-.81 to -2.33), seven moderate effect sizes (-.42 to -.66), and only three showed small effect sizes (-.24 to .20). The teacher indicated that she was somewhat satisfied with the intervention and the students reported they somewhat liked this intervention as a way to increase their homework performance.
Similar to Theodore et al. (2009), Reinhardt et al. (2009) investigated a comparable intervention, but focused on the use of a randomized interdependent contingency with elementary school students to increase homework accuracy rates. Unlike the previous two studies (Lynch et al., 2009; Theodore et al., 2009), Reinhardt et al. used an interdependent group contingency across homework subject areas to examine the efficacy of the intervention with six fourth grade students. Using a multiple baseline design across reading comprehension, mathematics, and spelling, the teacher calculated the accuracy rates for each of the students and rewards were provided contingent on the students reaching a randomly selected criterion for homework accuracy performance. If the goal was met, the teacher would choose a reward from the mystery motivator box. Findings revealed that the contingency was able to improve homework accuracy for these students, but the degree of improvement varied in terms of subject matter. The greater effect was for reading comprehension, perhaps because it was the first to be targeted for intervention and the students had the poorest performance before the intervention. This shows that this contingency was able to improve the accuracy of homework in the area of greatest need.

In addition to these, another recent study by Little, Akin-Little, and Newman-Eig (2010) utilized an interdependent group contingency program to increase the homework completion and accuracy rates of fourth grade elementary school students. These researchers also investigated whether randomized reinforcement was more effective than constant reinforcement (i.e., using constant lengths of free time and varied lengths of free time). Results showed that the interdependent group contingency intervention, with constant or varied reinforcement, was effective in improving homework completion and accuracy. Varied and constant reinforcement were equally effective when looking at homework accuracy rates. Interestingly, the use of
constant reinforcement was more effective than varied reinforcement in increasing homework completion. This is contrary to prior research that has found varied schedules of reinforcement to be beneficial over constant (Kelshaw-Levering et al., 2000; O’Melia & Rosenberg, 1994; Skinner et al., 2000), thus, more research would be needed in the area to determine the efficacy of this result.

Based on the studies discussed above, preliminary investigation into the use of group contingencies on improving homework completion and accuracy rates is promising. Although the majority of prior research has been single-subject design, these studies have found gains in both homework completion rates as well as the accuracy level of the homework. When student-managed group contingencies were combined with other methods, overall gains in homework completion and accuracy were seen, but with inconsistent improvement in accuracy (Olympia, Sheridan, Jenson, & Andrews, 1994). When comparing the three types of group contingencies for a fifth grade class of students with disabilities, all three were successful, but interdependent contingencies yielded slightly better accuracy rates (Lynch et al., 2009). Similar results were found when focusing on the interdependent contingency with elementary aged students, as the intervention increased accuracy rates (Reinhardt et al., 2009) as well as homework completion and accuracy rates (Little et al., 2010; Theodore et al., 2009). Further investigation needs to be conducted to determine if this intervention is equally as successful in increasing homework completion and accuracy of high school students, where homework has been purported to be the most beneficial, and to determine its effectiveness when using a population of special education students.

**Pilot Study.** In a prior exploratory study, Russo and Theodore (2009) employed a single subject reversal design to evaluate the effects of an interdependent group contingency with
random criteria and reinforcers on homework completion and accuracy rates. The participants were 11 students from grades 11 and 12 enrolled in a general education history and government class. The students were ethnically diverse (46% Hispanic; 36% African-American; and 18% Caucasian), all eligible for free or reduced lunch, and were chosen due to their history of homework completion and accuracy problems. Results of this investigation demonstrated that the interdependent group contingency improved rates of homework completion and homework accuracy. On average, students increased from a 51% homework completion and 42% accuracy rate during the first baseline phase to an 87% completion and 75% accuracy rate during the first intervention phase. Similar results were seen during the second baseline and intervention phases. Calculation of effect sizes revealed that the greatest effect was found for students during the first implementation of the intervention for increasing their completion and accuracy rates, with weaker results during the second. It appears that the intervention revealed meaningful results in the magnitude of change in homework performance behaviors. A treatment integrity protocol found that the procedure was followed to 100% accuracy, indicating an ease of administering the intervention. Furthermore, the teacher rated the intervention a 4.19 on a 6-point scale, indicating that she agreed with most aspects of the intervention. On the Consumer (student) Satisfaction survey, the overall mean was a 4.15 on a 5-point scale, which suggests that the students approved of and were satisfied with the intervention.

Rationale

Homework is an often-used strategy by teachers to help improve academic skills of their students. Completing homework clearly benefits academic achievement for students both with and without disabilities across different skill levels (Cooper et al., 2006; Keith et al., 1993; Keith & Page, 1985). Further, the academic benefit for completing homework appears to be more
beneficial to students at the secondary level, compared to the primary level (Cooper, 1989b; Cooper et al., 1998; Cooper et al., 2006; Keith & Cool, 1992). The completion of homework can provide students with extra academic engagement time and numerous opportunities to practice skills and learn new content. There are also some non-academic benefits, such as improved time-management skills, study skills, and increased parental involvement (Cooper, 1989b).

Students with disabilities appear to be at particular risk for homework problems, due to factors such as disorganization, motivational issues, negative attitude toward homework or a mismatch in skill level (Bryan et al., 2001; Bryan & Nelson, 1995; Epstein et al., 1993; Salend & Schliff, 1989). Yet due to its ability to help reinforce academic concepts and its correlation to improved achievement, homework is that much more important for students with disabilities (Trammel et al., 1994).

Teachers and parents have utilized numerous interventions to increase homework completion and/or accuracy rates of students from all age levels and backgrounds. School based interventions can be considered valuable, as they are less intrusive than involving parents and can be supervised by teachers. The interdependent group contingency is one such intervention that research has shown can be used effectively to increase homework rates of elementary aged students (Little et al., 2010; Lynch et al., 2009; Reinhardt et al., 2009; Theodore et al., 2009).

A common and reoccurring issue when evaluating the effectiveness of group contingences is that the research is typically conducted using a single-subjects design with small groups of students. Lynch et al. (2009), Reinhardt et al. (2009), and Theodore et al. (2009) all noted that future research is necessary to extend the study across settings, age groups, subject areas, and with children with disabilities. Therefore, when determining if an interdependent
group contingency is efficacious in increasing student homework completion and accuracy rates, replication across age groups is necessary to add to evidence for their use.

This is especially the case when considering students at the secondary level, as none of the aforementioned students had utilized populations at the high school level. It is necessary to provide teachers with evidence based interventions that can increase homework for high school students, especially when considering vulnerable populations such as students with disabilities enrolled in special education programs. These interventions are a necessary step to increasing both homework completion and accuracy rates, and in turn, influencing academic achievement.

Lynch et al. (2009) further noted that it is also important to study if improving completion and accuracy will actually contribute to an increase in academic performance. None of the aforesaid studies that used a group contingency to increase homework performance has related the increases found in homework to increases in academic achievement. It is imperative to study this relationship, especially considering the focus of relating homework to academic performance and achievement in prior research.

Therefore, the present research explored the effect of a teacher implemented interdependent group contingency, with random criteria for reinforcement and random reinforcers, on homework completion and accuracy rates for a class of high school students with disabilities. In addition, this study examined if these effects were seen across a measure of academic performance.

**Research Hypotheses**

It is crucial to further this research and determine if this is a classroom based strategy that will also be successful in influencing homework completion, homework accuracy and academic achievement of students who have disabilities at the high school level. This intervention was
designed as a whole class intervention, targeting special education students who have difficulty handing in their homework and/or doing so accurately. The hypotheses that guided the study are detailed below:

1. Participants will demonstrate increased *homework completion* rates during the implementation of the interdependent group contingency, as compared to baseline rates.

2. Participants will demonstrate increased *homework accuracy* rates during the implementation of the interdependent group contingency, as compared to baseline rates.

3. Participants will demonstrate increased *academic performance*, as measured by test/quiz grades, during implementation of the interdependent group contingency, as compared to baseline rates.
Chapter III: Method

Recruitment, Setting, and Participants

Recruitment. Single-subject research has typically included multiple participants, approximately three to eight individuals in a single study (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005). Recent single-subject research has incorporated additional participants, with many studies including an entire classroom of students as research participants (Reinhardt et al., 2009; Theodore et al., 2009). Building upon current trends, one high school class was recruited to participate in the present study.

To locate interested schools, emails and letters were initially sent out to principals of eight private, charter, and public schools in the North East. A principal at a private special education school volunteered her school for the study and verbal consent was obtained from the executive director of the school. The principal emailed staff members to volunteer to participate in a study to help support students with homework difficulties. A mathematics teacher volunteered to use her class as participants, as she self-identified her students as having homework difficulties. The PI interviewed the teacher to determine her background, as well as her experience utilizing behavioral based interventions, her current homework practices, and her students’ current level of academic and homework performance. She was selected as the teacher participant because she had had appropriate credentials (e.g., was a certified teacher, a master’s degree, and was not a new teacher) and she had used behavior interventions in the past (positive reinforcement), she reported that her students had much difficulty completing their homework (both with completion and accuracy), and she had no current program in place to influence or change homework behavior. Her only policy was that homework counted toward 10% of their
final quarter grade, so she checked students’ homework everyday (did not collect) and reviewed assignments with her class.

Informed consent was obtained from the parents of participating students in the selected class, as per Institutional Review Board (IRB) regulations. Parental consent was obtained by mailing consent forms home to the parent or guardian of each student in the class (Appendix A). Assent from students was collected through a research assistant (doctoral school psychology student) reading a short script explaining the details of their participation. The students signed their name on the assent form if they agreed to participate (see Appendix B). To reduce the possibility that students would feel any coercion to participate, the teacher was not present during the time assent was provided by the students. The study began after all parental consent forms were collected and all students in the class provided their written assent.

**Setting.** The participants were recruited from a private school for special education students in the northeast. The entire school serves approximately 340 students in grades Kindergarten through grade 12. All students were classified as special education students and were taught within classes that enrolled 12 students and one teacher. Characteristics of the school (K-12) were obtained from the National Center for Education Statistics (U.S. Department of Education, n.d.) for the 2009-2010 school year. The student racial/ethnic origin is as follows: 88% White; 4.0% Asian 3.0% Hispanic or Latino; 3.0% Black or African American; and less than 1% American Indian or Alaskan Native. There was no reported data of what percentage of students identified as Limited English Proficient (LEP) or eligible for free or reduced lunch. According to the executive director of the school, 94% of students graduate from the high school and 84% graduate with a Regents or RCT diploma.
Participants. The teacher of the class was a twenty-seven year old Caucasian female. She had four years of prior teaching experience; all were with the current school. She holds a Master’s of Science degree in education (MS. Ed.) in the area of Adolescent Special Education and was certified to teach students with disabilities (grades 7-12).

The participants were 12 students from a self-contained special education algebra class (12 students with one teacher) that followed New York State standards for Algebra. All students had Individual Education Plans (IEP’s) and were identified with the following special education classifications: Speech and Language Impairment (n=7), Learning Disability (n=2), Autism (n=2), or Emotional Disturbance (n=1). There were 10 male students and two female students. The class ethnicities were 50% Caucasian, 33% African American/Black and 17% Hispanic. All students were in the ninth grade and their ages ranged from 14 years old to 16 years old with a mean age of 14.75 years at the start of the study. Each student is described in more detail below and this information is summarized in Table 1 and Table 2.
Table 1

*Participant Demographics and Homework Performance*

<table>
<thead>
<tr>
<th>Student</th>
<th>Gender</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Special Education Classification</th>
<th>Homework Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>15</td>
<td>Black/African American</td>
<td>Learning Disability</td>
<td>Almost always hands in (4-5 a week)</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>14</td>
<td>Black/African American</td>
<td>Speech/Language Impairment</td>
<td>Sometimes hands in (2-3 a week)</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>14</td>
<td>Caucasian</td>
<td>Speech/Language Impairment</td>
<td>Almost always hands in (4-5 a week)</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>15</td>
<td>Black/African American</td>
<td>Speech/Language Impairment</td>
<td>Almost always hands in (4-5 a week)</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>15</td>
<td>Caucasian</td>
<td>Autism</td>
<td>Almost always hands in (4-5 a week)</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>15</td>
<td>Caucasian</td>
<td>Emotional Disturbance</td>
<td>Rarely hands in (1-2 a week)</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>14</td>
<td>Hispanic</td>
<td>Learning Disability</td>
<td>Usually hands in (3-4 a week)</td>
</tr>
<tr>
<td>8</td>
<td>Male</td>
<td>15</td>
<td>Black/African American</td>
<td>Speech/Language Impairment</td>
<td>Usually hands in (3-4 a week)</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>15</td>
<td>Caucasian</td>
<td>Speech/Language Impairment</td>
<td>Rarely hands in (1-2 a week)</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>16</td>
<td>Caucasian</td>
<td>Speech/Language Impairment</td>
<td>Rarely hands in (1-2 a week)</td>
</tr>
<tr>
<td>11</td>
<td>Male</td>
<td>15</td>
<td>Caucasian</td>
<td>Autism</td>
<td>Sometimes hands in (2-3 a week)</td>
</tr>
<tr>
<td>12</td>
<td>Male</td>
<td>14</td>
<td>Hispanic</td>
<td>Speech/Language Impairment</td>
<td>Rarely hands in (1-2 a week)</td>
</tr>
</tbody>
</table>
Table 2

Student Assessment Information

<table>
<thead>
<tr>
<th>Student</th>
<th>Full Scale IQ (Test name and date)</th>
<th>Math Achievement Subtest Score (Test name and date)</th>
<th>Reading Achievement Subtest Score (Test name and date)</th>
<th>Algebra Quarter 1 Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Not available</td>
<td>Not available</td>
<td>Independent=Level T (GE=5.3) Instructional=Level U (GE=5.5) (Fountas and Pinnell; 2/2011)</td>
<td>70</td>
</tr>
<tr>
<td>Student</td>
<td>Full Scale IQ (Test name and date)</td>
<td>Math Achievement Subtest Score (Test name and date)</td>
<td>Reading Achievement Subtest Score (Test name and date)</td>
<td>Algebra Quarter 1 Grade</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------</td>
<td>------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>------------------------</td>
</tr>
</tbody>
</table>

Student 1 is a 15-year old female student who is of African American/Black descent. She is classified as a student with a Learning Disability and is currently placed in all 12:1 self-contained classes. Her most recent cognitive scores were from November, 2010, when she obtained a Full Scale IQ score of 71 as measured by the Wechsler Intellectual Scales for Children, Fourth Edition (WISC-IV; Wechsler, 2003). Her most recent standardized test scores were from November, 2010 on the Woodcock-Johnson Tests of Academic Abilities-Third Edition (WJ-III, Woodcock, McGrew, & Mather, 2001; 2007). On this test she obtained a Calculation standard score at the 1st percentile, an Applied Problems standard score at the 1st percentile, a Letter Word standard score at the 40th percentile, a Word Attack standard score at the 24th percentile, a Reading Comprehension standard score at the 11th percentile, a Spelling standard score at the 1st percentile, and a Writing Samples score at the 24th percentile. Her teacher reported that she almost always will hand in her homework (4 to 5 times a week). This student had inconsistent attendance during the withdrawal and reinstatement phases of the study due to an illness that caused her to be out of school for over a month.

Student 2 is a 14-year old male of African American/Black descent. He is classified as a student with Speech/Language Impairment and is currently placed in all 12:1 self-contained
classes. His most recent cognitive scores were from April, 2009, when he obtained a Full Scale IQ score of 105 as measured by the WISC-IV (Wechsler, 2003). His most recent academic standardized test scores were from April, 2009 on the WJ-III (Woodcock et al., 2001; 2007). On this test he obtained a Calculation standard score at the 45th percentile, an Applied Problems standard score at the 75th percentile, a Letter Word score at the 67th percentile, a Reading Fluency standard score at the 59th percentile, a Reading Comprehension standard score at the 53rd percentile, a Spelling score at the 53rd percentile, and a Writing Samples standard score at the 48th percentile. His teacher reported that he sometimes hands in homework (2 to 3 times a week).

Student 3 is a 14-year old male of Caucasian descent. He is classified as a student with Speech/Language Impairment and is currently placed in all 12:1 self-contained classes. His most recent cognitive scores were from May, 2011 when he obtained a Full Scale IQ score of 92 as measured by the Stanford-Binet –Fifth Edition (SB5, Roid, 2003). His most recent standardized academic test scores were from May, 2011 on the WJ-III (Woodcock et al., 2001; 2007). On this test he obtained a Calculation standard score at the 43rd percentile, an Applied Problems score at the 57th percentile, a Letter Word standard score at the 96th percentile, a Reading Fluency standard score at the 28th percentile, a Reading Comprehension score at the 79th percentile, a Spelling standard score at the 96th percentile, and a Writing Samples score at the 56th percentile. His teacher reported that he almost always hands in homework (4-5 times a week). It should be noted that prior to starting the study, the teacher explained that this student had higher math skills than the rest of the class. This student was placed into a different math class after the 6th day of the intervention phase, and the student’s data was not included in any further analyses.

Student 4 is a 15-year old male of African American/Black descent. He is classified as a student with Speech/Language Impairment and is currently placed in all 12:1 self-contained
classes. His most recent cognitive scores were from June, 2010 when he obtained a Full Scale IQ score of 69 as measured by the WISC-IV (Wechsler, 2003). His most recent standardized academic test scores were from June, 2010 on the WJ-III (Woodcock et al., 2001; 2007). On this test he obtained a Calculation standard score at the 9th percentile, an Applied Problems score below the 1st percentile, a Math Fluency standard score at the 48th percentile, a Letter Word score at the 47th percentile, a Reading Comprehension standard score at the 5th percentile, and a Spelling score at the 55th percentile. His teacher reported that he almost always hands in homework (4 to 5 times a week).

Student 5 is a 15-year old male of Caucasian descent. He is classified as a student with Autism and is currently placed in all 12:1 self-contained classes. His most recent cognitive scores were from August, 2010 when he obtained a Full Scale IQ score of 77 as measured by the WISC-IV (Wechsler, 2003). His most recent standardized academic test scores were from August, 2010 on the WJ-III (Woodcock et al., 2001; 2007). On this test he obtained a Calculation standard score at the 18th percentile, an Applied Problems score at the 5th percentile, a Math Fluency standard score at the 1st percentile, a Letter Word score at the 70th percentile, a Reading Comprehension standard score at the 3rd percentile, a Spelling score at the 86th percentile, and Writing Samples standard score at the 1st percentile. His teacher reported that he almost always hands in his homework (4 to 5 times a week).

Student 6 is a 15-year old male of Caucasian descent. He is classified as a student with an Emotional Disturbance and is currently placed in all 12:1 self-contained classes. When inspecting the students Individualized Education Program (IEP), there were no norm referenced standardized test scores available. However, the IEP noted that he was diagnosed with Major Depressive Disorder (MDD) by a psychiatrist. Some reading scores were available, as he was
assessed using the Fountas and Pinnell (1996) leveled reading inventory in February, 2011, showed that he scored on an independent Level T (Grade Equivalent=5.3) and on an instructional Level U (Grade Equivalent =5.5). There were no mathematics scores available. His teacher reported that he rarely hands in his homework (1 to 2 times a week).

Student 7 is a 14-year old male of Hispanic descent. He is classified as a student with a Learning Disability and is currently placed in all 12:1 self-contained classes. His most recent cognitive scores were from August, 2010 when he obtained a Full Scale IQ score of 94 as measured by the WISC-IV (Wechsler, 2003). His most recent standardized academic test scores were from August, 2010 on the WJ-III (Woodcock et al., 2001; 2007). On this test he obtained a Calculation standard score at the 2nd percentile, an Applied Problems score at the 2nd percentile, a Math Fluency standard score at the 75rd percentile, a Letter Word score at the 45th percentile, a Reading Comprehension standard score at the 27th percentile, a Spelling at the 10th percentile, and Writing Samples standard score at the 25th percentile. His teacher reported that he usually hands in homework (3 to 4 times a week).

Student 8 is a 15-year old male of African American/Black descent. He is classified as a student with a Speech/Language Impairment and is currently placed in all 12:1 self-contained classes. His most recent cognitive scores were from June, 2010 when he obtained a Full Scale IQ score of 84 as measured by the WISC-IV (Wechsler, 2003). His most recent standardized academic test scores were from June, 2010 on the Wechsler Individual Achievement Test-Second Edition (WIAT-II; Wechsler, 2005). On this test he obtained a Calculation standard score at the 30th percentile, an Applied Problems score at the 2nd percentile, Letter Word standard score at the 8th percentile, a Reading Comprehension score at the 34th percentile, a Spelling standard
score at the 13\textsuperscript{th} percentile, and an Essay Composition score at the 14\textsuperscript{th} percentile. His teacher reported that he usually hands in homework (3 to 4 times a week).

Student 9 is a 15-year old male of Caucasian descent. He is classified as a student with a Speech/Language Impairment and is currently placed in all 12:1 self-contained classes. His most recent cognitive scores were from October, 2008 when he obtained a Full Scale IQ score of 91 as measured by the WISC-IV (Wechsler, 2003). His most recent standardized academic test scores were from October, 2008 on the Wechsler Individual Achievement Test-Second Edition (WIAT-II, Wechsler, 2005). On this test he obtained a Calculation standard score at the 2\textsuperscript{nd} percentile, a Math Reasoning score at the 2\textsuperscript{nd} percentile, a Letter Word standard score at the 4\textsuperscript{th} percentile, a Reading Comprehension score at the 2\textsuperscript{nd} percentile, a Spelling standard score at the 16\textsuperscript{th} percentile, and a Written Expression score at the 32\textsuperscript{nd} percentile. His teacher reported that he rarely hands in homework (1 to 2 times a week).

Student 10 is a 16-year old female of Caucasian descent. She is classified as a student with a Speech and Language Impairment and is currently placed in all 12:1 self-contained classes. Her most recent cognitive scores were from December, 2009 when she obtained a Full Scale IQ score of 103, as measured by the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). Her most recent standardized academic test scores were from December, 2009 on the WJ-III (Woodcock et al., 2001; 2007). On this test she obtained a Calculation standard score at the 1\textsuperscript{st} percentile, an Applied Problems score at the 1\textsuperscript{st} percentile, a Math Fluency score at the 1\textsuperscript{st} percentile, a Letter Word standard score at the 82\textsuperscript{nd} percentile, a Reading Comprehension score at the 42\textsuperscript{nd} percentile, and a Spelling standard score at the 95\textsuperscript{th} percentile. Her teacher reported that she rarely hands in homework (1 to 2 times a week). Also, according to
attendance records the student had to be hospitalized during the end of the reinstatement phase, thus there was some missing data during this point in time and for follow-up.

Student 11 is a 15-year old male of Caucasian descent. He is classified as a student with Autism and is currently placed in all 12:1 self-contained classes. His most recent cognitive scores were from November, 2010 when he obtained a Full Scale IQ score of 74, as measured by the Stanford-Binet –Fifth Edition (SB5, Roid, 2003). His most recent standardized academic test scores were from November, 2010 on the WJ-III (Woodcock et al., 2001; 2007), but standard scores and percentiles were not reported, just grade equivalents. On this test he obtained a Calculation Grade Equivalent of 7-3, an Applied Problems Grade Equivalent of the 4-1, a Letter Word Grade Equivalent of 7-1, a Reading Comprehension Grade Equivalent of 2-7, a Spelling Grade Equivalent of 3-8, and a Writing Samples Grade Equivalent of 4-4. His teacher reported that he sometimes hands in his homework (2 to 3 times a week).

Student 12 is a 14-year old male of Hispanic descent. He is classified as a student with Speech/Language Impairment and is currently placed in all 12:1 self-contained classes. There were no cognitive or speech/language test scores available on his IEP. His most recent standardized academic test scores were from March, 2008 on the WJ-III (Woodcock et al., 2001; 2007). On this test he obtained a Calculation standard score at the 7th percentile, an Applied Problems standard score at the 19th percentile, a Math Fluency score at the 1st percentile, a Word Reading score at the 1st percentile, and a Reading Comprehension standard score at the 1st percentile. His teacher reported that he rarely hands in homework (1 to 2 times a week).

Dependent Variables

For the purpose of this study, homework was defined as any task that is assigned to students to be completed during non-school hours (Cooper, 1989a). There were three dependent
variables in the current study: homework completion, homework accuracy, and academic performance. Homework completion was the percentage of homework assignments completed, where completion was defined as when at least half of the assignment was finished (Callahan, Rademacher, & Hildreth, 1998). If a student handed in a homework assignment that was less than half complete, it would be counted as a zero. The second dependent variable was the accuracy of the homework assignment, in which the teacher calculated the percent of items answered correctly for each homework assignment. If a student handed in homework that was not 100% completed, those items that were left blank were counted as incorrect. The last dependent variable is academic performance, which in this study was measured by test/quiz grades that were scheduled during each phase of the study. To collect data on the dependent variables, homework was assigned a minimum of four days per week (i.e., Monday through Thursday). Due to holidays, as well as cancelled school days due to inclement weather, there were some weeks during the course of the study where homework was not assigned for all four days.

The teacher kept track of daily homework completion and accuracy data on a homework data collection sheet that listed each student by an ID number (see Appendix C). At the top of every sheet, the teacher indicated the date and the number of homework problems that were assigned. In the first column the teacher placed a check mark if homework was completed (at least half finished to be counted as complete), an X mark if the homework was not complete, and an A to denote if the student was legitimately absent from school the day the assignment was assigned or due to be handed in. Legitimate absences were those in which the parent called in the absence into the attendance office. If the student was not legitimately absent the homework scores were counted as zeros. In the next column the teacher wrote the number of problems the
student completed (e.g., 6/10, 8/10, 10/10, etc.). The teacher also calculated accuracy rates for each completed homework assignment in the last two columns. One column was for number correct and one for the percent correct. The percent correct was calculated out of the total number of problems on the assignment, not the number the student completed (i.e., if there were 10 problems assigned and a student completed 6, but only 2 were correct, the accuracy score would be 30%). If a student did not hand in a homework assignment, accuracy data was not taken. However, when calculating goals, the teacher averaged a zero into the accuracy data. All students’ scores were included unless the student was absent from school.

Each day the teacher calculated a daily class completion mean by counting the check marks and dividing by the number of students who were present in class that day. For each phase of the study, homework completion rates were calculated as the percentage of completed homework assignments submitted during that particular phase across all students. Further, class mean accuracy rates were calculated daily, by summing each student’s percent correct and dividing by the number of students who were present in class that day. Just as with completion, accuracy rates were also calculated as the percentage of homework that was correct during that particular phase.

Academic performance was monitored throughout the course of the study through scheduled test or quiz grades. Consultation with the teacher determined the dates of these tests/quizzes, as to coordinate at least two tests/quizzes during each phases of the study. This provided some measure of academic achievement to relate to each phase of the study. Every attempt was made to have the format of the tests or quizzes consistent across all phases and based upon similar amounts of content area (e.g., all quizzes involved the similar number of problems to measure the skills that were taught). The teacher gave a quiz approximately once
every five days. However, the teacher scored each assignment out of total points earned, not out of 100%. For example, the three quizzes given during the baseline phase consisted of a quiz out of 13 points, a quiz out of 53 points, and a quiz out of 38 points. The second intervention consistent of three quizzes, one out of 13 points and the other two out of 20 points. The withdrawal phase had two quizzes, one out of 20 points and one out of 12 points. Lastly, the reinstatement phase had three quizzes as well, one was out of 20 points, one was out of 26 points and the last was out of 27 points. In order to compare these quizzes across phases, these scores were converted into percentages out of 100. For instance, if a student received 10 out of 12 points on a quiz, the total score was calculated by dividing 10 into 12 and multiplying by 100 (e.g., total score in this example would be a 83.33). These grades were collected on a data sheet (see Appendix I) by the teacher and provided to the Primary Investigator (PI). In addition, the teacher shared her electronic grade book with the PI, to ensure all quiz grades of the students were accurate. In total, there were three quizzes during both the baseline and the intervention phases, two quizzes during the withdrawal phase, and three quizzes during the reimplementation phase.

**Independent Variable**

The independent variable was the intervention of an interdependent group contingency with randomized components, both random criteria for reinforcement (e.g., random goals) and random reinforcement (e.g., mystery motivator). See Appendix J and Appendix K for a list of the goals and rewards. The teacher received training in how to implement the intervention prior to the start of the study. The teacher was also provided with a script to read to the class before implementing the intervention, as well as a step-by-step treatment protocol to follow each day the intervention was administered. During the intervention phase, daily homework rewards were
delivered contingent upon the students meeting a randomly selected criterion for homework performance. If the students met the chosen criterion, the teacher selected a random reward and delivered the chosen reward to the entire class.

**Design**

Single subject designs are a research approach used to demonstrate the functional relationship between an independent and dependent variable, or in other words, that changes in the dependent variable are directly due to the presence or absence of those changes in the independent variable (Richards, Taylor, Ramasamy, & Richards, 1999). In a single subject design the participant acts as his or her own control. Thus, data on each participant’s behavior are repeatedly collected as that participant is exposed to each condition, often numerous times over the course of the study (Cooper, Heron, & Heward, 2007).

An ABAB reversal, or withdrawal design as it is sometimes called, is a type of single-subject design that is used to investigate the effectiveness of an independent variable (Alberto & Troutman, 2006). It entails repeated measures of behavior during one setting over consecutive phases. In this design, data on the dependent variable (target behavior) is collected to establish a baseline, then the independent variable (intervention) is implemented, next the intervention is withdrawn, and lastly re-implemented to determine the effects it has on the dependent variable (Richards et al., 1999). Cooper et al. (2007) noted that it is a straightforward and powerful design for demonstrating a functional relationship between a manipulation in the environment or an intervention and a behavior. Further, it has been noted in past research that this design can easily demonstrate cause-and-effect relationships between the behavior and intervention (Tawney & Gast, 1984). This design has been utilized in varied areas of special education,
including with students with behavioral disorders, communication disorders, academic/learning problems, and with those with hearing or visual impairments (Cooper et al., 2007).

In the current study, a single subject reversal design was utilized across all participants to assess the effects of an interdependent group contingency using both random criteria and reinforcers of high school students’ with disabilities homework completion, accuracy, and achievement rates. This design included five phases: A baseline period of approximately two weeks, or seven days of homework data (A1); an intervention period of three weeks, or 12 days of homework data (B1); a withdrawal (return to baseline) period of two weeks, or seven days of homework data (A2); and a reimplementation (return to intervention) phase for three weeks, or 12 days of homework data (B2); and, a follow-up phase with three days of homework data occurring three weeks after the reimplementation of the intervention was over. It should be noted that the introduction of the independent variable occurred two times to compare the target behavior with baselines. This was in order to validate the functional relationship that may exist between the dependent and independent variables (Richards et al., 1999), in this case, between the intervention and homework completion and accuracy.

The ABAB reversal design is appropriate for this study, as the independent variable can be withdrawn to reverse the dependent variable (homework behavior) back to rates similar to baseline. The baseline phase should always be used before any implemented intervention to measure the dependent variable until the behavior is consistent, in order to allow for prediction of future responding (Horner et al., 2005). As Horner et al. suggest, this requires data collected over multiple occurrences, at least five or more, without substantive trend. The hope for the current study was that five days of baseline data collection would establish a stable baseline. Unfortunately, for most students, this was not enough to do so. Therefore, seven days of baseline
data were taken, but baseline data was not stable for all students by that point. As it would be difficult to establish a stable trend for all 12 students, the intervention phase commenced at this point.

There are several advantages of this type of design. It is a design that allows for experimental control, as well a precise analysis of an independent variable on a dependent variable (Alberto & Troutman, 2006). However, there are also a few disadvantages of this design, including the practical issue of withdrawing an intervention or treatment that is working to show the functional relationship with the dependent variable. One way to counterbalance this weakness is to have a second baseline phase (B2) in which the treatment can be reintroduced after the behavior returns to only one third to two thirds of its baseline level (Sulzer-Azaroff & Mayer as cited in Richards et al., 1999), as was attempted in the current study. Notwithstanding these weaknesses, this design is both powerful and easy to implement to show a change in behavior for a student or a group of students.

**Measures**

**Reinforcer preference assessment.** A positive reinforcer is an incentive administered after a desired behavior that will increase the future occurrence of this behavior (Alberto & Troutman, 2006). Choosing potential reinforcers to include in the study is imperative in creating behavior change. Research has shown that systematic sampling of participants to individualize reinforcers is more reliable than relying on the opinions of teachers and parents (Daly, Jacob, King & Cheramie, 1984). Furthermore, a reinforcer that is picked by the individual who receives it, instead of someone else, may be more effective (Thompson, Fisher & Contrucci, 1998). This suggests that participants need to be involved in selecting their own rewards when planning interventions. For students who are higher functioning, it is possible to use a prepared reinforcer
menu or survey, which will name potential reinforcers and have students rank-order their preference of these items (Alberto & Troutman, 2006).

In light of these findings and recommendations, a similar method was used in the present study to identify potential reinforcement for students. A reinforcer preference assessment was created, with input from the teacher, to assess the reinforcers that students valued and wanted to earn for completing their homework accurately. This survey included ten items, with the opportunity for students to fill in one suggestion not on the survey. The students had to rank the items from 1 to 10, with 1 being their first choice, and 10 being their last choice. This survey was administered immediately prior to the start of the baseline phase of study and can be found in Appendix D.

**Intervention script.** The teacher was provided with a script (see Appendix E) to read to the class before implementing the intervention (in both phases of the study). The purpose of the script was to introduce the intervention to the class. This script included the following statement:

For the next few weeks we will have a new homework program in our class. Your aim as students is to accurately complete your homework each day and you will then be rewarded as a class for doing so. I have determined certain percentages for class homework completion and homework accuracy that will be your criterion, or goals. I have written these on index cards, placed them in this jar, and labeled the jar as “Homework Goals.” I will collect your homework each day and grade it. During the next class period, if you have met the goal for the day as a class, everyone will receive a reward. These rewards are what you have told me you find to be especially reinforcing. I have written these on index cards and placed them in this jar, labeled “Homework Rewards.” This process is called an interdependent group contingency, because in order
for the entire class to receive a reward, the class average must meet the criteria or goal for the day. Each day, I will collect and score your homework. At the beginning of the next day, I will select one card from the Homework Goals jar, which will be the goal for the class. If the class meets the goal, I will select a reward from the reward jar. Every student in the class will receive the reward. This will happen each day that we are using the interdependent group contingency.

**Treatment integrity protocol.** The integrity of a treatment is measured by the accuracy and consistency with which the elements of an intervention are implemented as it was planned and described (Gresham, 1989). It is necessary to consistently measure if the teacher is implementing the intervention in the way it was intended. It has been noted that low treatment integrity is a major source of confounding an experiment and making it difficult to interpret the results with any confidence (Cooper et al., 2007).

In the current study, treatment integrity was measured as a percentage of procedural components accurately completed by the teacher over the course of the entire study. This was documented in two ways. First, the PI developed a treatment integrity protocol that consisted of the 10 treatment components in the procedure of implementing the independent variable (Appendix F). The teacher checked off each component of the intervention each day she implemented the intervention. Specifically, the teacher indicated that she (a) collected homework from every student in class, (b) scored and recorded homework completion numbers for every student, (c) scored and recorded homework accuracy for every student, (d) selected a criterion from the Homework Goals, (e) determined if the class had met the criterion for the day, (f) told the class if they had met the criterion, (g) selected a reinforcer from the Reinforcers jar if criterion was met, (h) provided the class with the selected reward if the criterion was met, (i) as
long as it was not the last day before a return to baseline, explained to class that they would have opportunity to earn rewards again the next day when a new homework goal would be selected, and (j) at end of the period, remind the class what the homework for the night was. These sheets were collected and a percentage of the components completed were calculated for each day of the intervention phase.

Second, a doctoral school psychology student observed the teacher implementing the intervention once a week (approximately 20% of the intervention phases). Twenty percent is a customary amount of data to be reviewed, as suggested in behavioral research (Cooper et al., 2007). These observations were once a week, thus for a total of three times during the intervention phase and three times during the reinstatement phase. The doctoral student checked off each step on the protocol as the teacher completed the intervention (also using Appendix F). Again, a percentage of correct steps followed were calculated.

**Consumer satisfaction scale.** Social validity is defined as how acceptable the participants of interventions (e.g., students, teachers, parents) find the goals, procedures, and importance of treatment implications (Wolf, 1978). The term "consumer satisfaction" has been proposed by Hawkins (1991) to be used instead of social validity because it recognizes that what is being measured is fundamentally a collection of consumer opinions, not really the validity of the intervention itself. Measuring how much the participants of an intervention believe the intervention procedures are acceptable and important to changes in the target behavior is one of the most frequently used methods for assessing consumer satisfaction (Cooper et al., 2007). Thus, the measure used to determine student participants’ level of acceptability with the intervention will be referred to as a measure of consumer satisfaction.
After the completion of the intervention, students’ rated the acceptability of the intervention using a consumer satisfaction scale based on Bray and Kehle’s (1996) index (see Appendix G). There is no reported validity or reliability data on this measure. This scale consists of eight statements that determined if the students’ are satisfied with the intervention, the reinforcers, and the overall effect of the intervention on homework behaviors. The participants rated these items on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores corresponding to higher satisfaction with the intervention.

**Teacher acceptability.** Treatment acceptability is the opinion and judgment that an individual forms about an intervention, such as if the intervention is reasonable, intrusive, or useful (Kazdin, 1980). After the intervention was complete, the teacher rated the acceptability of the intervention using the Intervention Rating Profile (IRP-15), developed by Witt and Elliott (1985) (see Appendix H). The IRP-15 is a 15-item questionnaire that asks participants to rate various aspects of the intervention (e.g., *I would suggest the use of this intervention to other teachers*) on a 6-point Likert-type, from 1 (strongly disagree) to 6 (strongly agree). Higher scores on the IRP-15 reflect the teacher’s greater level of acceptability of the intervention.

Witt and Elliot (1985) designed the IRP-15 to yield a unitary measure of acceptability (general acceptability) and a principal components factor analysis found this to be accurate, as the scale yielded one factor with item loadings from .82 to .95. Witt and Elliot also found the IRP-15 to be a reliable measure, with a high internal consistency (Cronbach’s alpha of .98). Furthermore, Martens, Witt, Elliott, and Darveaux (1985) established the IRP-15 to have adequate construct validity through measuring its correlation with the Semantic Differential Scales (SD; Osgood, Suci, & Tannebaum, 1957). The IRP-15 had a strong correlation with the component of the semantic differential scales that measured general acceptability ($r(51) = -.86, p$
< .001). Note that the negative correlation was because higher scores on the IRP-15 denoted greater acceptability, while lower scores on Semantic Differential Scales indicated more acceptability.

**Procedure**

Before the start of the intervention the teacher assigned each student in the class a unique ID number. The teacher kept the master list of student ID numbers and the researcher received all data with an ID number, not a name.

**Teacher training.** Prior to beginning the baseline phase of the study, the teacher was instructed on the details of the study and how to administer the group contingency intervention. This occurred over two sessions that took place before the baseline phase and lasted approximately 45 to 60 minutes each, as well as a shorter 20 to 30 minute booster session before the implementation of the intervention.

During the first session, the researcher explained the background and theoretical underpinnings of the intervention, as well as a brief review of the research that was conducted related to the topics of homework, behavioral interventions, and group contingencies. In addition, the potential benefits to both the teacher and the student participants in the study were described in detail. A review of the necessary materials, procedures, and the teachers’ requirements were also covered at this time. All of these factors were reiterated during the second training session.

During the second session, full and detailed explanations of the procedures of the study were again clarified to the teacher. This explanation included every step in the intervention, as well as all of the necessary materials that were needed to be completed during the course of the intervention. The materials for the study were provided at this time, and included:
1. **The intervention script.** This was read out loud to the class prior to the intervention (B1) phase of the study (see Appendix E and below).

2. **The reinforcer preference assessment (Appendix D).** The teacher administered the preference assessment to her class as soon as all consent forms were collected, so the researcher could provide the teacher with the necessary reinforcers prior to the intervention phase.

3. **Homework data collection sheets for each day of the study.** As mentioned above, when describing the dependent variable, the teacher monitored all data on a daily homework data collection sheet that listed each student by an ID number (see Appendix C). The teacher completed this sheet for each day of the study, indicating the date, the number of homework problems assigned, if the homework was complete (at least half of the assignment completed), the number of problems completed, the number of accurate problems, and the percent accuracy. During training, the teacher was given time to practice using this sheet with sample homework assignments that the researcher brought to the session. The purpose of these practice sheets was for the teacher to gain experience in calculating data, as well as to ensure that the teacher was able to accurately follow this procedure.

4. **Jar for Homework Goals.** The teacher was provided with a clear plastic jar labeled *Homework Goals.* Inside this jar were folded index cards that contained the various class goals. These are the goals that were randomly selected as the criteria to be met each day in the study. Once baseline procedures were completed, appropriate goals were created based on this baseline data (see Appendix J for a list).
5. **Jar for Homework Reinforcers.** The teacher was provided with a clear plastic jar labeled *Homework Reinforcers*. Inside this jar were folded index cards that had the names of the chosen reinforcements used in the study. Types of reinforcers were assessed using the preference assessment and the most popular reinforcers were written on different cards and placed in the jar prior to the intervention. Some examples of reinforcers included extra points on lowest quiz grade, pencils, points toward a class pizza party (see Appendix K for a sample list).

During the booster session the researcher conducted a final review of the procedures, provided the teacher with all necessary reinforcers, and answered any questions. In addition, the baseline data were reviewed in order to determine appropriate goals, as it is important that goals are attainable by the majority of students. Therefore, the ranges of the data, as well as the mean scores were determined. There were ten goals developed, which ranged from 10% to 20% higher than the mean score for homework completion and accuracy (e.g., around 50% of the class completed homework at baseline, an appropriate goal would be 60% of the class completed homework). These goals were utilized during the intervention phase, but new goals were determined for the reinstatement phase (based on withdrawal data). It should be noted that when accuracy goals were calculated, the teacher included a zero score for those students who did not hand in homework (which differs from how the homework accuracy dependent variable was measured in this study). The students were aware that if they did not hand in their homework, this zero would count toward accuracy. Further, preference assessment data were reviewed to create appropriate reinforcers to be utilized throughout the study.

**Baseline.** The first phase of the study was a baseline phase (A1) that lasted for seven days. Homework completion and accuracy for each participant were collected on the data
collection sheets described above. Throughout baseline the teacher continued to use the *business as usual* class homework procedure, including the regular method of homework checks and procedures. In this class, the teacher did not collect and grade the homework assignment; she merely checked that it was completed by the student and would review the answers on an overhead projector with the class. Students were responsible to correct their own assignment during this review.

**Intervention.** The interdependent group contingency was employed for 12 days during the intervention phase (B1). As mentioned previously, the teacher was provided with a script (see Appendix E) to read to the class before implementing the intervention. The script clearly explains that the entire class has the opportunity to earn rewards if a randomly chosen homework goal is met and either everyone or no one will receive the reward. The teacher also explained the possible daily goals and available reinforcers. Further, during every day of the intervention the teacher followed a step-by-step treatment protocol (see Appendix F) to check off each step of the intervention. As mentioned, a graduate student observed the teacher implementing the intervention once a week during implantation of the intervention and used the same step-by-step treatment protocol sheet.

Specifically, during the beginning of each class period the teacher collected homework to check and evaluate if the homework was complete and accurate. This information was recorded on the same chart that was used during baseline. After homework was checked, the teacher calculated the class wide completion and accuracy rates. The next school day, homework was given back to the students. Daily homework rewards were delivered contingent upon the students meeting a randomly selected criterion for homework performance from the *Homework Goals* jar. If the class met the chosen criterion, the teacher randomly selected a reward from the
Homework Reinforcers jar. The entire class received the reward for meeting the goal. If the class did not meet the goal, the teacher explained that they would have the opportunity to earn the reward again the next day for accurately completing their homework. At the end of each class the teacher provided the class with a reminder of what homework the students need to complete for the next day. This occurred every day of the intervention.

Withdrawal (return to baseline). Next, there was a withdrawal of the intervention, or a return to baseline phase (A2). In this phase homework data were collected for an additional seven days, or when the homework rates returned to one third to two thirds of its baseline level (Sulzer-Azaroff & Mayer as cited in Richards et al., 1999). It was difficult to establish a stable baseline, and during the withdrawal phase, completion rates actually returned to a level lower than the original baseline. During this time, the teacher informed the students they would not be reinforced for homework during the next two weeks and went back to prior business as usual homework procedures (e.g., the teacher merely checked that homework was completed by the student and would review the answers on an overhead projector with the class).

Reinstatement of the intervention. The final phase of the study was a reinstatement phase (B2), where the intervention was administered again for 12 days. The teacher used the same procedure as in the first intervention phase. Goals were reassessed, based on recent baseline data, in which goals were set again to be no more than approximately 20% higher than the mean.

Follow-up. Following the termination of the last intervention phase the teacher had the liberty to continue to use the intervention or return to the previous business as usual homework procedures. Follow-up data were collected for three consecutive days three weeks after the reimplementation of the intervention phase was over. During the time after the reimplementation
phase and before follow-up, the teacher had all materials to utilize the intervention, but she had the choice to use the intervention or not. The teacher did not implement the intervention on a daily basis after the reimplementation phase. She continued to collect and score homework on most days, but only used the intervention on two occasions between the reimplementation and follow-up phase.

Data Analysis

Visual analysis. Visual analysis has been typically used in single subject design to evaluate if a relationship exists between an independent and dependent variable and the strength of that relationship (Kazdin, 1982; Tawney & Gast, 1984). When the pattern of data in one phase fluctuates more than would be expected from the data observed in the previous phase (e.g., baseline) an effect is said to be recognizable (Horner et al., 2005). Therefore, visual analysis was first used to determine the effect of the intervention. Each participant’s data for the baseline, intervention, withdrawal, reimplementation, and follow-up phases were graphed for homework completion, homework accuracy, and academic quiz grades. Further, all means and standard deviations were calculated for each participant across each phase of the study for all three dependent variables. These were also analyzed in the interest of assessing individual participant change.

Statistical analyses. Recently, there has been a movement away from relying just on visual analysis to document change in single-subject designs and toward reporting other statistical methods, such as effect sizes (Lynch et al., 2009; Olive & Smith, 2005; Theodore et al, 2009). There have been approximately 40 documented approaches proposed for assessing effect size within single-case design research (Parker & Hagan-Burke, 2007).
One common way to calculate these effect sizes is using Busk and Serlin’s (1992) *Approach One: No Assumptions* model, which essentially uses the standard mean difference. This method is most similar to traditional effect size calculations for group designs. Olive and Smith (2005) recommend this model to calculate effect sizes in single-subject research over the other effect size methodologies. Thus, Busk and Serlin’s *Approach One: No Assumptions* model was used in this study to compute effect sizes for student completion rates, accuracy rates, as well as academic achievement. An effect size score was derived for the intervention phase by calculating the difference in the means of the baseline and intervention phases, and then dividing by the standard deviation of the baseline phase. This method is a way to show if the treatment was effective for each individual student. Effect sizes were calculated for each individual student for each dependent variable. However, due to much missing data for accuracy (due to many homework assignments not being completed) effect sizes were not possible for certain students who had limited baseline data.

Lastly, in order to determine if there was a treatment effect of the intervention as a whole (not just for each individual student), one-sample t-tests were used for each dependent variable. In order to calculate these, the difference between the baseline and intervention (or the withdrawal and reinstatement) were calculated and analyzed to see if it was significantly different from zero, which would indicate a treatment effect across the two phases of the study.

**Interobserver agreement.** Horner et al. (2005) suggest that another observer should frequently monitor the dependent variable throughout the intervention for each participant in each phase of the study. One way to accomplish this is through the calculation of a percentage of agreements between the individual administering the intervention and an independent observer (i.e., interobserver agreement). For the purpose of this study, approximately 20% of
homework assignments (once a week) were collected and photocopied from each phase of the study (sampling all participants) and scored by a school psychology doctoral graduate student to calculate an interobserver agreement rate for homework completion and problems completed accurately. Twenty percent was chosen because it has been suggested in behavioral research (Cooper et al., 2007) and it is a customary figure used in single subject-designs to determine interobserver agreement (Smith, Daunic, & Taylor, 2007).

The doctoral student was provided with brief training in how to score homework as complete and accurate. The doctoral student was given an overview of the study, a tutorial on how to collect the data on the data sheet, as well as all of the answers to the teacher’s homework to use to check each homework assignment. To calculate the interobserver rate, a percentage was calculated by dividing the number of assignments agreed upon as completed and not completed by the number of agreements plus disagreements and then multiplying by 100. The same procedure was used for accuracy, as the doctoral student rater scored students’ homework using an answer key provided by the teacher. Results of these analyses are detailed in chapter four.
Chapter IV: Results

This chapter reviews all findings of the present investigation as they relate to the research questions and hypotheses that were previously presented. All student data were included in the results \((n=11)\), except for student 3, who was placed into a different math class after the sixth day of the intervention and was not part of the remainder of the study. It should also be noted that Student 1 missed a great number of school days due to an illness and Student 10 was hospitalized at the end of the reimplementation phase, and therefore data are missing for the end of the reimplementation and the follow-up phase. Homework data were taken every day during all baseline and intervention phases and all quiz grades during the study were recorded. All homework completion, homework accuracy, and quiz grades were graphed for each individual student. The descriptive statistics across phases for each dependent variable are presented in tables and described for each student. In addition, effect sizes were calculated using ‘Approach one: No Assumption method’ (Busk & Serlin, 1992) and scores were placed in tables. One-sample t-tests were calculated for each dependent variable and results described. Results of interobserver agreement, treatment integrity, as well as responses to student consumer satisfaction and teacher acceptability are also analyzed and reported.

Homework Completion

The first research question investigated the effect of an interdependent group contingency on the homework completion rates of students with disabilities. Homework was considered complete if at least half of the assignment was finished (Callahan et al., 1998). If a student handed in a homework assignment that was less than half complete, it was counted as a zero. This occurred a total of six times for four students during three phases of the study (did not occur during initial baseline or follow-up). It is possible that counting these as a zero may have
inflated the results, but not likely, as it occurred very seldom and rates were close to zero (e.g., 20%, 22%, 44%, etc). If the student handed in a homework that was partially complete, the exact completion rate was calculated (e.g., 8 problems completed out of 10 would be 80% complete).

There is inconsistency in the homework completion data across students, so it is also important to review the homework data as it is displayed graphically in Figure 1. Data were inspected using visually analysis for: (1) level (mean), (2) trends, and (3) variability across similar phases (Horner et al., 2005). Some aspects, such as trend, were difficult to consider for the data, as there were many students who did not complete their homework, and thus many scores of zero. Therefore, much emphasis is placed upon looking at the means across phases and improvements seen therein. These individual means were calculated by determining the average percentage of completed homework assignments for each phase of the study. Standard deviations for homework completion were also calculated. Table 3 displays the mean homework completion percentage rates for each student and class across all of the phases of the study.

Table 3

*Mean Homework Completion Rates for All Phases*

<table>
<thead>
<tr>
<th>Student (n=11)</th>
<th>Baseline Mean</th>
<th>Intervention Mean</th>
<th>Withdrawal Mean</th>
<th>Reinstatement Mean</th>
<th>Follow-up Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70.67</td>
<td>98.93</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>2</td>
<td>14.29</td>
<td>88.29</td>
<td>68.57</td>
<td>55.98</td>
<td>44.74</td>
</tr>
<tr>
<td>4</td>
<td>99.45</td>
<td>74.54</td>
<td>92.86</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>5</td>
<td>95.71</td>
<td>97.22</td>
<td>40.00</td>
<td>96.30</td>
<td>100.00</td>
</tr>
<tr>
<td>6</td>
<td>33.88</td>
<td>15.83</td>
<td>14.29</td>
<td>50.77</td>
<td>0.00</td>
</tr>
<tr>
<td>7</td>
<td>78.34</td>
<td>75.42</td>
<td>66.67</td>
<td>80.33</td>
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</tr>
<tr>
<td>8</td>
<td>38.44</td>
<td>47.38</td>
<td>54.29</td>
<td>41.67</td>
<td>30.56</td>
</tr>
<tr>
<td>9</td>
<td>65.68</td>
<td>56.83</td>
<td>0.00</td>
<td>53.72</td>
<td>30.00</td>
</tr>
<tr>
<td>10</td>
<td>11.69</td>
<td>40.00</td>
<td>14.29</td>
<td>83.33</td>
<td>--</td>
</tr>
<tr>
<td>11</td>
<td>16.67</td>
<td>81.94</td>
<td>81.43</td>
<td>70.00</td>
<td>33.33</td>
</tr>
<tr>
<td>12</td>
<td>46.36</td>
<td>46.63</td>
<td>0.00</td>
<td>46.24</td>
<td>30.56</td>
</tr>
<tr>
<td>Total</td>
<td>51.93</td>
<td>65.73</td>
<td>48.40</td>
<td>70.76</td>
<td>50.25</td>
</tr>
</tbody>
</table>
Each individual student will be discussed in detail. However, it should be noted that the great deal of variability in the data caused some difficulty in visually analyzing the graphs for change in level and trend. As is illustrated in Table 3, Student 1 had a mean baseline homework completion rate of 70.67% (SD=36.03), which increased to 98.93% (SD=3.55) during the intervention phase. His completion rate was maintained at a similar level throughout the withdrawal, reinstatement, and follow-up phases at 100%. However, as is illustrated in Figure 1, Student 1 was absent for a large majority of the second half of the study, thus there was only one data point for the withdrawal phase and two data points for the reinstatement phase. Nonetheless, it appeared as if the intervention had an immediate and consistent effect, as all intervention data points for handing in homework were close to 100%.

Student 2’s mean baseline homework completion rate was 14.29% (SD=37.80), as he only completed one homework assignment, which increased to 88.29% (SD=29.40) during the intervention phase, where he completed all but one assignment. Student 2’s mean decreased to 68.57% (SD=47.41) when the intervention was withdrawn. However, this rate decreased during reinstatement to 55.98% (SD=48.58) (missing three days of data due to absence) and declined again during the follow-up phase to 44.74% (SD=63.27). However, these final treatment rates were still higher than his original baseline mean. The intervention also appeared to have an immediate effect, as the last three data points in baseline were 0% and the first three data points in the intervention were close to 100%.

Student 4’s mean completion rate during the baseline phase was 99.45% (SD=1.45), which decreased to 74.54% (SD=44.98) during the intervention. Through the withdrawal phase his homework completion rate increased to 92.86% (SD=18.90) and was maintained at 100% across the reinstatement and follow-up phases.
Student 5 earned a mean baseline completion rate of 95.71% ($SD=11.34$), which increased slightly to 97.22% ($SD=8.3$) during the intervention phase. This rate decreased to 40.00% ($SD=45.17$) during the withdrawal phase, and then improved to 96.30% ($SD=11.11$) during reinstatement and was maintained at 100% during follow-up. Large effects of the treatment can be seen during reinstatement, as there was an increase over the withdrawal mean, but were consistent with the baseline rates.

During the baseline phase Student 6 had a mean homework completion rate of 33.88% ($SD=44.03$), which decreased to 15.83% ($SD=37.04$) during the intervention phase. This decreased again to a mean rate of 14.29% ($SD=37.80$) during withdrawal, but increased to 58.33% during reinstatement. During follow-up the student did not hand in any homework, achieving a mean homework completion rate of 0%. As Student 6 did not consistently hand in homework at any point during the study, the data for him was very variable. Thus, these results are difficult to interpret.

Student 7 began with a baseline homework completion mean of 78.34% ($SD=36.66$), which decreased slightly during the intervention phase to a mean rate of 75.42% ($SD=42.90$). This further decreased to 66.67% ($SD=51.54$) during withdrawal, and then increased to a mean of 80.33% ($SD=37.08$) during the reinstatement of the intervention, which was slightly higher than the original baseline rates. However, there was a great deal of missing data after the initial baseline phase due to absences. During follow-up the student only handed in one out of three homework assignments, thus allowing for a mean completion rate of 33.33% ($SD=57.74$).

During the baseline phase, Student 8 had a mean homework completion rate of 38.44% ($SD=48.16$), which subsequently increased to 47.38% (49.66) during the intervention phase. This increased further to 54.29% ($SD=51.27$) during the withdrawal phase and then decreased to
41.67% ($SD=51.49$) during the reinstatement phase, which was similar to baseline functioning. During follow-up, the student had a mean completion rate of 30.56% ($SD=57.74$). This student also had a lot of variability within the data, as can be seen in the consistently high standard deviation and the graphically displayed data.

According to Table 3, Student 9 earned a mean homework completion rate of 65.68% ($SD=46.72$) during the baseline phase, which decreased to a 56.83% ($SD=50.32$) during the intervention phase. During withdrawal this student did not hand in any homework, yielding a mean homework completion rate of 0%. This was increased to 53.72% ($SD=48.18$) during the reinstatement phase and decreased to 30.00% ($SD=51.96$) during the follow-up phase. The intervention did not seem to have an immediate effect, as the first two homework assignments were incomplete. However, the largest effect of the intervention appeared from the withdrawal to the reinstatement phase.

Student 10 earned a mean homework completion rate of 11.69% ($SD=30.96$) during the baseline phase, as he only completed one homework assignment. This rate was increased to 40.00% ($SD=51.64$) during the intervention phase and then decreased to 14.29% ($SD=37.80$) during the withdrawal phase. The student’s average increased again to a rate of 83.33% ($SD=40.82$) during the reinstatement phase. The intervention appeared to have an immediate effect during the intervention, showing the greatest improvement during the reinstatement phase. However, this student was absent during half of the reinstatement phase and the follow-up phase (and reportedly absent for much of the remainder of the school year).

Student 11 achieved a mean homework completion rate of 16.67% ($SD=40.82$) across the baseline phase (only handed in one homework and was absent once), which increased to 81.94% ($SD=38.57$) during the intervention phase. During withdrawal, the rate remained high at 81.43%
(SD=37.61) and then decreased to 70% (SD=48.30) during reinstatement. This reinstatement rate was much higher than his original baseline mean (68.04 points higher). During follow-up the student had a homework completion mean of 33.33% (SD=57.74).

Lastly, Student 12’s mean homework completion rate was 46.36% (SD=46.24) during the baseline phase, which increased slightly to 46.63% (SD=50.01) during intervention. During the withdrawal phase, this student did not hand in any homework, which caused the rate to decrease to 0%, but it returned to 46.24% (SD=45.23) during the reinstatement phase. Thus, final reinstatement means were similar to baseline. It should be noted that attendance was somewhat of an issue for this student, as he was absent four days of intervention data, one day of withdrawal, and three days of reinstatement. This rate then decreased slightly to 33.33% (SD=52.92) during the follow-up phase.

In addition to individual homework completion rates, the class means for homework completion was also calculated across all the students (Table 3 and Figure 1). According to the aggregate data, the daily homework completion baseline rates for the class ranged from 11.69% to 99.45%, with a mean baseline completion rate of 51.93% (SD=31.99). The range for homework completion means increased during intervention from 15.83% to 98.93%, with a class mean of 65.73% (SD=26.40). This was a total increase of 13.80% over the baseline total mean percentage. During the withdrawal phase the mean decreased to 48.40% (SD=36.86), with means ranging from 0% to 100%. During reinstatement of the intervention the class mean completion rate increased to 70.76% (SD=26.40) with means ranging from 41.67% to 100%. This was an increase of 22.36% over the withdrawal homework completion rate and 18.83% over baseline homework completion rate. However, during follow-up, the mean decreased to rates similar to baseline and withdrawal phases, for a mean completion rate of 50.25% (SD=36.12), which
ranged from 0% to 100%. Inspecting the data graphically, a slight visible increase can be seen across the treatment phase and a further increase appears across reinstatement phases.
Figure 1. Daily homework completion rates for each student across the baseline, intervention, withdrawal, and follow-up phases.
Homework completion effect sizes. To better understand the magnitude of the effect of the intervention on homework completion for each student, effect sizes were calculated. This was done for each participant using Busk and Serlin 'Approach one: No Assumption method (Busk & Serlin, 1992). An effect size score was derived for the intervention phase by calculating the difference between the means of the baseline and intervention phases, and then dividing by the standard deviation of the baseline phase. Effect sizes were used to determine if either phase had a positive impact on the student’s ability to complete his or her homework. Effect sizes were also created for the follow-up phase by calculating the difference in the mean of the follow-up phase from the mean of the baseline phases and dividing by the standard deviation of the baseline phase. These data are presented in Table 4. These effect sizes can be interpreted using Cohen’s (1992) levels of significance, where 0.8 and above indicates a large effect size, 0.5 indicates a medium effect, and 0.2 represents a small effect.

As is seen in Table 4, there was a range in effect sizes for the intervention across the students from a negative effect of -6.11, to a large positive effect of 2.55 for the intervention. However, effect sizes for the follow-up phase were not as strong. For instance, Student 1 had an effect size of .39 for the intervention and .41 for the follow-up phase. Student 2 had an effect of .81 for the intervention, which decreased to an effect of .09 during follow-up. Student 4 unfortunately showed negative effects for the intervention, as he had a negative effect of -6.11, but showed a positive effect of 2.65 during the follow-up phase. The intervention effect size was a 2.55 for Student 5 and the follow-up effect size was also positive of 2.83.

The effect of the intervention for student 6 was a .21, and there was a negative effect of -.55 for the follow-up. In addition, student 7 had an effect of .15 for the intervention, but the effects of the intervention were during the follow-up negative, at -1.07. Similarly, Student 8
displayed an effect size of .04 for the intervention phase and a -.33 for the follow-up. A positive effect of .48 was found for student 9 for the intervention and a slightly negative effect of -.06 at the follow-up. Further, there was a large positive effect of the intervention found for student 11 of 1.57, but no effect could be investigated at follow-up, as the student did not hand in any homework. Student 11 had a positive effect of .66 for the intervention and a -.38 for the follow-up. Lastly, student 12 had a positive effect of .53 for the intervention and an effect of .16 was found at follow-up. However, there were no effects found at follow-up for the intervention, as the effect size was a 0.05 for the whole class data.

As is illustrated in Table 4, during the intervention phase, effect sizes varied for student participants. All were positive effects, excluding a negative effect size for Student 4 (-6.11) and no effect for Student 8 (.04). There was a large effect size found for the remaining three participants, Student 2 (.81), Student 10 (1.57) and Student 5 (2.55). A medium effect size was found Students 9, 11, and 12, with effect sizes of .48, .53 and .66, respectively. A small effect of the intervention was found for Students 7, 6 and 1 with effect sizes of .15, .21, and .39, respectively.

Table 4 further demonstrates that effect sizes for the follow-up phase were quite varied. Student 4 had a large positive effect of the intervention at follow-up (2.65) and Student 5 also had a large follow-up effect size (2.83). Two student’s (Student 12 and 1) displayed small positive effects at the follow-up (.16 and .41). No effects were seen for Student 2 (.02) or Student 9 (-.06). However, there were negative effect sizes found for four student participants. Student 8 and Student 11 showed small negative effects (-.33 and -.38), while Student 6 displayed a medium negative effect of .55 at follow-up, and Student 7 showed a large negative effect of 1.07.
Table 4

*Homework Completion Means, Standard Deviation and Effect Sizes for the Intervention and Follow-up*

<table>
<thead>
<tr>
<th>Student</th>
<th>Baseline phases mean</th>
<th>Intervention phases mean</th>
<th>SD baseline</th>
<th>Intervention effect size</th>
<th>Follow-up mean</th>
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**Homework completion t-tests.** A one-sample t-test was conducted on the completion data to evaluate whether the mean difference between the baseline and intervention, and between the withdrawal and reinstatement phases was significantly different from zero, which would indicate that a treatment effect occurred across the two phases of the study.

For the treatment and baseline phases, the mean difference between the baseline and intervention score ($M=13.80; SD=32.18$) was not significantly different from zero ($t(10) = 1.423, p = .185$). This indicates that there was no treatment effect from baseline to intervention. For the withdrawal and reinstatement phases, the mean difference between the baseline and intervention completion scores ($M=22.36; SD=30.79$) was significantly different from zero ($t(10) = 2.409, p = .037$). This indicates that there was a treatment effect from the withdrawal phase to the reimplementation of the intervention.
Summary. The first research question asked whether the interdependent group contingency would be successful in increasing homework completion rates of a class of students with noted homework difficulties. The hypothesis that participants will demonstrate increased *homework completion* rates during the implementation of the interdependent group contingency, as compared to baseline rates was partially supported by the results. Overall, the class as a whole showed improvements both during implementation and reimplementation of the intervention, as compared to baseline levels. When looking at individual students, seven out of eleven increased their intervention completion rates over baseline levels (64% of the sample). During the second implementation phase, there were similar or increased homework completion rates over withdrawal levels for eight students (73% of the sample). Reimplementation phase means were similar or improved for ten students, as compared to baseline levels (91% of the sample). Furthermore, there seems to be some functional relationship of the independent variable, as rates increased for most during intervention and reinstatement, and during the withdrawal phase, rates decreased to a level similar to initial baseline levels. However, similar results were not seen for all students, as some students handed in slightly less homework during the intervention phase of the study.

When looking at effect sizes, the intervention was seen to have had a positive effect for nine of the student participants. There was a large effect size found for the three participants and a medium effect size was found for another three students. A small effect of the intervention was found for three students. Negative effects were found for one student and no effect was found for another student.
After conducting one-sample t-tests, there appeared to be a treatment effect for the reinstatement of the intervention, but not for the first implementation of the intervention. Thus the treatment increased in its effectiveness when it was implemented a second time.

Due to these inconsistencies, the hypothesis is only partially supported for the intervention to be an effective intervention to increase homework completion rates of high school students with special education needs.

**Homework Accuracy**

The second research question investigated the effect of an interdependent group contingency on the homework accuracy rates of students with disabilities. During the intervention when a student did not hand in a homework assignment, accuracy was not measured. Further, if a student handed in an assignment that was counted as complete, but not to 100% complete, the skipped problems were counted as inaccurate. For instance, if a student had a homework assignment of 10 problems and only completed nine, the one problem that was not completed was counted as inaccurate. It should also be noted that during the baseline phase there were two students (student 2 and 10) who handed in only one assignment. During the withdrawal phase there were two students who did not hand in any homework (Student 9 and Student 12) and three others who handed in only one assignment (Student 1, 6, and 10), though their accuracy tended to be high on that one assignment. This variability and inconsistency in data caused some difficulty in visually analyzing the graphs for change in trend. A mean homework accuracy rate was calculated for each student and the total class (level), as well as standard deviations for each student participant of the study (variability). Homework accuracy means can be found in Table 5. Daily homework accuracy data is presented in Figure 2 across all data points in the study.
Table 5

Mean Homework Accuracy Percentages for all Phases

<table>
<thead>
<tr>
<th>Student (n=11)</th>
<th>Baseline mean</th>
<th>Intervention mean</th>
<th>Withdrawal mean</th>
<th>Reinstatement mean</th>
<th>Follow-up mean</th>
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<td>10</td>
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<td>11</td>
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<td>Total</td>
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<td>59.11</td>
<td>70.64</td>
<td>57.56</td>
<td>55.52</td>
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</tbody>
</table>

During the baseline phase, the homework accuracy mean for Student 1 was 61.83% ($SD=19.32$), where scores ranged from 30.77% to 85.71% correct on completed assignments. These accuracy rates increased during the intervention phase to 68.93% ($SD=22.49$) and a range of scores from 16.67% correct to 96.30% correct. These scores decreased during the withdrawal phase to 66.67% (only one assignment completed) correct and then increased again during reinstatement to 73.08% ($SD=38.07$) correct, with only two assignments being handed in to an accuracy of 46.15% to 100% correct. Student 1 had a mean of 67.98% correct during the follow-up. Again note that this student had minimal data for the withdrawal and reimplementation phases due to absences.

Student 2 completed only one assignment during the baseline phase to a 78.57% accuracy rate. During the intervention phase, homework accuracy decreased to 60.41% ($SD=19.93$), where scores ranged from 25% to 92.59% correct. During the withdrawal phase, scores decreased to
81.38% ($SD=21.07$), with ranges from 50 to 100% accurate. Scores decreased again to 51.49% accurate ($SD=34.27$) during reinstatement, with accuracy scores ranging from 23.08 to 100%. During follow-up there was only one assignment, which was completed to 52.63% correct.

The homework accuracy mean for Student 4 was 71.42% ($SD=22.79$), where scores on completed homework ranged from 30.77% to 100%, which decreased to an accuracy of 51.95% ($SD=24.44$) during the intervention phase (scores ranged from 20% to 93.75% on completed homework). These scores increased during the withdrawal phase to a mean of 69.64% ($SD=29.17$), and then decreased again during reinstatement to a mean of 48.17% ($SD=31.55$), and lastly increased during the follow-up to a mean of 58.04% ($SD=36.83$) correct.

Student 5 evidenced a baseline homework accuracy mean of 67.67% ($SD=30.74$), where scores ranged from 0% accurate to 85.71% correct. The mean during the intervention phase increased slightly to 69.16% ($SD=17.26$). However, scores within this phase ranged from 40% complete to 100% complete. Accuracy rates then increased to a mean of 80.00% ($SD=17.32$) during the withdrawal phase (only three assignments were completed). Student 5’s homework accuracy increased dramatically during reinstatement to a mean accuracy rate of 97.12% ($SD=5.36$), and increased again during the follow-up to 100% accuracy ($SD=0$).

During the baseline phase, Student 6 had an average accuracy rate of 47.14% ($SD=21.04$), with scores ranging from 28.57% to 70% on those homework assignments that were completed. This accuracy rate increased during the intervention to a mean of 83.15% ($SD=18.59$), however there were 10 missing homework assignments (on the two assignments completed, the student received a 96.3% and a 70% for accuracy). During withdrawal the accuracy mean decreased slightly to 80.00%, again due to mostly incomplete homework (there was only one assignment score for accuracy). During reinstatement, the student’s accuracy mean
decreased to 48.85\% (SD=27.37) with score ranging for 20\% accurate to 100\% accurate. This student completed no assignments during follow-up.

The homework accuracy mean for Student 7 was 49.27 (SD=21.26), with percent correct ranging from 19.23\% to 71.43\%. This rate decreased to 27.63\% (SD=15.32) during the intervention phase, with percent correct ranging from 6.25\% to 46.67\%. Accuracy rate then increased during the withdrawal phase to 18.75\% (SD=27.50), as this student handed in three out of the four homework assignments with 0\% accuracy. During the reinstatement phase the homework accuracy mean was 26.12\% (SD=10.05), and decreased to a mean of 21.05\% during follow-up (only one assignment was handed in).

During the baseline phase, Student 8 evidenced a homework accuracy mean of 59.01\% (SD=19.64), where scores ranged from 36.36\% to 71.43\% correct on those assignments completed (only handed in three assignments). These accuracy rates remained somewhat stable during the intervention phase at 50.44\% (SD=19.70) with a range of accuracy scores from 28.57\% correct to 81.48\% correct on assignments completed (only half of the assignments were completed). These scores increased during the withdrawal phase and then decreased during the reinstatement phase to 39.11\% (SD=28.81); however, only four assignments were completed during this phase. Lastly, only one assignment was completed during the follow-up phase, which was 58.33\% correct.

Student 9 had a baseline mean accuracy rate of 64.88\% (SD=11.02), where percentage correct scores ranged from 50\% to 80\% on those assignments completed. During the intervention phase homework accuracy was 30.21\% (SD=20.76), where scores ranged from 6.25\% to 60\% correct. Student 9 did not complete any homework during the withdrawal phase, so no rates were
reported. Homework accuracy increased to a mean of 54.46% ($SD=23.24$) during reinstatement, and only one assignment was completed during follow-up at 8.3% accuracy.

During the baseline phase, Student 10 handed in only one assignment, which was completed to 40.91% accuracy. This average was increased to an accuracy mean of 97.22% ($SD=5.56$) during the intervention phase (scores ranged from 88.89% to 100% on completed homework). Again, the student only submitted one homework assignment during the withdrawal phase, which was completed to 100% accuracy. During reinstatement, homework accuracy was 52.78% ($SD=41.76$), however, Student 10 was absent for six days during this phase and was absent for the entire follow-up period.

Student 11 only submitted one assignment during the baseline phase, which was 78.57% correct. The mean during the intervention phase was 52.15% ($SD=24.00$). Within this phase the student handed in all but two assignments, and scores ranged from 20% accurate to 92.59% accurate. Student 11’s homework accuracy increased during the withdrawal phase to a mean accuracy rate of 75.76% ($SD=23.69$). During reinstatement the student had a homework accuracy mean of 93.28% ($SD=23.69$), as when the student handed in homework, it tended to be highly accurate (range from 84.62 to 100%). Scores remained similar at follow-up, but only one assignment was handed in, which was 91.67% accurate.

During the baseline phase, Student 12 had an average accuracy rate of 54.64% ($SD=16.63$) on those homework assignments handed in. Accuracy scores ranged from 40% to 78.57% correct on those assignments that were completed. This accuracy rate increased slightly during the intervention phase to a mean of 58.92% ($SD=28.91$), with rates ranging from 18.52 to 85.71% on the four assignments completed. During the withdrawal phase the student did not
hand in any homework. During reinstatement the student’s accuracy mean increased to 48.75% ($SD=19.82$), and the one assignment completed during follow-up was 41.67% accurate.

Class means for homework accuracy were also calculated (Table 5). According to the aggregate data, the daily homework accuracy baseline rates for the class ranged from 40.91% to 78.57%, with a mean accuracy rate of 61.26% ($SD=12.50$). However, during the baseline phase there were three students who completed only one assignment, which may have skewed the baseline rates toward these scores. Student 2 completed assignment 2 with 78.57% accuracy, Student 10 completed assignment 7 with 40.91% accuracy, and Student 11 completed assignment 3 with 78.57% accuracy. The mean decreased slightly during the intervention phase to an accuracy rate of 59.11% ($SD=20.57$). The range of scores varied from 27.63% to 97.22%. This was a total decrease of 2.16% from the baseline mean.

During the withdrawal phase the homework accuracy mean increased to 70.64%, ($SD=22.19$) with means for accuracy ranging from 18.75% to 100%. Again, during this phase there were two students who did not hand in any homework (Student 9 and Student 12) and three who only handed in one assignment (Students 1, 6, and 10), where there accuracy tended to be high (e.g., student 10 handed in one assignment that was 100% accurate). Again, the lack of data may have distorted the results. During reinstatement of the intervention the total class mean completion rate was 57.56 % ($SD=21.73$), with means ranging from 26.12% to 97.12%. This was a decrease of 13.07% over the withdrawal mean homework completion rate and a 3.70% decrease over baseline mean rate. During follow-up, the mean decreased again to an accuracy rate of 55.52% ($SD=29.73$), which ranged from 8.33% to 100% accurate. However, there were two students (6 and 10) who did not hand in any completed homework during this phase, and six students who handed in only one out of three assignments.
Figure 2. Daily homework accuracy rates for each student across the baseline, intervention, withdrawal, and follow-up phases.
**Homework accuracy effect sizes.** To better understand the magnitude of the effect of the intervention on homework accuracy, effect sizes were calculated. This was done for each participant using Busk and Serlin ‘Approach one: No Assumption method (Busk & Serlin, 1992). An effect size score was derived for the intervention phase by calculating the difference in the means of the baseline and intervention phases, and then dividing by the standard deviation of the baseline phase. Effect sizes were used to determine if the intervention had a positive impact on the student’s ability to complete their homework accurately. Effect sizes were also calculated for the follow-up phase by taking difference in the mean of the follow-up phase from the mean of the baseline phase and dividing by the standard deviation of the baseline phase. Some effect sizes could not be found (for three participants), as there was only one data point collected for baseline (due to incomplete homework). Also, because of a lack of follow-up data (not completing homework) follow-up effect sizes were not calculated for one additional student participant. These data are presented in Table 5. These effect sizes can be interpreted using Cohen’s (1992) levels of significance, where 0.8 and above indicates a large effect size, 0.5 indicates a medium effect, and 0.2 represents a small effect.
Table 6

*Homework Accuracy Means, Standard Deviations, and Effect Sizes for the Intervention and Follow-up*

<table>
<thead>
<tr>
<th>Student (n=11)</th>
<th>Baseline phases mean</th>
<th>Intervention phases mean</th>
<th>Follow-up mean</th>
<th>SD baseline</th>
<th>Intervention effect size</th>
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<td>79.08</td>
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As is seen in Table 6, there was a range in effect sizes across the students from a positive effect of .35 for the intervention to a negative effect of -2.05. However, effect sizes for the follow-up phase were not as positive or strong. For instance, Student 1 had an effect size of .35 for the intervention and .19 for the follow-up phase. No effect could be found for Student 2 for the intervention or follow-up. Student 4 showed negative effects of -1.27 for the intervention, and a negative effect of -.92 during the follow-up phase. The intervention effect size was .30 for Student 5 and the follow-up effect size was .85. The effect of the intervention for student 6 was .12 and no effect could be calculated at follow-up. In addition, Student 7 had an effect of -.34 for the intervention, which decreased to -.01 during the follow-up. Student 8 displayed an effect size of -.84 for the intervention phase and -.15 for the follow-up. A negative effect of -2.05 was found for Student 9 for the intervention, and there was a negative effect of -5.13 for the follow-
up. Student 12 had a slightly negative effect of -.05 for the intervention and -.78 for the follow-up.

As is illustrated in Table 6, during the intervention phase, effect sizes varied for student participants. More specifically, effect sizes could not be calculated for three participants, due to limited baseline data (only one data point of accuracy). Small effects of the intervention were found for Student 1 and Student 5, with effect sizes of .35 and .30. The intervention had no effects for two participants (Student 12 had an effect size of -.05 and Student 6 had an effect of .13). Negative effect sizes were found for four of the participants. Student 7 had a small negative effect of -.34 and Students 4, 8, and 9 had large negative effect sizes of -1.27, - .84, and -2.05, respectively.

Further, as also seen in Table 6, effect sizes for the follow-up phase were somewhat similar. Due to incomplete homework at baseline and follow up, effect sizes could not be calculated for Students 2, 6, 10, and 11. Negative effect sizes were still exhibited for many student participants. For instance, Student 5 had a large positive effect size of .85 at follow-up. Student 1 showed a small effect at follow-up of .19, while Student 7 (.01) did not show any effect of the treatment on homework accuracy. Students 4, 9, and 12 exhibited large negative effect sizes of -.92, -.78, and -.05.13, respectively. Student 8 showed a small negative effect of -.15 for the intervention at follow-up.

**Homework accuracy t-tests.** A one-sample t-test was conducted on the accuracy data to evaluate whether the mean difference between the baseline and intervention, as well as between withdrawal and reinstatement was significantly different from zero. This would indicate a treatment effect occurred across the two phases of the study for homework accuracy. No significant difference was found between treatment and baseline phase scores ($t(10) = -.259$ p =
.801) or between the withdrawal and reinstatement phase scores (\(\tau(8) = -1.469\), p = .180). This indicates that there was no treatment effect from baseline to intervention or from the withdrawal to the reimplementation phases of the intervention for homework accuracy.

**Summary.** The second research question asked if the interdependent group contingency would be successful in increasing homework accuracy rates of a class of special education students with noted homework difficulties. The hypothesis that participants would demonstrate increased homework accuracy rates during the implementation of the interdependent group contingency was only partially supported by the results. Five students saw increases in accuracy levels from initial baseline to the intervention phase (45.5% of sample). There seemed to be similarities when looking at the reimplementation of the intervention, as four out of the nine students demonstrated an increase in accuracy level from the withdrawal phase to the reimplementation phase, (44% of sample) [2 students did not hand in any homework during withdrawal phase]. Reimplementation phase means were similar or improved for five students, as compared to baseline levels (45.5% of the sample). However, the effects seen were small, and effects could not be determined at all for three students. Two students showed a small positive effect of the intervention, no effects were seen for two students, and the effect sizes of the intervention were negative for four students (three large negative effects and one small negative effect). Lastly, t-tests showed no significant difference between the differences between the phases, indicating there was no statistically significant effect of the intervention.

**Academic Performance**

The third research question investigated the effect that an interdependent group contingency would have on the academic performance of students with disabilities. Academic performance was monitored throughout the course of the study through scheduled quiz grades.
Three quiz grades were documented during every phase of the study except the withdrawal phase, where only two grades could be provided. Further, no quizzes were administered during the follow-up phase, and are therefore not reported.

These quizzes were of somewhat similar length, but did cover similar time frames of material, as the teacher tended to give a quiz approximately every five days or so. However, the teacher scored each assignment out of total points earned, not out of 100%. For example, the three quizzes given during the baseline phase consisted of a quiz out of 13 points, a quiz out of 53 points, and a quiz out of 38 points. In order to compare these quizzes across phases, these scores were converted into percentages correct out of 100. For instance, if a student scored 10 out of 12 points on a quiz, the total score was calculated by dividing 10 into 12 and multiplying by 100 (e.g., the score in this example would be a 83.33%). See Table 7 and Figure 3 for exact quiz grades for each student during each phase of the study.

Table 7

Student Quiz Grade in Each Phase of the Study

<table>
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<tr>
<th>Student</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Withdrawal</th>
<th>Reinstatement</th>
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<td>75.00</td>
</tr>
<tr>
<td>8</td>
<td>46.94</td>
<td>86.84</td>
<td>67.11</td>
<td>75.00</td>
</tr>
<tr>
<td>9</td>
<td>61.22</td>
<td>62.28</td>
<td>72.37</td>
<td>100.00</td>
</tr>
<tr>
<td>10</td>
<td>30.61</td>
<td>67.54</td>
<td>61.84</td>
<td>100.00</td>
</tr>
<tr>
<td>11</td>
<td>59.18</td>
<td>95.61</td>
<td>64.47</td>
<td>100.00</td>
</tr>
<tr>
<td>12</td>
<td>59.18</td>
<td>65.79</td>
<td>56.58</td>
<td>79.17</td>
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<tr>
<td>Total</td>
<td>56.76</td>
<td>74.72</td>
<td>73.21</td>
<td>87.12</td>
</tr>
</tbody>
</table>
As can be seen in Table 7 and Figure 3, student academic achievement tended to be higher during the intervention and reinstatement phases. During the baseline phase, Student 1 evidenced a quiz mean of 64.57% (SD=14.04), which increased during the intervention phase to 91.39% (SD=10.86). These scores increased again during the withdrawal phase to 99.04% (SD=9.14) and then decreased during reinstatement to 79.79% (SD=9.14), however, this student had minimal data for the withdrawal and reimplementation phases due to absences.

Student 2 had a baseline quiz mean rate of 81.72% (SD=19.53), which decreased slightly during the intervention to 78.06% (SD=12.37). During the withdrawal phase, scores increased just slightly to 84.62% (SD=13.60), and then increased again to 90.25 (SD=8.91) during reinstatement.

The quiz mean for Student 4 was 77.18% (SD=11.42), which increased to a mean of 82.78% (SD=7.52) during the intervention phase. These scores were maintained during the withdrawal phase to a mean of 83.57% (SD=9.09), and then decreased during reinstatement to a mean of 74.24% (SD=12.83).

Student 5 evidenced a baseline quiz mean of 79.33% (SD=22.20) that increased during the intervention to a mean of 83.89% (SD=12.06), and then predominately remained the same during withdrawal to be a mean of 85.00% (SD=21.21). Student 5’s quiz mean increased during reinstatement to 87.28% (SD=11.01).

During the baseline phase, Student 6 had a quiz mean score of 73.86% (SD=12.69), which increased during the intervention to a mean of 79.44% (SD=3.37). During withdrawal the quiz mean remained stable at 80.10% (SD=3.56), and then increased again during reinstatement to an average of 92.03% (SD=8.11).
During the baseline phase, Student 7 had a quiz mean of 54.68% ($SD=9.85$), which increased during the intervention phase to 62.00% ($SD=11.45$). These scores decreased again during the withdrawal phase to 44.90% ($SD=3.67$) and then increased during reinstatement to 63.07% ($SD=14.91$). This student also had minimal data for the withdrawal and reimplementation phases due to absences.

Student 8 had a baseline quiz mean rate of 66.96% ($SD=19.95$), which increased during the intervention to a mean of 71.67% ($SD=2.89$). During the withdrawal phase scores increased slightly to 80.00% ($SD=14.14$) and then remained stable at 80.87% ($SD=13.06$) during reinstatement.

The quiz mean for Student 9 was 65.29% ($SD=6.15$), which increased to an accuracy of 78.33% ($SD=20.21$) during the intervention phase. These scores decreased during the withdrawal phase to a mean of 65.58% ($SD=7.89$), and then increased during reinstatement to a mean of 77.59% ($SD=13.03$).

Student 10 evidenced a baseline quiz mean of 53.33% ($SD=19.88$) that increased during the intervention to a mean of 90.83% ($SD=15.88$), and then predominately remained the same during withdrawal to a mean of 89.29% ($SD=15.15$). Student 10’s quiz mean decreased during reinstatement to 83.33%, but due to absence from school, there was only one quiz grade reported.

During the baseline phase, Student 11 had a quiz mean score of 73.09% ($SD=19.68$), which increased during the intervention to a mean of 81.67% ($SD=21.84$). During withdrawal the quiz mean decreased to 75.87% ($SD=25.97$), and then increased again during reinstatement to an average of 86.31% ($SD=12.4$).
The quiz mean for Student 12 was 60.52% ($SD=4.75$), which increased to an accuracy of 63.72% ($SD=34.22$) during the intervention phase. These scores decreased during the withdrawal phase to a mean of 49.81% ($SD=49.25$). The two scores during this phase were discrepant (i.e., one grade was a 15 and the other was a 84.62) thus causing a very high standard deviation. Lastly, during the reinstatement phase the mean increased to 78.16% ($SD=11.52$).

When looking at the class totals, the overall quiz mean during baseline was a 68.23% ($SD=9.64$), which then increased over 10 points during the intervention phase to a mean of 78.53% ($SD=9.56$). Further, the quiz mean decreased slightly during the withdrawal phase to 76.16% ($SD=16.47$), and then increased again during the reinstatement phase to a mean of 81.18% ($SD=8.18$). This final mean was 12.95 points higher than the original baseline mean and over 5 points higher than the withdrawal mean.
Percentage Complete

Student 5
Baseline
Intervention
Withdrawal
Reinstatement

Student 6
Baseline
Intervention
Withdrawal
Reinstatement

Student 7
Baseline
Intervention
Withdrawal
Reinstatement
Figure 3. Quiz grades for each student and class mean across the baseline, intervention, and withdrawal phases.
**Academic performance effect sizes.** Effect sizes were also calculated for academic performance for the intervention and follow-up phases using Busk and Serlin ‘Approach one: No Assumption method (Busk & Serlin, 1992). These were calculated in the same manner as homework completion and accuracy. There were no follow-up effect sizes, as quiz scores were not collected at follow-up. Results of effect sizes for quiz grades are shown in Table 8.

As is seen in Table 8, there was a range in effect sizes across the students from a positive effect of 3.32 to a negative effect of .16. For instance, Student 1 had an effect size of .27 for the intervention. Student 2 displayed an effect size of .05, while Student 4 showed an effect size of -.16 for the intervention phases. The intervention effect size was .15 for Student 5 and the effect of the intervention for student 6 was .69. In addition, Student 7 had an effect of 1.29 for the intervention. Student 8 displayed an effect size of .14 for the intervention and an effect size of 2.04 was found for Student 9. Student 10 had an effect of .79, while student 11 had an effect of .48. Lastly, Student 12 had an effect of 3.32 for the intervention phases.

Again, these effect sizes can be interpreted using Cohen’s (1992) levels of significance, where 0.8 and above indicates a large effect size, 0.5 indicates a medium effect, and 0.2 represents a small effect. Positive effects of the intervention were found for all students except for Student 4 (-.16). Large effect sizes (.8 and above) were found for Students 7, 9, 10, and 12 (1.29; 2.04; 0.79; and 3.32, respectively). Medium effect sizes (between .5 and .8) were found for Students 6 and 11 (0.69 and 0.48, respectively). Lastly, Student 1 and 5 obtained a small effect size (between .2 and .5) of .27 and .15. There was no effect found for Student 2 and Student 8, and only a small negative effect of -.16 for Student 4.
Table 8

*Student Quiz Means, Standard Deviations, and Effect Sizes for Intervention*

<table>
<thead>
<tr>
<th>Student (n=11)</th>
<th>Baseline Quiz Mean</th>
<th>Intervention Quiz Mean</th>
<th>Withdrawal Quiz Mean</th>
<th>Reinstatement Quiz Mean</th>
<th>SD of Baseline</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64.57</td>
<td>91.39</td>
<td>99.04</td>
<td>79.79</td>
<td>14.04</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>81.72</td>
<td>78.06</td>
<td>84.62</td>
<td>90.25</td>
<td>19.53</td>
<td>0.05</td>
</tr>
<tr>
<td>4</td>
<td>77.18</td>
<td>82.78</td>
<td>83.57</td>
<td>74.24</td>
<td>11.42</td>
<td>-0.16</td>
</tr>
<tr>
<td>5</td>
<td>79.33</td>
<td>83.89</td>
<td>85.00</td>
<td>87.28</td>
<td>22.20</td>
<td>0.15</td>
</tr>
<tr>
<td>6</td>
<td>73.86</td>
<td>79.44</td>
<td>80.10</td>
<td>92.03</td>
<td>12.67</td>
<td>0.69</td>
</tr>
<tr>
<td>7</td>
<td>54.68</td>
<td>62.00</td>
<td>44.90</td>
<td>63.07</td>
<td>9.85</td>
<td>1.29</td>
</tr>
<tr>
<td>8</td>
<td>66.96</td>
<td>71.67</td>
<td>80.00</td>
<td>80.87</td>
<td>19.95</td>
<td>0.14</td>
</tr>
<tr>
<td>9</td>
<td>65.29</td>
<td>78.33</td>
<td>65.58</td>
<td>77.59</td>
<td>6.15</td>
<td>2.04</td>
</tr>
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<td>11</td>
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<td>81.67</td>
<td>75.87</td>
<td>86.31</td>
<td>19.68</td>
<td>0.48</td>
</tr>
<tr>
<td>12</td>
<td>60.52</td>
<td>63.72</td>
<td>49.81</td>
<td>78.16</td>
<td>4.75</td>
<td>3.32</td>
</tr>
</tbody>
</table>

**Academic performance t-tests.** A one-sample t-test was conducted on the academic achievement data to evaluate whether the mean difference between the baseline and intervention, as well as between the withdrawal and reinstatement phases was significantly different from zero. This would indicate a treatment effect occurred across the two phases of the study for achievement (quiz grades).

For the treatment and baseline phases, the mean difference between the baseline and intervention score ($M=10.30; SD=11.78$) was significantly different from zero ($t(10) = 2.9, p = .016$). This indicates that there was a treatment effect from baseline to intervention. For the withdrawal and reinstatement phases, the mean difference between the baseline and intervention score ($M=5.02; SD=13.36$) was not significantly different from zero ($t(10) = 1.246, p = .241$). This indicates that there was no treatment effect from the withdrawal phase to the reimplementation phase of the intervention for academic achievement.
Summary. The last research question and hypothesis proposed that participants would demonstrate increased academic performance, as measured by test/quiz grades, during implementation of the interdependent group contingency, as compared to baseline rates. This hypothesis was partially supported through the examination of quiz grades. The majority of students increased their averages during phases of the study where the intervention was being implemented (as compared to baseline). For instance, during the first intervention, 10 out of the 11 increased their quiz grades (91% of the sample), some greatly so. In addition, eight students demonstrated an increase or similar rate in academic performance from the withdrawal phase to the reimplementation phase (73% of sample) and 10 increased over initial baseline rates (91% of the sample). Further, there were large and medium positive effect sizes for six of the students and small effects for two students (73% of the sample). However, when analyzing the data for significance using one-sample t-tests, the hypothesis was supported only for the initial intervention phase, and not for the reimplementation phase. Thus, there was only a treatment effect for the first implementation of the intervention.

Summary of Research Hypotheses

As was described, Hypotheses 1, 2, and 3 were only partially supported by the results. Each of the three research hypotheses and the corresponding support and sources of data are reflected in Table 9.
Table 9

Summary of Research Hypotheses and Findings

<table>
<thead>
<tr>
<th>Research Hypothesis</th>
<th>Findings</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants will demonstrate increased <em>homework completion</em> rates during the implementation of the interdependent group contingency, as compared to baseline rates.</td>
<td>Partially Supported</td>
<td>Increases in overall class means during intervention phases, large or medium effect sizes for most participants, and significant t-score for treatment effect</td>
</tr>
<tr>
<td>Participants will demonstrate increased <em>homework accuracy</em> rates during the implementation of the interdependent group contingency, as compared to baseline rates.</td>
<td>Partially Supported</td>
<td>Varied increases in means during intervention phases, low or negative effect sizes across participants, and no significant t-scores for any phase in the study</td>
</tr>
<tr>
<td>Participants will demonstrate increased <em>academic performance</em>, as measured by test/quiz grades, during implementation of the interdependent group contingency, as compared to baseline rates.</td>
<td>Partially Supported</td>
<td>Increases in overall class means during intervention phases, large or medium positive effect sizes for most participants, and significant t-score for treatment effect</td>
</tr>
</tbody>
</table>

**Interobserver Agreement**

Homework was collected from each phase of the study (collected once a week and sampling all participants) and scored by a school psychology doctoral graduate student to calculate an interobserver agreement rate for homework completion and problems completed accurately. This included two total days of data from the baseline phase, three total days of data from the intervention phase, two total days of data from the withdrawal phase, and three total days of data from the reimplementation phase. To calculate the interobserver agreement rate was calculated by dividing the number of homework assignments agreed upon as complete, by the number homework problems in total on the assignment, and then multiplying by 100. The same procedure was used for accuracy, with the rater scoring each student’s homework using an answer key provided by the teacher. Results indicated that interobserver agreement was 100%
for both completion and accuracy for all four phases of the study. This interobserver agreement rate was not calculated for the follow-up phase.

**Treatment Integrity**

A treatment integrity protocol was developed to measure the accuracy and consistency with which the elements of the intervention were implemented (Gresham, 1989). The teacher went through a checklist (Appendix F) that consisted of the 10 treatment components in the procedure of the intervention, marking each component as it was implemented. Results from the checklist indicated that all steps were completed with 100% accuracy.

Treatment integrity was also measured through structured observations of the teacher implementing the intervention. A doctoral school psychology student observed the teacher implementing the group contingency for approximately 20% of the intervention phases, or six total observations. The doctoral student checked off each step on the protocol as the teacher completed the intervention. Similar to the teacher’s treatment integrity, results also indicated that the intervention was completed with 100% accuracy.

**Consumer Satisfaction**

The students’ rated the acceptability of the intervention using a consumer satisfaction scale based on Bray and Kehle’s (1996) index (see Appendix F) after the second implementation of the intervention. The participants rated these items on a 5-point Likert-type scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores corresponding to greater satisfaction with the intervention. All students completed the survey, except for Student 3, who left the classroom to transfer to another class and Student 10 who was absent for the last few months of school, and thus unable to take the survey.
The overall mean for the students was a 3.84 (range was from 3 to 4.6), which indicated that the students liked the intervention. More specifically, the highest ratings from students were that they liked the rewards they received, a mean ranking of 4.6. The students also indicated that they liked being rewarded for accurately completing homework assignments (4.4) and would like their teacher to continue using the intervention (4.2). The students also agreed that the reinforcement was fair (3.9) and that the intervention helped them complete their homework (3.7). The one area that the students did not like as much was not knowing what the homework goal would be. Students indicated they ‘Neither Agreed or Disagreed’ (3) with this component of the intervention. According to the teacher, the students were excited by the intervention from the beginning and communicated that they wanted her to continue utilizing it for the rest of the year.

Teacher Acceptability

The teacher rated the acceptability of the intervention using the Intervention Rating Profile (IRP-15), developed by Witt and Elliott (1985) (see Appendix H). The IRP-15 is a 15-item questionnaire and asks participants to rate various aspects of the intervention (e.g., I would suggest the use of this intervention to other teachers) on a 6-point Likert-type, from 1 (strongly disagree) to 6 (strongly agree). Higher scores on the IRP-15 reflect a greater level of acceptability of the intervention. The teacher’s overall mean ranking across all fifteen items was a score of 5 (range was from 3 to 6), falling exactly at the ‘Agree’ category. This score indicated that the teacher found the intervention to be acceptable and not intrusive within the classroom.

More specifically, the teacher strongly agreed to six of the statements, indicating that the intervention was reasonable for the behavior problem in question (homework), liked the procedures used in this intervention, most teachers would find this intervention suitable for behavior problem, behavior was severe enough to warrant the intervention, and the intervention
had no negative side effects for the students. The teacher agreed to five of the statements, indicating that the intervention was acceptable for the problem behavior (homework), most teachers would find the intervention appropriate for behavior, she would suggest this intervention to other teachers, would be willing to use the intervention in the classroom setting, was a good way to handle the problem behavior and overall was beneficial to the students. The teacher slightly agreed to three statements, noting that it would prove effective in changing student behavior, was consistent with those she had used in the classroom, and was a fair way to handle the problem behavior. The only question the teacher slightly disagreed with was whether the intervention would be appropriate for a variety of children. She noted that while she felt this class of students responded well to the intervention, one of her lower functioning classes would not be as receptive to the intervention, due to a lack of understanding the procedures. However, it should be noted that the teacher did not continue to use the intervention every day after the last reinstatement phase was over. Instead, she used the intervention sporadically when she wanted to increase homework motivation for her students.
Chapter V: Discussion

This chapter provides a brief summary of the research conducted and detailed discussion of the results. In addition, implications of the research, discussion of the limitations of the present study, as well as suggestions for future research are presented.

Homework as a strategy to improve academic achievement has been a long used method by teachers, in both the elementary and secondary grade levels (Becker & Epstein, 1982; Muhlenbruck et al., 1999). There have been many studies to document that completing homework has a positive relationship to achievement (Cooper et al., 2006; Keith, 1982; Keith & Cool, 1992), particularly at the secondary level (Cooper et al., 2006; Keith, 1982; Keith & Cool, 1992; Paschal et al., 1984). Due to this positive relationship, many have tried to implement strategies to increase students’ compliance with homework, many focusing on special education students, as this population is often at high risk of having problems completing homework (Miller & Kelley, 1994; Schellenberg et al., 1991; Trammel et al., 1994).

The purpose of the current study was to expand the research through the use of an interdependent group contingency with randomized components to target homework completion and accuracy rates for special education students (Little et al., 2010; Lynch et al., 2009; Reinhardt et al., 2009; Theodore et al., 2001). Specifically, the effect of the interdependent group contingency, with randomized criteria for reinforcement and random reinforcers (i.e., mystery motivator), on the homework completion, homework accuracy, and academic achievement (e.g., quiz grades) of a class of special education high school students was investigated. Of particular note is that this is the first study to investigate the impact of a group contingency on academic performance and the first that utilized a self-contained class of high school special education students with a variety of disabilities.
During the intervention phases of the study, daily homework rewards were delivered contingent upon the students meeting a randomly selected criterion for homework performance. This study utilized repeated measurement of three dependent variables within a single subject withdrawal design. Specifically, homework completion and homework accuracy were examined on a daily basis over the course of two three-week intervention periods, and again at a three-week follow-up. During the baseline and intervention periods, quiz grades were measured and compared to determine if there were effects of the intervention on the academic performance of students. As mentioned, this study was unique, as it utilized a self-contained class of special education students (no other study has done so) and it was the first to investigate the use of a group contingency on homework behavior and its relationship to academic performance.

The results indicated that the majority of students showed improvements in rates of homework completion, and effects of the intervention were especially strong for the reinstatement phase of the study. However, only some students improved in their accuracy rates during the intervention phases of the study. Gains for both homework completion and accuracy were not maintained at follow-up. The intervention was found to be effective when inspecting the change in academic performance across phases of the intervention, especially so when examining the first intervention phase.

**Homework Completion**

The first research question investigated if the use of an interdependent group contingency would be effective in improving the homework completion rates of high school students with disabilities. The results found increased homework completion means for the majority of individual students in the intervention phases, moderate to large effect sizes for six students and small effects for three additional students, as well as a significant treatment effect for the second
intervention phase. When evaluating the homework completion data by class, the class wide intervention completion mean was at a higher level than it was at baseline. Further, the reinstatement class mean was greater than both the baseline and withdrawal means. These all provided partial support to the research hypothesis that the use of the interdependent group contingency would increase homework completion rates. However, when inspecting rates at follow-up, homework rates and effect sizes were lower, and in some case negative. The follow-up data weakness may be due to students not handing in any homework the three days of data collection. Furthermore, the teacher did not use the intervention in its entirety during this time.

**Individual students.** With respect to individual students, effect sizes across completion data were positive for all students except for one. Seven out of 11 students had similar or higher means at intervention than at baseline. What is even more impressive is that ten out of 11 students showed similar or increased homework completion rates at reinstatement, compared to their initial baseline rates. Of those students, some had substantial improvements and very positive effect sizes, as nine students showed an effect of the intervention.

There were three students (Student 2, Student 5, and Student 10) that displayed large positive effect sizes for homework completion. It is interesting that two of the three students who showed the highest effect sizes were students that displayed IQs in the average range, which suggests a typical aptitude to do well in school. For instance, Student 10 had an IQ Score of 103 (average range) and student 2 had an IQ Score of 105 (average range), and these two students had homework completion effect sizes of 1.57 and .81, respectively. Student 2 did not end with particularly high reinstatement mean rates (56%), but these were much improved over a low baseline mean (14%). It is possible that these students had more potential to do well in school, thus they responded better to the implementation of the intervention. Student 5 did not have a
particularly high IQ, but as is explained below, there may have been other characteristics of this student that impacted him to display such positive effects. In addition, the aforementioned had poor homework behavior, as students with disabilities often do (Salend & Gajria, 1995). Thus, through the use of the intervention they developed proper homework behavior (e.g., better time management) that persisted through the study.

The two students in the study that were classified with autism showed marked improvements in their homework completion rates. It is possible the intervention had stronger effects for students who displayed a certain disability category, in this case autism. As mentioned above, Student 5 showed a large effect size for homework completion (2.55). While his reinstatement mean was just slightly higher than his baseline mean, the student did not hand in assignments during withdrawal, which lowered his overall mean during this time. Similarly, Student 11 (also classified with autism) showed a moderate effect size (.66) of the intervention for homework completion. This student began the study only handing in 16.67% of his homework during baseline, which increased by 56.33% during intervention. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM IV-TR, American Psychiatric Association, 2000), individuals diagnosed with autism have delays in social interactions, communication, and repetitive and stereotyped patterns of behavior, interests or activities. The clear and repetitive structure of the intervention itself may have appealed to these students, while the reinforcement utilized may have helped to increase their motivation to complete the homework. The teacher also anecdotally noted that the two students with autism responded well to the intervention and were invested in the positive outcomes during the intervention phases.

Student 12 also had a moderate effect size of the intervention (.53). Interestingly, this student ended the study with a reimplementation mean that was very similar to his baseline
mean. However, he handed in no homework during the withdrawal phase, which cause the mean of the baseline phases to be quite low. Further, this student was also absent for numerous days (eight days) during the study. These missing data points occurred mostly during the intervention or reimplementation phases, and could have impacted the results for this student, which might have been much higher if he was present for more days.

Small, but positive, effect sizes were found for Student 1, Student 6 and Student 7. Student 1 had rather immediate and positive effects of the intervention in the first intervention phase. Positive effects were also seen through the reimplementation phase for this student, but as mentioned above, this student was sick and had much missing data during the withdrawal and reimplementation phases. Student 6 showed improvements in performance, but these improvements were somewhat delayed. This student only handed in a third of his homework during baseline, which then decreased in the following two phases. It was not until the reimplementation phase that this student showed more consistent homework completion behavior and ended with a mean that was almost 20 points higher than initial baseline rates. Student 7 also had varied results, but this student was also missing a great deal of data because of absenteeism (missing 11 days). The reimplementation mean was higher than the baseline mean and if the student was not absent as frequently, stronger results may have been seen.

The three students who had lower rates of homework completion during the intervention phases of the study need to be further delineated. Student 9 showed some variability in relation to his homework completion rates when the intervention was administered. This student decreased from his baseline completion mean throughout the study, as he began with a 65.68% baseline mean and ended at a 53.72% reinstatement mean. However, this student did increase over his withdrawal rate, as he did not complete any homework during the withdrawal phase.
(increased from 0% completion to 53.72% during the reinstatement). While this student showed lower homework rates at reinstatement than at baseline, a moderate effect was found for this student, as the average of his two intervention phases was higher than his average of his two baseline phases.

Student 8 displayed an overall decrease in his homework completion mean for his intervention phases mean (1.84% lower than baseline phases mean) and no effect of the intervention was found. While there was a slight decrease in his completion mean from baseline to intervention, student 8 ended the reimplementation phase with a mean score that was in fact higher than initial baseline rates. It should be noted that this student had the greatest degree of variability in his baseline data ($SD=48.16$), which creates difficulty in determining if the results were actually due to the implementation of the intervention (Kazdin, 1982). Further, large negative effects were seen for this student in regards to accuracy and no effect was seen on academic achievement.

Only one participant (Student 4) showed a negative effect size of the intervention. This student started the intervention with very high baseline mean (99.45%) and his mean decreased during the first intervention phase to 74.54, but he ended with 100% completion mean at the reimplementation phase. Limited effects for homework completion among some of the students may have been due to ceiling effects (Kazdin, 2003). In other words, strong baseline performance could have limited the amount of change possible, which may have resulted in these ceiling effects. In addition to this, it should be noted that this student had the lowest IQ in the class and negative effect sizes were also seen across the other two dependent variables.

These findings have much social and practical relevance, as the teacher noted that the majority of students in her class had very poor homework completion rates at the beginning of
the study and was concerned about their lack of homework negatively impacting their final quarter grades. The findings thus give support for this intervention as a viable homework intervention to use with students with disabilities who are struggling to complete their homework. In addition, these results corroborate similar research conducted on the area that displayed interdependent group contingences are effective in increasing homework completion rates (Little et al., 2010; Lynch et al., 2009; Theodore et al., 2009).

**Homework Accuracy**

The second research question investigated if the use of an interdependent group contingency would be effective in improving the homework accuracy rates of high school students with disabilities. Results were variable with respect to improving homework accuracy rates, as only small improvements were found for individual students from baseline to intervention phases. When evaluating the homework accuracy increases by class, the class means were lower during the intervention phases than at their baseline. Further, the reinstatement mean was less than both the baseline and withdrawal means. Also, no significant differences were found when comparing the differences in homework accuracy means across phases from baseline to intervention. Follow-up data was also variable, and overall lower than initial baseline rates.

However, when investigating change for specific students during the intervention phases, looking at both descriptive statistics and effect sizes, some improvements in accuracy rates were evident. Two students did show small positive effects of the intervention. When inspecting means, there seemed to be some improvements. For instance, five out of the 11 students had similar or higher means at intervention when compared to baseline (Student 1, 5, 6, 10, and 12) and four students showed increased homework accuracy rates at reinstatement compared to their withdrawal rates (Student 1, 5, 7, and 11). When looking at total improvements over baseline
levels, again five students showed improvements over their baseline levels (Student 1 5, 6, 10, and 11). Consequently, the hypothesis that the intervention would improve accuracy rates of students with disabilities was partially supported.

There are a few variables that may have contributed to these weaker findings for homework accuracy, which will be further delineated when discussing individual students. First, some students may not have had the academic content knowledge in mathematics to accurately complete their homework (e.g., skill deficits). This is very much likely, as those students who were proficient in mathematics (according to first quarter grades) were the only students who showed improvements in accuracy. Further, weak cognitive abilities may have also impacted students’ ability to complete homework accurately. Again, this was a special education class, so some students with disabilities had impaired cognitive functioning. Those with limited cognitive abilities may have had difficulty independently completing the problems with a great deal of accuracy. In addition, it is also possible that the chronic absenteeism impacted the accuracy results of the study. Those students who missed many days of school may not have been exposed to the curriculum that the homework was covering. Thus, these students may have attempted to complete the homework, but may have had difficulty doing it accurately. Homework rates would therefore be more impacted for accuracy than for completion. Lastly, limited accuracy data could have negatively impacted the results. This is quite probable, as when students did not hand in their homework, there was no data on accuracy. This occurred frequently during the baseline and withdrawal phases. More emphasis is then placed on the few assignments that were completed, which in turn may have negatively impacted the results.

**Individual students.** When reviewing effect sizes of the intervention, results were as not as strong as with homework completion. Effect sizes could not be found for three students, due
to limited baseline data (only one data point), and sizes were close to zero for two other participants, showing no true benefit or detriment to accuracy performance. Small effects of the intervention were found for student 1 and student 5, which were effect sizes of .35 and .30.

Students with higher grades in the class seemed to show better results with respect to accuracy. For instance, Student 1 and Student 5 were the only two students to show positive effect sizes and also earned two of the highest first quarter grades in the class (85 and 94). However, it should be mentioned that Student 1 did miss a great deal of data toward the end of the study due to an illness. When inspecting data for Student 5, a positive trend can be seen throughout the study, as accuracy increased throughout each phase of the study and he ended the reimplementation phase with high accuracy rates (mean of 97.12), as well as 100% accuracy during follow-up.

The only other student that had a grade in the 80s or 90s was Student 11, who earned an 83 on the first quarter report card. No effect size was found for student 11, due to limited homework completion data at baseline and no SD of baseline to calculate an effect size. However, when inspecting homework accuracy means for this student, there were improvements seen. Baseline rates began at 79% accuracy and increased 14 points at reinstatement to a mean accuracy rate of 93%. Thus, it is possible that this intervention, in respect to accuracy, works best for those students who have a higher degree of proficiency with the material that is being taught within the classroom.

Several factors may have contributed to the differences in homework accuracy across the other study participants. Due to the low homework completion rates, especially during the baseline and withdrawal phases, there were quite a few students who had very limited data on accuracy. For instance, mixed results were found for Student 10. The intervention was very
effective for this student in regards to homework completion, as this student handed in much more homework during the intervention phases of the study. However, this student only completed one assignment during the baseline phase and one during the withdrawal phase. A large negative effect size was obtained for this student because the one assignment that was handed in during the withdrawal phase was 100% accurate. Thus, the limited accuracy data may have influenced the results.

Similarly, Student 6 showed varied results when inspecting accuracy data. Student 6 increased a great deal in his accuracy rates from baseline to intervention (from a mean of 47% accurate to a mean of 83% accurate). Conversely, there was a large decrease in accuracy rates from the withdrawal to reinstatement phase. However, this student only handed in one assignment during the withdrawal phase, which was to an 80% accuracy rate. Thus, the second phase of the intervention, as well as the effect size, may not necessarily be representative of the effectiveness of this intervention for this particular student. Likewise, during the baseline phase Student 2 completed only one assignment (to 79% accuracy), which was higher than the means of his intervention and the reinstatement phases. Again, since there was only one data point during baseline, this one point may not be representative of the student’s accuracy and thus not a good comparison point to use.

Some students missed many days of school intermittently throughout the weeks that the study took place. When the students missed school, they inevitably missed academic learning time in the content that was assigned for homework. One of the most popular reasons teachers assign homework is to provide the opportunity for students to review and then practice the subject matter that was covered in class (Becker & Epstein, 1982). If a student misses class, they may have further difficulty in completing homework accurately. As was mentioned above, when
discussing homework completion, Student 7 missed 11 days of school and Student 12 missed a total of eight days of school during the course of the study.

When looking at the data, Student 7 showed inconsistent gains in homework accuracy. For instance, this student displayed intervention rates that were lower than baseline rates by 21.64 percentage points. While his reimplementation mean was higher than withdrawal (7.73 points higher), the reimplementation mean was still lower than baseline by 23.15 percentage points and no effect size was found for the intervention. Similar to student to 7, Student 12 was absent for a large period of time and did not have much movement in homework accuracy throughout the study. Not only was this student absent a great deal during the intervention phases (four times during the intervention phase and three times during the reimplementation phase) but the student also completed no homework during the withdrawal phase. The student did show small positive growth in accuracy from baseline to intervention. However, those assignments that were completed during the reimplementation phase (5 assignments) were completed to an accuracy rate that was less than original baseline rates. Therefore, overall means of the intervention and baseline phases were only within one point of each other. It is quite possible that the chronic absenteeism impacted the results of the study for these two students, and potentially for other students who missed some days throughout the course of the study.

Large negative effect sizes for accuracy data were found for three of the participants, Student 4, Student 8 and student 9. As was mentioned in the previous section, Student 4 also showed no effect of the intervention for homework completion, as he handed in less homework during the intervention. Student 4 also had very limited cognitive abilities, as well as extremely weak applied math skills. This student may not have had the aptitude to accurately complete the homework, which may have caused the student to not complete the work accurately. Student 9
showed decreases in homework completion throughout the study, as during the withdrawal phase he did not hand in any homework. Thus, no accuracy data could be analyzed for this phase of the study. In addition to this, student 9 also had very weak mathematic skills on standardized testing and a first quarter grade in the 70s. This lack of homework data, as well as limited academic skills, may have impeded these students’ ability to accurately complete the homework. Consequently, the intervention may not have been enough for student 4 and 9 to increase their homework completion or accuracy, as a skill deficit may have interfered with their homework performance.

Student 8 had a negative effect size and homework accuracy rates were lower during the intervention phases. This student had limited homework completion data, especially during the intervention and withdrawal phases (only handed in approximately 15% of homework during this time), which may have put more emphasis on the accuracy of the homework that was handed in. It should be noted that this student did not show any effects of the intervention with regard to homework completion or academic achievement.

Interestingly, the results in this study differed from previous findings regarding homework accuracy. Prior research that has employed this intervention found improvements in students’ homework accuracy rates. For instance, Lynch et al. (2009) found that when comparing the three types of group contingencies, the interdependent contingencies yielded somewhat better accuracy rates than the other two. Further, both Theodore et al. (2009) and Lynch et al. (2009) found an interdependent group contingency improved the homework accuracy performance for students. Results from the current study did not find conclusive outcomes to demonstrate the effectiveness of the interdependent contingency on homework accuracy rates. However, previous research utilized classrooms of elementary school children, while the current study was
completed with high school students. Thus the nature of the homework assignments for high school students in the current study may have been more complicated and more difficult to complete accurately.

Further, Reinhardt et al. (2009) found that an interdependent contingency was able to improve homework accuracy. However, Reinhardt et al. did not use students with disabilities as participants in the study, thus also potentially adding to the different findings of the current study. A student with a disability might view homework as too difficult and leave some parts of the assignment unfinished because it is deemed too challenging or was not able to complete it independently (Bryan et al., 1995; Polloway et al., 1992). While the teacher made every attempt for the homework to be a review of the day’s classwork, it is possible that the homework was difficult for some students to complete accurately, thus causing dissimilar results from prior research.

Although a statistically significant change in performance when using the intervention was not found for homework accuracy, there may be practical significance to these results, as the interdependent group contingency did help some students hand in their homework accuracy. For some students, completing their homework and doing so accurately may have been a preliminary taste of the natural reinforcers that come with school achievement (e.g. higher grades, positive teacher feedback on homework performance, etc.). Those students, who did show improvements in accuracy, may have internalized some of these effects.

**Academic Performance**

The last research question investigated if the use of an interdependent group contingency would be effective in improving the academic achievement of high school students with disabilities. Results found that during the phases of the intervention when the teacher was
utilizing the interdependent group contingency, there were positive effects on academic achievement. Specifically, there were positive changes in quiz means during use of the intervention, positive effect sizes for all students, except for one, as well as a significant treatment effect on students’ grades during the first implementation of the intervention. These data all provide partial support to the hypothesis that use of the intervention would produce higher academic achievement.

Of particular note, is that this was the first study to investigate if the use of any kind of group contingency to increase homework behavior had an impact on academic achievement. Even those studies that utilized mystery motivators or other behavioral interventions did not extend the research to investigate any gains or benefits to student achievement. Previous literature has found homework completion has a positive relationship to the academic performance and grades of students (Cooper et al., 2006; Keith, 1982; Keith & Cool, 1992). A key finding for the current study was that when the intervention was being utilized, students displayed higher academic achievement, as measured by average quiz scores. Findings from the current study offer additional support for the use of a class wide group contingency intervention, to not only increase homework completion and accuracy, but also to positively impact academic achievement.

**Individual students.** With the exception of one student, all of the students in the current study showed increases in their mean quiz grade during the intervention phases. There were some students who showed much improvement on their quiz grades and large positive effects of the intervention.

Results support the notion that positive effects in homework completion appear to be related to positive effects in achievement. The four students (7, 9, 10, and 12) that had large
positive effects for academic achievement had at least medium positive effects of homework completion, except for student 7, who displayed a small effect size for homework completion.

In addition, medium effect sizes were found for two students (Students 11 and 6) for academic achievement; student 11 had a positive medium effect and student 6 had a small medium effect for homework completion. This similar to prior research, which has shown that spending more time academically engaged is predictive of future academic success (O’Melia & Rosenberg, 1994). In the current study, more time spent on homework was related to increases in quiz grades. These positive effects indicate it is possible that completing homework alone was enough for the students to practice skills, which was related to higher quiz grades.

Further, it should be noted that Student 6 had small, but positive findings in respect to homework completion and accuracy (small effect size for completion and positive effect size of .12 for accuracy). Further, when inspecting quiz grades this student increased his average throughout the entirety of the study (74, 79, 80 and 92 in each respective phase). Moreover, Student 6 was a student classified as having an Emotional Disturbance and diagnosed with MDD. Recent research has noted that aspects of depressive behavior may have to do with lack of positive reinforcement that is contingent on behavior in the environment (Kanter, Busch, Cautilli, & Baruch, 2012). It is possible that the positive reinforcement delivered throughout this study was enough to help increase motivation to hand in homework accurately, which then could have contributed to the increase in quiz grades.

Interestingly, none of these students who showed the greatest improvement in quizzes earned grades on the first quarter report card that were in the A or B range (80 to 100). Students 7, 9, and 12 were receiving grades that were in the mid 70s for the first quarter report card. Thus, this intervention was the most effective in increasing quiz grades for those students who were
only somewhat struggling with the class. Student 10 received a grade of 55 for the first report card, but as stated, this student had to be hospitalized for mental health reasons. Thus, the poor first quarter grade may be due to her struggles with mental health issues since the beginning of the school year.

Lastly, Student 1 and 5 obtained small effect sizes (between .2 and .5) of the intervention. Student 1 showed large gains from her baseline quiz mean to intervention quiz mean (approximately 25 points higher). Similar gains were not seen from the withdrawal to the reinstatement phases of the study. However, Student 1 missed a great deal of the last two phases of the intervention due to an illness. Missing school and academic learning time may have accounted for lowest quiz grades found in the reinstatement phase. Student 5 showed consistent, but small gains in quiz means during the intervention phases of the study. Further, a large positive effect size for homework completion and a small positive effect size for homework accuracy. As mentioned, student 5 also received the highest grade for the first quarter report card (94) and his positive homework behavior during the intervention phases may have related to these increases in academic performance.

The positive relationship between completing homework and academic achievement is well documented in the research (Cooper, 1989b; Cooper et al., 1998; Cooper et al., 2006; Keith et al., 1993; Marzano & Pickering, 2007). As mentioned, eight of the students showed positive effects of the intervention with respect to academic performance, and the majority of these students also displayed improvements in homework completion and many with homework accuracy. Thus, it may not be surprising that in the current study, as homework completion rates increased, so did academic achievement of students.
Another reason for improved quiz grades in the current study may relate to teacher feedback. Olympia et al. (1994) indicated that a good homework program should include assignments that are assigned regularly with prompt feedback. Prior to the study, the teacher would simply record if the homework was complete or not, but did not correct the homework. In contrast, during the implementation of the intervention, the teacher provided the students with more feedback. She collected the homework and scored each assignment for accuracy. During the intervention phases, more students completed homework and these assignments were handed to the teacher and therefore graded. Thus, the teacher correcting each problem may have helped the students understand where their mistakes were. In addition, when the assignment was reviewed as a class, student had more time to reflect on their mistakes, as their homework was now completed at higher rates than in the past and had corrections.

It is also pertinent to discuss those students who showed no or negative effect sizes with respect to academic performance. Student 2 and Student 8 showed no significant effect sizes of the intervention. However, positive gains were found for Student 8 in respect to quiz grades. Grades increased from baseline to intervention and remained relatively stable from the withdrawal to the reinstatement phases of the study. What is even more essential is that the reinstatement quiz mean was almost 14 points higher than at baseline. In addition, while Student 2 did not show increases in quiz grade during the first intervention phase, this student did show improvement from the withdrawal to the reinstatement phase, and final reinstatement quiz mean was almost 9 points higher than original baseline rates. Nine points has a great impact when related to letter grades, as this student went from a grade in the 80s range (predominately related to a letter grade of a ‘B’) to a grade in the 90s range (predominately related to a letter grade of an ‘A’).
Student 4 was the only student who showed a small negative effect of the intervention for academic performance. This student showed minimal improvements in quiz grades from baseline to intervention, but then showed a decline in quiz performance during reinstatement. However, it should be noted that while this student tended to hand in homework that was complete, his accuracy was often very poor and he displayed a decline in accuracy during the reinstatement phases as well. Student 4 also had the lowest IQ in the class, which could have attribute a skill deficit interfering with his ability to do well on academic tests. Further, there was a negative effect size of the intervention found for this particular student when looking at both his homework completion and his homework accuracy.

**Differential Effectiveness of the Intervention**

The positive findings of the current study, especially in relation to academic performance, are noteworthy as they signify that a school-based intervention can elicit positive improvements in student homework behaviors and academic achievement. Further, this was the first study to investigate effects of an entire class of high school students that were classified special education students. Given that this study took place in a natural classroom setting within a special education classroom containing unique students as participants, the varied results may not be surprising. Considering the differences in the classes’ disabilities, mathematics achievement and skills, cognitive abilities, absenteeism rates, as well as other environmental or personal stressors, it is noteworthy that positive results were seen.

Certain characteristics of each of student’s specific disability may have had a differential impact on the results. The current sample included six students with a Speech or Language Impairment, two students that were classified as having a Learning Disability, two students classified with Autism, and one that was classified as having an Emotional Disturbance. The
literature has identified a number of difficulties students with disabilities have in completing their homework or doing so accurately. These problems include academic skill deficits, poor organizational skills, difficulty with sustained attention, and poor self-regulation to remain on task (Power et al., 2006). Since many students with disabilities display similar problems with homework completion, it is assumed that homework interventions would be similarly effective for those students with disabilities. However, with respect to the results of the current study, the great variability of those students with disabilities within the classroom may have been related to the differential effectiveness of the homework intervention.

Other individual student factors, such as academic skill deficits, may have been related to the success or limitations of this intervention. As some research has suggested, students with disabilities are at-risk for difficulties completing homework because they may not be able to complete it independently (Polloway et al., 1992). While the teacher planned and assigned homework tasks that involved content that she felt was appropriate to the instructional levels of her students, she provided the same assignment to all students (i.e., no differentiation was made for individual students). Thus, if one student had a significant deficit in a particular math area, he or she may have had more difficulty completing the homework and doing so with accuracy.

Various environmental, natural, or personal stressors may have impacted some student’s ability to hand in homework or complete it accurately. Outside variables were not taken into account, and may have impacted the results of this study. If a particular student had a personal problem or other environmental occurrences, these issues could have negatively impacted their ability to hand in homework, which in turn could have effected some of the results. While the teacher tried to make every attempt to gather this information, personal or environmental stressors of each student were not always readily available or apparent. For instance, Student 10
had to be hospitalized toward the end of the study for mental health reasons. While some positive results were seen for student 10, the various mental health problems the student was undergoing throughout the weeks of the study may have influenced his results. Additionally, Student 1 had an illness that caused her to be absent for a large majority of the second baseline and intervention phase. This was a medical problem, not necessarily a mental health issue, but could have impacted her homework compliance throughout the study as well.

In addition, the level of parental involvement was not taken into account for each student. Involving parents in the homework process itself or education process in general has been seen to increase student completion of homework and has been positively related to student achievement (by Fan & Chen, 2001; Jeynes, 2005; Patall et al., 2008). It is possible that the differing levels of parental involvement for individual students may have related to some of the differential results. It was not possible to monitor aspects of parental involvement throughout the study and no data was taken to document if parents were involved in helping students to complete homework.

Student absenteeism may have also differentially impacted the results. Since the study was conducted in a natural setting with high school students, there were some students who had chronic or numerous absences. This may have negatively impacted the results of the study. Some other students sporadically missed many days of school throughout the weeks that the study took place. When missing school the student is also missing out on academic learning time within the classroom, as well as the relevant skills needed to complete homework accurate. It is quite possible that the chronic absenteeism impacted the results of the study for particular students, and potentially for other students who missed a great deal of days throughout the course of the study. This was more likely to affect their homework accuracy and academic achievement.
Rates of homework completion and accuracy during follow-up were rather low. It should be noted that regular classroom procedures were used for the majority of time after the completion of the reimplementation phase and during the follow-up period. In regard to homework completion, about half the students showed improvements or similar rates to baseline at follow-up, but the overall mean was much lower across the entire class. Similar results were seen for homework accuracy. Academic achievement data was not available during the follow-up phase. A few reasons may explain these decreases during follow up. First, there were only three data points collected, which may have contributed to the lower rates. Further, the teacher did not consistently use the intervention after the final reinstatement phase. She would randomly choose a day that she would use the intervention (only did this on two occasions). Furthermore, the students were not handing in their homework, and thus not having their homework corrected and receiving feedback from their teacher. This inconsistency may have contributed to the low rates at follow-up, as students may not have been as motivated to complete their homework. Perhaps it is not surprising that rates decreased toward baseline levels, as the students’ homework was no longer a primary focus for the teacher, which in essence may have contribute to students no longer focusing on completing their homework fully or accurately.

**Randomized Contingency Components**

One important aspect of this study was the use of randomization of the components of the interdependent group contingency to hopefully improve the effectiveness of the intervention over a non-randomized design. Past research has shown that when randomizing the components of a group contingency, encouraging results in the decrease of behavior problems or increases in academic performance have been found (Alric et al., 2007; Kelshaw-Levering et al, 2000; Madaus et al., 2003; Theodore et al., 2004). However, much research has studied the impact of
the random reward or mystery motivator, but less so have focused on the influences of a
randomly chosen criteria or goal to receive this reinforcement.

**Random rewards.** The results of this study support the use of randomization for the
contingency components. Students reported that they enjoyed the daily rewards they were
receiving, as this was the highest rating on the consumer satisfaction survey. Further, the teacher
anecdotally noted that the students got extremely excited when she would pick a reward, as they
enjoyed the anticipation of not knowing what they would receive. This is consistent with
research on the effectiveness of the mystery motivator, which has shown that randomization has
shown a decrease in behavior problems (Kowalewicz & Coffee, 2013; Murphy et al., 2007;
Schanding & Sterling-Turner, 2010), increases in academic performance (Alric et al., 2007), and
increases in homework have been found (Madaus et al., 2003; Moore et al., 1994).

**Random goals.** In contrast, on the consumer satisfaction scale, the students rated ‘I liked
not knowing the homework goal that would be selected each day’ to be the lowest score (e.g., it
was an average score of three, which denoted neither degree nor disagree). While no study has
specifically investigated if random goals impact student success, one study did investigate if
varied reinforcement impacted homework compliance. Little et al. (2010) found that using an
interdependent group contingency with varied or constant reinforcement had similar benefits for
homework accuracy; however, constant reinforcement show slightly great increases in
homework completion. Even though Little et al. investigated varied homework reinforcement,
not criteria for reinforcement, it is possible that variable homework goals may have impacted
some student’s motivation to complete homework. Students may have been affected by the lack
of predictability and stability of not knowing what the homework goal was each day. Due to the
fact that this was a class of special education students who were in a smaller classroom setting
due to the need of structure and consistency, the lack of predictability of not knowing the goals may have caused inconsistent patterns of homework behavior.

Further, not consistently earning a reward may have impacted the students. The students earned the reward more consistently during the second intervention phase. For instance, during the first intervention period the students earned the reward seven out of 12 days. During the reinstatement, the students earned the reward 10 out of 12 days. Due to lower withdrawal baseline rates, goals were correspondingly slightly lower. It is possible that some of the increased homework completion in the second intervention could be because they earned the goal more consistently.

**Educational Implications**

This study adds to the literature to support the use of interdependent group contingencies with randomized components to increase homework completion and accuracy. While previous research has examined the effects of group contingencies, the majority has focused on the elementary grade levels (Little et al., 2010; Lynch et al., 2009; Reinhardt et al., 2009; Theodore et al., 2009). Thus, the current study demonstrates that this intervention can also be effectively used at the secondary grade levels, where there is a paucity of research. Not only was this was one of the first studies to employ a group contingency intervention with high school students, this was also one of the few to use a whole class of special education high school students. Further, to date, there have been no studies measuring the impact on achievement while using a group contingency homework intervention. The significant (both statistically and practically) increases found in homework completion and academic performance while using the intervention supports the efficacy of this intervention to improve not only homework behavior,
but academic achievement. The positive outcomes of this study demonstrate the effectiveness of the intervention across a broad spectrum of classroom types and students.

As was shown through the teacher acceptability survey, teacher acceptability of the intervention was high. The teacher strongly agreed that most teachers would find it suitable for homework problems and that it was somewhat effective for changing the student’s homework behaviors. Further, the teacher agreed that it was a good way to handle problems with homework compliance. She also strongly agreed that it was a reasonable intervention for homework and that she liked the procedures. Thus, the teacher did find the intervention to be acceptable, appropriate for homework problems, as well as effective for increasing homework compliance. She was satisfied with the increase in homework completion and accuracy rates when she was employing the intervention. This adds evidence to the use of interdependent group contingencies, as it is a practical intervention to implement during the school day, and is seen by a teacher as a valuable tool in increasing students’ homework completion, accuracy, and achievement.

According to consumer satisfaction survey data, students were most satisfied with the intervention itself, including the procedures and rewards. The highest rating on the survey was that they liked the rewards that were earned. However, students felt somewhat ambivalent about the intervention helping them complete their homework and complete it accurately, as the average score fell within the range of ‘neither agree or disagree.’ Thus, the students may not have really reflected on whether the intervention helped them or not. While they were easily able to identify what they liked (e.g. rewards), they were less able to reflect on whether it helped them on not. Further, it is unclear if they were satisfied with depending on each other to meet their goals, thus the interdependency of the intervention may not have been beneficial in this case.
Anecdotally, the teacher indicated that her students exhibited increased eagerness for homework during the intervention and they appeared to enjoy using the intervention. She explained that they were excited to find out what their criterion would be and were very animated when they met their goal. Further, she reported that the students showed disappointment when they did not meet their goal, and thus did not earn the reinforcement. The teacher did remark that the students were even more excited when they earned an especially rewarding reinforcer (e.g., points to pizza party). The teacher reported that students did not make comments (encouraging or negative) to others about completing homework, but the PI instructed the teacher not to share which students did or did not complete homework. Thus, the students may not have been aware that when other students did not complete their homework, they had less of a chance in meeting their goal. Having to work together and be dependent on one another to meet goals may not have been a supporting factor in the current study. Nonetheless, it did appear that the students enjoyed the various components of the intervention.

This intervention is also easy to implement for the teacher and to do so with fidelity. For instance, in the current study, the intervention was implemented with 100% integrity and with 100% interobserver agreement. This indicates that the intervention is one that can be implemented to target an entire class, and is able to be managed by one teacher efficiently to facilitate homework compliance and academic progress.

Limitations

One limitation inherent to any single subject design is generalization, which threatens the external validity of the results. Due to the nature of using a single class of students with specific skills and needs, it is difficult to predict how well this intervention would work with other classes of students. As Kazdin (1982) notes, studying a specific population with very unique features
may limit the extension of the findings to people with similar characteristics. This is even more apparent in this study, as participants were all high school students’ part of a smaller special education class and were all classified with a disability that impacts their education performance. Thus, the results of this study may only be applicable to high school students from smaller special education classrooms, and may not be applicable to special education students whose placement is within general education or inclusion classrooms.

The first limitation, or threat to internal validity, relates to the inconsistent baseline data of the students. It is important for data to be stable during baseline in order to truly evaluate intervention effects (Kazdin, 1982). Unfortunately, data were variable for the majority of students in both homework completion and accuracy rates throughout baseline. It would have been beneficial to have a stable baseline to compare to intervention data, but in this case it was not possible due to the inconsistent nature of the students, especially with respect to accuracy.

The second limitation in respect to internal validity was the inconsistency in the length and content across assignments. While homework was kept as consistent as possible on a daily basis, there was variability across assignments from day to day. The teacher attempted to make most assignments of similar length (e.g., 10 – 15 problems), but if one assignment was slightly longer than another or more difficult, these differences may have impacted a student’s motivation to complete the assignment or ability to do so accurately. This may demonstrate a threat to the study’s internal validity, as the effects or non-effects of the intervention may have been due to the homework assignment itself and not the intervention.

Similar to length of assignment, the content of the assignment was not kept the same throughout all phases of the study. While every assignment involved solving math problems and equations, the topic would vary based on the algebra curriculum that the teacher was covering in
class that particular day or week. For instance, the teacher began baseline reviewing prime numbers, factors, ordering numbers, and fractions. During the first intervention phase the teacher focused on order of operations and then moved into measurement. The teacher started with evaluating and simplifying expressions during the intervention phase and continued with expressions during the second baseline. Finally, she ended with graphing and slope during the last reinstatement phase. Many of the students had noted difficulties with mathematics, and if they were frustrated by one specific content area of mathematics, this content may have impacted their homework completion and accuracy rates. Similarly, if one particular area was more difficult for a student, even with the aid of the intervention, it may not have been enough to compensate for a skill deficit and the student would therefore not show improved academic achievement.

An additional limitation was the difficulty in separating the skills deficit from the performance deficit that that many of these students exhibited. While the teacher made every effort for homework to be a review of the daily classroom work, students may still have had difficulty in accurately completing the assignments. This may be why the intervention was more effective for students completing their homework, rather than doing so accurately. This may also explain why students, such as Students 4 and 9, showed increases in completion rates, but a decline in accuracy over time in the intervention.

Another potential threat to internal validity of the study was the inability to control parent or caregiver influence or involvement in each student’s homework process, and the lack of any measure to assess this potential role in the current study. As research has suggested, involving parents in the homework process has been seen to increase either student completion of homework, accuracy of homework, student achievement, or all three factors (Patall et al., 2008).
Further, negative attitudes and low expectations by parents can also decrease a student’s success with homework (Polloway et al., 1994). Some of the students in the present study may have parent support at home, either encouraging them to complete the homework or working with them to accurately complete the homework, while others may not have had this support. In the present study this was not measured, thus parental assistance cannot be ruled out as a potential influence or reason for the results.

Similarly, students’ social and life factors could not be controlled in the current study. These may include negative life events or stressors the students were experiencing, problems with their families, or any other daily problem that one individual student may have been experiencing, when others did not. While the teacher anecdotally reported on any significant events in the students’ lives, these were not measured or documented in any specific way.

**Future Research**

The positive impacts of this intervention provide support for the use of interdependent group contingencies to improve homework completion, homework accuracy, and academic achievement for high school students with disabilities. This was one of the first studies to study the effects of an interdependent group contingency with an entire class of special education high school students. Since most of the research takes place at the elementary level (Little et al., 2009; Lynch et al. 2009, Theodore et al., 2009 Reinhardt et al., 2009) it is imperative to utilize this intervention with additional groups of high school students. To add to this, research should be extended to different academic content areas (i.e., history, science, etc.) and settings (i.e., general education and inclusion classrooms) at the high school level. Additionally, future research should continue to explore the use of this intervention with groups of students who have disabilities, to determine the effectiveness and generalizability of the intervention.
The academic impact of increases in homework completion and accuracy through use of the intervention should also be further explored. While this study employed quiz grades, future research may want to use other measures to calculate academic performance, such as standardized academic measures, a measure of classwork, or a curriculum-based measure. This could be done through repeated measure, or possibly using a measure of academic performance pre and post intervention.

Lastly, this study utilized a limited follow-up period. While this was an improvement on other studies that included no follow-up, future research should measure the long-term effects of the intervention. Including follow-up data on completion, accuracy, and achievement rates over a longer period of time would add to the efficacy of use of the intervention.

**Conclusion**

The current findings of this study indicate that the interdependent group contingency was effective in improving the homework performance of high school students with disabilities who have homework problems. This study showed that use of an interdependent group contingency is an effective intervention to employ within a special education classroom to enhance students’ homework completion, homework accuracy, and achievement. Importantly, both the teacher and the students liked the intervention, found it valuable in helping change their homework behavior, and overall, found it to be an effective intervention. While there were some limitations to the study itself, this research presents a viable and practical intervention for teachers to utilize in their classrooms to help address homework completion or accuracy problems, and to increase academic achievement at the same time.
Appendix A

Parent/Guardian Consent Form

Dear Parent or Guardian,

My name is Maria Russo and I am a student in the Educational Psychology Ph.D. Program at the Graduate Center of the City University of New York (CUNY), and Principal Investigator of this project, *The Effects of an Interdependent Group Contingency on Homework Completion, Accuracy, and Achievement*. The purpose of this study is to improve homework completion and accuracy of students. I would like permission to include your child in the use of a strategy that will help him or her with completing homework accurately. All students in the class will have the opportunity to earn rewards upon handing in daily homework assignments. At the completion of the study your child will be asked to complete a short survey consisting of questions about how they feel about doing homework and how they felt about being in the study, which should only take around 5 minutes. I will also be collecting achievement data on your student, including quiz and test grades. The study is expected to improve the amount of homework that all students complete, improve accuracy rates, and have a positive effect on achievement.

This strategy will be used for six weeks and will take approximately five minutes each day. There is no punishment if students fail to complete homework outside of the normal homework policy that the teacher already has established in the classroom. All information collected will be kept strictly confidential, and will be stored in a locked file cabinet to which only my advisor and I will have access. Participation is entirely voluntary and you may withdraw your child at any time, with no negative consequences to your child.

There is no known risk or harm to participating in this study. The benefit of your child’s participation is to increase his or her homework completion and accuracy and to practice academic skills outside the classroom. There will be approximately one teacher and fifteen students taking part in this study. I may publish results of the study, but names or any identifying characteristics will not be used in any of the publications. If you would like a copy of the study, please provide me with your address and I will send you a copy in the future.

If you have any questions about this research, you can contact me at (631) 241-5085 or MRusso1@gc.cuny.edu or my advisor Dr. Marian Fish at (212) 817-8290 or MFish@gc.cuny.edu. If you have questions about your rights as a participant in this study, you can contact Kay Powell, IRB Administrator, The Graduate Center/City University of New York, (212) 817-7525, kpowell@gc.cuny.edu.

I agree to let my child ______________________________ participate in the study.

(Child’s name)

__________________________________  ______________________________________
Parent’s signature                          Date                           Investigator’s signature            Date
Appendix B

Student Assent Form

Dear Student:

You have been chosen to participate in a research study. The purpose of this study is to improve homework behavior of students. All students in the class will have the opportunity to earn rewards upon handing in daily homework assignments. Some examples of these rewards include free time at the end of class, 5 points on lowest assignment, pen or pencil of choice, etc. At the end of the study you will be asked to answer some questions about the study.

You do not have to be in this study if you do not want to and you can stop at any time. Your parent or guardian has told us it is ok for you to participate. If you want to participate, please check the box under “I agree to participate” and sign this form. After it is complete return it to your teacher.

I agree to participate [ ]

I do not agree to participate [ ]

____________________________________
Sign your Name

____________________________________
Print your Name

____________________________________
Print your Name
Appendix C

Homework Data Collection Sheet

Date: ______________

Number of HW problems assigned: ________

<table>
<thead>
<tr>
<th>Student’s ID Number</th>
<th>Completed (√, X, or A)</th>
<th># of Problems Completed</th>
<th># Problems Accurate</th>
<th>% Problems Accurate</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Class Total

√ = At least half of homework has been completed
X = Less than half of homework has been completed
A = Student was absent
During the next few weeks you have the opportunity to earn rewards for handing in complete and accurate Homework. Please look at the following rewards you may earn. Rank them from 1 to 10, with 1 being your first choice, and 10 being your last.

___ Highlighter

___ Mechanical Pencil

___ Colored Pen

___ Two points added to lowest quiz grade

___ Five points added to lowest homework assignment

___ Candy of choice (Indicate favorite ________________________)

___ Homework pass (to be used during second term)

___ Small notepad

___ Points toward class pizza party

___ Small bottle of hand lotion
For the next few weeks we will have a new homework program in our class. Your aim as students is to accurately complete your homework each day and you will then be rewarded as a class for doing so. I have determined certain percentages for class homework completion and homework accuracy that will be your criterion, or goals. I have written these on index cards, placed them in this jar, and labeled the jar as “Homework Goals”. If the class has met the goal for the day, everyone will receive a reward. These rewards are what you have told me you find to be especially reinforcing. I have written these on index cards and placed them in this jar, labeled “Homework Rewards”.

This process is called an interdependent group contingency, because in order for the entire class to receive a reward, the class average must meet the criteria or goal for the day. Each day, I will collect and score your homework. At the beginning of the next day, I will select one card from the Homework Goals jar, which will be the goal the class. If the class meets the goal, I will select a reward from the reward jar. Every student in the class will receive the reward. This will happen each day that we are using the interdependent group contingency.
Appendix F

Treatment Integrity Checklist

Date: __________

<table>
<thead>
<tr>
<th>Step</th>
<th>What to do</th>
<th>Check when done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Collect homework from every student in class.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Score and record homework <em>completion</em> number for every student.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Score and record homework <em>accuracy</em> for every student.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Select a criterion from the <em>Homework Goals</em> Jar.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Determine if the class has met the criterion for the day.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>If they have met the criterion, tell the class.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Select a reinforcer from the <em>Reinforcers</em> jar if criterion was met.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Provide the class with the selected reward if the criterion was met.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>As long as it is not the last day before a return to baseline, explain to class they will have opportunity to earn reward again tomorrow when a new homework goal will be selected.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>At end of period, remind the class what the homework for the night is.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

Consumer Satisfaction Scale

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked being rewarded for accurately completing my homework assignments.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I believe the group contingency helped me COMPLETE my homework.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I felt the criteria for reinforcement was fair.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I liked not knowing the reward that would be selected each day.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I liked the rewards I earned.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I liked not knowing the homework goal that would be selected each day.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I believe the group contingency helped me complete my homework accurately.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I would like my teacher to continue the use of this group contingency.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix H

Intervention Rating Profile –15 (IRP-15)

The purpose of this questionnaire is to obtain information that will aid in the selection of classroom interventions. These interventions will be used by teachers of children with behavior problems. Please circle the number that best describes your agreement or disagreement with each statement using the scale below.

1=strongly disagree  2=disagree  3=slightly disagree  4=slightly agree  5=agree  6=strongly agree

1. This would be an acceptable intervention for the child’s problem behavior. 1 2 3 4 5 6

2. Most teachers would find this intervention appropriate for behavior problems in addition to the one described. 1 2 3 4 5 6

3. This intervention should prove effective in changing the child’s problem behavior. 1 2 3 4 5 6

4. I would suggest the use of this intervention to other teachers. 1 2 3 4 5 6

5. The child’s problem behavior is severe enough to warrant use of this intervention. 1 2 3 4 5 6

6. Most teachers would find this intervention suitable for the behavior problem described. 1 2 3 4 5 6

7. I would be willing to use this intervention in the classroom setting. 1 2 3 4 5 6

8. This intervention would not result in negative side effects for the child. 1 2 3 4 5 6

9. This intervention would be appropriate for a variety of children. 1 2 3 4 5 6

10. This intervention is consistent with those I have used in classroom settings. 1 2 3 4 5 6

11. The intervention was a fair way to handle the child’s problem behavior. 1 2 3 4 5 6

12. This intervention is reasonable for the behavior problem described. 1 2 3 4 5 6

13. I liked the procedures used in this intervention. 1 2 3 4 5 6

14. This intervention was a good way to handle this child’s behavior problem. 1 2 3 4 5 6

15. Overall, this intervention would be beneficial for the child. 1 2 3 4 5 6

Appendix I

Achievement Data Sheet

Date of assessment: ____________________

Type of assessment (quiz, unit test, etc.): ____________________

Topic: ____________________

<table>
<thead>
<tr>
<th>Student’s ID Number</th>
<th>Score</th>
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<tbody>
<tr>
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</tbody>
</table>
# Appendix J

## Criteria for Reinforcement

<table>
<thead>
<tr>
<th>Goals for first intervention period</th>
<th>Goals for reimplementation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% of class handed in homework</td>
<td>47% of class handed in homework</td>
</tr>
<tr>
<td>62% of class handed in homework</td>
<td>50% of class handed in homework</td>
</tr>
<tr>
<td>65% of class handed in homework</td>
<td>52% of class handed in homework</td>
</tr>
<tr>
<td>68% of class handed in homework</td>
<td>55% of class handed in homework</td>
</tr>
<tr>
<td>50% accuracy average of class</td>
<td>45% accuracy average of class</td>
</tr>
<tr>
<td>52% accuracy average of class</td>
<td>50% accuracy average of class</td>
</tr>
<tr>
<td>55% accuracy average of class</td>
<td>Highest accuracy score of 75%</td>
</tr>
<tr>
<td>58% accuracy average of class</td>
<td>Highest accuracy score of 79%</td>
</tr>
<tr>
<td>Highest accuracy average was 80%</td>
<td>Highest accuracy score of 80%</td>
</tr>
<tr>
<td>Highest accuracy average was 75%</td>
<td>Highest accuracy score of 85%</td>
</tr>
</tbody>
</table>
Appendix K

Reinforcer List

Mechanical Pencil
Two points added to lowest quiz grade
Five points added to lowest homework assignment
Candy of choice
Homework pass (to be used during second term)
Small notepad
Points toward class pizza party
Small bottle of hand lotion


Keith, T. Z. (1988). Using path analysis to test the importance of manipulable influences on


doi:10.1037/spq0000030


www.publicagenda.org/aboutpa/pdf/standards-backlash.pef


