The Effects of Mystery Motivators on Homework Completion and Accuracy of a 10th Grade Mathematics Class

By

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A Master's Project

Submitted in Partial Fulfillment

of the Requirements for the Degree of

Master of Science in Education

Inclusive Curriculum and Instruction

Department of Education

State University of New York at Fredonia

Fredonia, NY

December, 2013

Project Certification Page

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CERTIFICATION OF PROJECT WORK

We, the undersigned, certify that this project entitled, ***The Effects of Mystery Motivators on the Homework Completion and Accuracy of a 10th Grade Mathematics Class, by Heather Robin Candidate for the Degree of Master of Science in Education, Department of Curriculum & Instruction***, is acceptable in form and content and demonstrates a satisfactory knowledge of the field covered by this project.

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Abstract

Homework is a teaching strategy used in mathematics to promote student mastery of new material through practice. Unfortunately, many students fail to complete homework regularly, accurately, or independently. This study examined the effects of an intervention package consisting of dependent and independent group contingencies and mystery motivators on a 10th grade class' homework completion and accuracy rates. Using an A-B-A-B research design, the investigator found that the intervention package produced immediate and noticeable increases in all students' homework performance. These experimental effects were documented across subsequent experimental phases and anecdotal evidence suggested that the teacher and pupils found the intervention to be fun and helpful in completing math homework. These findings are highly consistent with previous results from the group contingency and mystery motivator literatures. Implications for future research and practice are discussed.

Introduction

Consistent and accurate homework completion has a positive overall impact on student achievement (Cooper, Robinson, & Patall, 2006; Keith & Keith, 2006; Little, Akin-Little, & Newman-Fig, 2010; Olympia, Sheridan, Jenson, & Andrews, 1994; Paschal, Weinstein, & Walberg, 1984; Trautwein, 2007). Academic benefits associated with successful homework completion include improved understanding and retention of content material (Salend & Gajri, 1995), increased mastery of basic academic skills (e.g., reading, writing, spelling, and math) through direct practice, and enhanced student independent mastery of content l (Epstein & Van Voorhis, 2001). Alternatively, not completing homework and/or completing homework with errors has been associated with lower graded, less motivation, and negative attitudes toward school and learning (Olympia et al., 1994). Since homework has academic benefits, researchers have studied many interventions to increase its completion and accuracy. Two interventions that were particularly effective and interesting are mystery motivators and group contingencies.

Mystery motivators are incentive systems that deliver random rewards for appropriate behavior to individuals, small groups, or an entire class (Rhode, Jenson, & Reavis, 1994). Their effects have been studied in a number of research studies over the past three decades, including a few that showed that they can increase homework completion and accuracy. Group contingencies also have a rich empirical history in psychology and education. They were used to improve a wide range of academic, behavioral, and interpersonal outcomes for individuals with special needs and their normally developing peers (Gresham & Gresham, 1982; Hulac & Benson, 2010; Litow & Pomroy, 1975; Skinner, Skinner & Burton, 2009). The purpose of the present study was to examine the effects of a classroom intervention package containing both interdependent and dependent group contingencies and mystery motivators on the homework

completion and accuracy rates of a class of 20, 10th grade math students in a rural setting. It is anticipated that more students will complete daily math homework and with a higher level of accuracy. More specifically, this study addresses the following research questions: What effects does the mystery motivator game, a combination of group contingencies and unknown rewards, have on the percentage of students completing daily math homework, as well as the accuracy with which they complete their work?

Before describing study procedures, a brief illustrative literature review is provided around three relevant topics: (a) unknown rewards (i.e., mystery motivators), (b) group contingencies, and (c) combined group contingencies and mystery motivators.

Instructional Challenges in 21st Century Classrooms

Teaching in contemporary classrooms is not easy. Pupil diversity continues to increase along multiple dimensions, (e.g., ethnicity, linguistic competence, socio-economic status, academic achievement, and social development) higher academic standards have become the norm, and policy-driven accountability systems that tie pupil learning to teacher evaluation are being put in place (i.e., Annual Professional Performance Reviews). Teachers must instruct more diverse pupils to higher learning outcomes and provide evidence that they did so well. One area where many teachers have struggled is getting *all* students motivated enough to complete homework consistently, accurately, and independently. Student failure to complete homework and/or doing it incorrectly continues to concern both parents and educators. Many students lack self-regulatory and independent work skills and many others lack the academic competence to complete homework assignments regularly (Olympia et al., 1994). Additionally, some students are simply not interested in school-related work despite the negative consequences associated with homework incompletion (Rathvon, 1999).

Another instructional challenge for teachers is finding incentives that are equally motivating for an entire class of students. Some students, for example, may find eating lunch with the teacher to be highly motivating, others may be less enthralled, and some others might even prefer to eat alone. If consequences do not interest students, then they are not likely to work hard to reach their goals. One novel approach that was used with group contingencies was mystery motivators (MM) (Rhode et al., 1993). Mystery motivators are incentive systems that deliver random rewards for appropriate behavior to individuals, small groups, or an entire class. There are two parts to the MM system. The first is a series of boxes that represent the days of the week (e.g., a class calendar). An invisible ink pen is used to put an "M" on randomly selected days when rewards are available (e.g., two or three of five days). A criterion is set (e.g., class average on homework at least 80% correct); if met, students use a developer pen to color in the daily square. In an "M" appears, then a reward is given; if not, students are encouraged to try harder the next day. (Students should be given frequent opportunities to win and earn rewards initially; frequency can be thinned over time). The second MM component is a series of highly decorated envelopes that are displayed prominently in class. Each envelope contains a paper slip with the name of a mystery reward. When students meet criteria and an invisible "M" appears they pick one of the mystery envelopes. The Mystery Motivator intervention was designed to increase the proficiency of any academic or behavioral task demand by providing a "mystery" reinforcement using a random schedule (Jenson, Rhode & Reavis, 1994). The strategy has been effective because of its design in which it takes the idea of a reward which already increases pupil performance and adds a twist by keeping items a mystery. Adding the surprise element into the strategy maintains student interest for extended periods of time (Jenson et al., 1994). This intervention was used across the curriculum including math, science, history, language arts, and

music. It has also been used in general and special education classrooms as well as at the elementary and secondary levels.

Mystery motivators are *recognition tools* based on a lottery-like system that allows individuals to select from a variety of high- and low-value prizes for engaging in preferred appropriate behaviors (Wesley & Mattaini, 1999). Anticipation and interest are maintained as a result of the uncertainty of the reward. Each day targeted positive behaviors are achieved, individuals select the corresponding day on a weekly chart. If the box on the corresponding day contains a Mystery Motivator symbol, then the individuals pick a reward from the reward menu (Wesley & Mattaini, 1999).This strategy can be implemented with a specific student in mind or it can be implemented with an entire class. In this study, the mystery motivator was used in combination with interdependent and dependent group contingencies.

Group Contingencies

As noted earlier, group contingencies have been used effective in numerous school settings to improve disruptive behavior, academic achievement, and more recently, homework completion and accuracy (e.g., Murphy, Theodore, Alosio, Alric-Edwards,& Hughes, 2007; Popkin & Skinner, 2003; Sharp & Skinner, 2004; Theodore, Bray, & Kehle, 2004; Theodore, Bray, Kehle, & DioGuardi, 2003; Theodore, Bray, Kehle, & Jenson, 2001). Moreover, it was reported that group contingencies do not require much teacher time and effort and that pupils tend to like them. Elliot, Turco, and Gresham, (1987) suggested that group contingencies can be utilized to improve the academic and behavioral performance of an entire class and they can be easily integrated into existing curricula. The “power” behind group contingencies lies in their ability to harness positive peer influence and attention (Litow & Pumroy, 1975; Skinner, Cashwell, & Dunn, 1996; Stage & Quiroz, 1996).

Litow and Pumroy (1975) initially described three types of group contingencies: (a) independent, (b) dependent, and (c) interdependent. An independent contingency requires the same criteria, behaviors, and reinforcement for all students; however, reinforcement is delivered individually, based on the *independent* performance of each student. A dependent group contingency, in contrast, is established when the entire group receives reinforcement based on one or a few students attaining a specified criterion. For example, the whole class earns five minutes of extra recess time if row #1 finishes all their work before the bell. Finally, an interdependent contingency consists of dispensing the same reward to all students based on the collective performance. For example, the whole class earns a pizza party when they read 100 books independently. Other ways to establish interdependent contingencies include: (a) dividing class into teams, (b) averaging their performance, (c) requiring everyone in class to meet the same criterion, and (d) setting either a minimum or maximum criterion that either each student or group of students must meet (Theodore, DioGuardi, Hughes, Aloiso, , & Eccles, 2009).

Although there are no significant differences between the three types of group contingencies (Gresham & Gresham, 1982; Shapiro & Goldberg, 1986; Theodore et al., 2004; Theodore, 2009) interdependent versions include several noticeable advantages. They facilitate positive peer interactions because the class works toward meeting common goals (Kelshaw-Levering, Sterling-Turner, Henry, & Skinner, 2000; Theodore et al., 2009); they are time efficient and require little effort because teachers are only managing one contingency program (Davis & Blankenship, 1996; Theodore et al., 2009); and they avoid potential pitfalls (e.g., peer criticism and rejection) because the entire class either does or does not win (Skinner et al., 1996; Theodore et al., 2009).

There are, however, some potential disadvantages as well. First, students who are compliant and follow the classroom requirements may become frustrated over not earning a reward simply because the entire class did not reach the criterion. (Skinner et al., 1996; Theodore et al., 2009). This may result in resentment, retribution to the culpable individual(s), and perhaps a decline in their performance as well (Skinner et al., 1996). Second, if selected rewards are not appealing or even disliked, then they may not motivate pupils and produce desired changes (Kelshaw-Levering et al., 2000). Consequently, students may continue to engage in undesirable behavior and deliberately sabotage the program. (Theodore et al., 2009) Third, if students perceive that their opportunity to earn rewards is ruined, they may discontinue following classroom requirements (Popkin & Skinner, 2003). Finally, modifying one area of behavior may simultaneously result in the display of other behaviors that have not been targeted for change or a decline in other academic areas (Kelshaw-Levering et al., 2000; Popkin & Skinner, 2003; Theodore 2009). If pupils earn rewards in math, for instance, they may not work as hard in reading or science. Two ways to minimize these potential limitations are to randomize contingency components and keep them unknown to pupils (Hulac & Benson, 2010; Skinner et al., 2009).

Randomized Rewards

Randomized reward requires teachers to keep potential consequences unknown to the learners. As noted one of the more common and effective forms of unknown rewards are mystery motivators (Rhode et al., 1994; Madaus et al., 2003). There are several benefits to randomizing consequences but perhaps the two most striking are that (a) this approach decreases the possibility that students will sabotage the program because they not like the selected reward; and (b) because the rewards are a mystery, students are less likely to become disappointed and/or

frustrated if they do not earn a desired item or activity (Skinner et al., 1996; Theodore et al., 2009). The following studies show how interdependent and group contingencies were used in conjunction with mystery motivators to bring about significant improvements in students' academic and behavioral performance.

Literature Review

In an initial investigation comparing the effects of independent, dependent, and interdependent group contingencies, Gresham and Gresham (1986) studied 12 students varying in ages from six to 10 years old (M =8.2 years old) and with IQ's ranging from 45-68 with an average of 57. The researchers compared the effects on the three group contingencies to teacher-led instruction on pupils' disruptive behaviors in a self-contained special education classroom. They found that when the interdependent and dependent group contingencies were in place disruptive behavior decreased significantly and quickly. In fact, disruption decreased from an average of 32 disruptions per day to 10 in the first five days of intervention. These effects were replicated across two subsequent phases. With interdependent contingencies in place student disruptions average nine per day and with dependent group about 16. Gresham and Gresham (1982) concluded that group-oriented contingencies were more effective than teacher-led procedures in reducing the class' disruptive behavior.

A later study conducted by Kelshaw-Levering and her colleagues (2000) was an initial attempt to randomize group contingencies through the use of a series of opaque jars. Target behaviors, criteria, target students, and contingent rewards were randomized using one or four jars and compared to the effects of teacher-led procedures in reducing the disruptive behavior of a second grade classroom. The study involved 12 students whom their highly experienced teacher described as one of the most challenging groups in her career. Baseline assessments

indicated that students engaged in an average of 38 disruptive behaviors per instructional session (i.e., 90 minutes); a rather high level of disruption indeed. The investigators then compared the effects of one jar which only randomized rewards to four jars which randomized all contingency components. Both approaches were more effective than existing instruction and reduced disruption to about 12 disruptive behaviors per session. Behavioral disruptions were later reduced to less than five per class. The researchers concluded that while both group contingencies were more effective than teacher-led instruction, the four jars (all components randomized) was slightly more effective than simply keeping rewards unknown to students (i.e., one jar).

Theodore, Bray and Kehle (2004) conducted a third empirical investigation that compared the effects of group contingencies and randomized rewards to an existing classroom management system in reducing the disruptive behaviors of three, 17 year old males diagnosed with serious emotional disturbance according the Individuals with Disabilities Education Act (IDEIA, 2004). The study took place in a self-contained classroom and baseline data showed that disruptive behaviors occurred up to 60 times per observation session. Using an alternating treatments design (AltD), the researchers found that group contingencies immediately and noticeably reduced disruptive behavior to zero to10 times per session. Follow-up observations found that treatment effects were partially maintained. Social acceptability assessments indicated that the teacher was very satisfied with the intervention while students were lukewarm at best. Results showed that the three different contingencies reduced disruptive behavior across all three participants. This research demonstrated that the impact of unknown rewards, in particular, as a strong motivator for students (Theodore et al., 2004).

Another empirical study (Heering & Wilder, 2006) examined the effects of dependent group contingencies in particular on the on task behavior of pupils in two general education classrooms (i.e., 3rd & 4th grade). The study was conducted during math and the researchers found that when group contingencies were introduced on-task behavior increased to 80% and 90% respectively across the two classrooms. This was a noticeable improvement about baseline on task rates (i.e., 38% & 46%). Follow-up observations showed partial maintenance effects for target students across both classrooms.

The next investigation (Lynch, Theodore, Bray, & Kehle, 2009) examined whether group contingencies and randomized rewards would increase homework completion and accuracy among six pupils who were classified with a learning disability or speech impairment. All students were enrolled in a self-contained class at a suburban elementary school and ranged in ages from 10 to 11 years old. Baseline data showed that the six students' mean accuracy on homework was 46%. Under group contingencies, however, pupils' homework averages jumped immediately to a range of 86% to 95%. Data indicated further that for four of six students (67%), interdependent group contingencies were the most effective. During the final phase, two students maintained 100% accuracy across all homework assignments. One student showed great variability in his post-intervention performance.

The final study (Theodore et al., 2009) examined the scope and application of empirical interventions to improve homework completion and accuracy and added to a limited number of studies addressing this issue. They monitored the homework completion and accuracy of 21(13M & 8F), 4th grade students including six with IEPs and one with a 504 plan across multiple experimental phases. Results showed once again that interdependent and dependent group

contingencies were particularly effective in improving students' homework performance. Moreover, students with special needs were equally responsive to the intervention procedures.

In conclusion, this illustrative literature review suggests that homework completion and accuracy are important educational outcomes for children. The literature suggests as well, however, that many students fail to either complete homework regularly or they do so with low accuracy. Research also indicates that there are a number of effective classroom-based interventions for improving student performance. This review focused on two particular research lines involving group contingencies and mystery motivators. Both research lines reported immediate and noticeable improvements in pupils' academic and behavioral performance when group contingencies were used instead of existing teaching practices, compared the effectiveness of all three contingency types (i.e., independent, dependent and interdependent), and all reported medium to high satisfaction ratings among pupils and teachers alike. One area that received very little attention, however, was homework completion and accuracy at the high school level.

The purpose of the present study, therefore, was to examine the effects of an intervention package containing both interdependent and dependent group contingencies and mystery motivators, on the homework completion and accuracy of a lower performing 10^{th} grade math class in a rural Western New York setting. The primary research questions are: (a) what effect will the intervention package have on 10^{th} graders' daily math completion rates, and (b) what effects will it have on their daily math homework accuracy?

Method

Subjects and Settings

The study was conducted in a medium-sized (i.e., 800 students), rural high school in Western New York. It took place in a 10th grade, general education mathematics classroom

comprised of 20 students (12F, 8M). Seventeen students were Caucasian and three were Hispanic. Students ranged in age from 14 to 16 years old and five had IEPs for learning disabilities (i.e., attention deficit hyperactivity disorders). The classroom teacher was approached initially by the primary investigator to determine if he was experiencing any learning challenges in his 10th grade math classes. The teacher, a Caucasian male with approximately eight years of teaching experience, noted that a substantial proportion of students in one math class failed to complete homework and when they did their overall accuracy rates were below grade expectations. This particular class was his most challenging group to motivate and engage in math-related work. The Mystery Motivator Game was explained to the teacher and he expressed his interest in participating in the project. Teacher, pupil, and parent consent was obtained according to the University Institutional Review Board policies and procedures. The project was conducted during regularly-scheduled math classes and all homework assignments were standardized for length, difficulty, and format.

Dependent Variables

The primary dependent variables in the study were (a) percentage of students who completed and turned in daily math assignments and (b) percent correct on those assignments. Completion percentage was calculated by dividing the number of students who turned in homework by the number of students present in class times 100%. If a student was present and failed to turn in homework a grade of zero was assigned. Percentage correct was calculated by counting the number of math problems completed correctly by the number of math problems assigned times 100%. As noted, if a student attended class, but did not turn in homework then a 0 grade was given. Completion and accuracy data were aggregated at the class levels. Daily mean completion and accuracy rates were then displayed graphically using simple line graphs. Data

were analyzed using established rules for visual inspection detailed in the literature (e.g., Horner, Carr, Halle, McGee, Odom, & Wolery, 2005; Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf & Shadish, 2010).

To ensure that data were being collected accurately and consistently, the investigator and classroom teacher *independently* scored pupils' math assignments during 25% of randomly selected days across all experimental phases. Inter-scorer agreement was calculated on an *item-by-item* basis. If both scorers marked an item in the same way (i.e., both complete and/or correct) then that item was marked as an agreement (A). If independent scorers marked items differently (i.e., one complete and one incomplete OR one correct and one incorrect) then that item was scored as a disagreement (D). Inter-scorer agreement was then calculated as the number of agreements divided by the number of agreements and disagreements times 100%. Inter-scorer reliability averaged .92 over the course of the investigation with a range of .84 to 1.0.

Independent Variable

The independent variable was called the Mystery Motivator Game and it consisted of (a) interdependent and dependent group contingencies (i.e., 100% completion, 80% accuracy), (b) randomized target students, and (c) contingent rewards including mystery motivators. Reward criteria were established initially based on pupils' baseline performance and in consultation with the classroom teacher. The teacher wanted all students' to complete homework (i.e., 100% completion) each day, place it in the homework bin *before* the late bell rings, and earn an average grade of at least 80%. Interdependent group contingencies were established by the teacher reviewing the homework bin to determine if all students present turned in an assignment. If so, then the teacher selected a paper slip from a covered box that contained all pupils' names (i.e., dependent group contingency). The randomly selected pupil's paper was then graded

privately to determine if the second criterion (i.e., 80% correct) was met. If both criteria were met, then the targeted student was given one of five puzzle pieces. When all five pieces were completed, the entire class earned the opportunity to select a mystery motivator. If either criterion was not met, the class was told simply that they did not meet the criteria and therefore, did not earn a puzzle piece that day. (The class was not told whose paper was reviewed individually and privately). They were encouraged, however, to try harder the next day.

The third procedural component was contingent rewards in the form of mystery motivators. Mystery motivators are incentive systems that deliver random rewards for appropriate behavior to individuals, small groups, or an entire class. Prior to beginning the intervention, students were asked to complete *reward menus* to identify high preference incentives. Among the 20 possible reward names placed into the covered box five contained the words "mystery motivator" on them. Mystery motivators were highly decorated sealed envelopes that contained paper slips with the names of high preference rewards written on them. These envelopes have question marks written all over them and they were displayed prominently in the classroom (e.g., hanging from the ceiling on string). On days when a "mystery motivator" slip of paper was selected from the box, students voted on which envelope to select and open to determine that day's reward. The reward was then shared by the entire class (i.e., group contingency).

To ensure that the intervention was implemented correctly, a10-item fidelity of implementation checklist was developed. The 10 primary steps required to implement the intervention as intended were included on the checklist. Spaces to indicate the presence or absence of each procedural step were included as well. During intervention sessions, the investigator made observations and recorded the presence or absence of each procedural

component during 25% of randomly selected intervention sessions. Fidelity of implementation was calculated as the number of components present divided by the number present and absent times 100%. It was determined that the intervention was implemented with 100% accuracy for all intervention sessions.

Experimental Design and Procedures

An A-B-A-B withdrawal of treatment design was used to assess the effects of the mystery motivator game on students' homework completion and accuracy rates. This particular design is capable of establishing a functional relationship between the intervention and its outcomes by showing that student performances change, *when and only w*hen, the intervention is presented and/or withdrawn (Kennedy, 2005).

Baseline. In the present study, student homework performance was first examined under typical or normal teaching conditions. During these initial baseline sessions, math homework was assessed at the beginning of class by the general education teacher. Percentage scores for both completion and accuracy were recorded for all students and later forwarded to the investigator. During baseline, there were no explicit consequences (neither positive nor negative) for homework performance (good or bad). Scores were typically entered into the teacher's grade-book and pupils were given general feedback on their homework papers.

Intervention. Prior to the intervention phase, the investigator instructed the general education teacher how to implement the intervention. After initial baseline sessions were completed, students participated in a brief (i.e. 20 minute) training session led by the general education teacher. The teacher announced that the class would be playing the "Mystery Motivator Game" for the next few weeks. She described how the "game" was played and drew sample slips from the covered boxes to show how homework would be evaluated. The two

criteria to win, 100% completion and 80% correct, were displayed prominently in class and reviewed regularly.

A typical intervention session worked as follows: First, the general education teacher graded students' homework while they worked on math problems independently. Next, he emphasized to the class that everyone must work as a team in order to earn mystery rewards. The teacher the checked the homework bin to determine if everyone present turned in an assignment. If so, then a paper slip was picked from a covered box. The name on the paper determined whose homework was reviewed for accuracy. If the selected paper met the second criterion (i.e., 80% correct and higher), then the class was told that they earned a reward for that day. A paper slip was then selected from a second covered box. If a mystery motivator paper slip was picked, then the class voted on which envelope to open.

Withdrawal. After the intervention data stabilized, the intervention was removed for three days (return to baseline conditions). Students were informed that they would not receive rewards for their math homework performance during that time. All visual indicators (i.e., posted criteria, covered boxes, and mystery motivator envelopes) of the intervention were removed.

Intervention II (Reimplementation). Following the second baseline period, the intervention was reintroduced. For this phase, the students were informed that they could again earn rewards for their homework performance. All game related materials were displayed again and game rules were reviewed regularly.

Results

The effects of the mystery motivator game on the class' homework completion rates can be seen in Table 1. During initial baseline, only about half (52%) of the class turned in homework daily. This ranged from a low of 37% to a high of 67%. Only two students (10%)

turned in homework during all three baseline sessions and an equal number failed to turn in any assignments during this initial phase. When the mystery motivator game was implemented, there was an immediate and noticeable improvement in the class' homework completion rates. In fact, the mean completion rate increased to 99% with all students turning in assignment on four of five intervention sessions. There was only once instance of a student failing to complete homework during the first intervention phase. There were also no overlapping data points across the first two experimental phases. When the intervention was put back into effect, there was another immediate and noticeable increase in the class' homework completion performance. On average, 98% of pupils completed homework when the mystery motivator game was in effect. During 10 of 12 intervention sessions, all students present turned in math homework. For the third time, there were no overlapping data points across adjacent experimental phases.

The effects of the mystery motivator game on the class' math homework accuracy rates can be seen in Table 2. As depicted, the class' daily homework average was extremely low with a mean of 36% and a range of 24% and 45%. The low averages were expected given that 0 grades were assigned when homework was not turned in. Only one pupil (5%) had a passing average on math homework during initial baseline. When the mystery motivator game was implemented, there was an immediate and noticeable increase in the class' daily homework averages. The class average increased to a mean of 93% with a range of 84% to 100%. This represented over a 50% increase in the class average and there were no overlapping data points across the first two experimental conditions.

When the mystery motivator game was withdrawn, the class' daily math homework averages dropped quickly and substantially to a mean of 50% and a range of 38% to 57%. Once more, there were no overlapping data points across adjacent experimental phases. When the

intervention was put back into place, the class' math homework average increased immediately and noticeably to a mean of 96% with a range of 78% to 100%. During seven of 10 intervention sessions, the class maintained correct averages of at least 95%. There were no overlapping data points across the final two experimental conditions.

Discussion

The present findings showed that the mystery motivator game, consisting of interdependent and dependent group contingencies and unknown rewards, produced immediate and significant improvements in a 10th grade math class' homework completion and accuracy rates. When the game was implemented the percentage of students completing math homework increased from a little over half of the class (53%) to almost every one (M = 99%). Almost everyone in class completed daily math homework when the mystery motivator game was played. More importantly, pupils' accuracy improved just as dramatically. The class' homework average, for example, under *normal* teaching conditions was failing (M = 43%) and only two pupils had passing grades. However, when the game was in effect the mean percentage correct rose to 94% (A) or the equivalent of a four letter-grade increase. These results are quite consistent with previous research that showed that interdependent and dependent group contingencies and mystery motivators can: (a) improve academic performance (Popkin & Skinner, 2003; Reinhart et al., 2009; Schanding & Sterling-Turner, 2010; Sharp & Skinner, 2004; Theodore et al., 2009), (b) reduce disruptive behavior (e.g., Christ, & Christ, 2006; DiMartini, Bray, & Kehle, 2000; Kehle, Bray, Theodore, Jenson, & Clark, 2000; Kelshaw-Levering et al., 2000; McKissick et al., 2010; Mottram, Bray, Kehle, Broudy& Jenson, 2002; Theodore et al., 2004; Theodore et al., 2001), (c) homework completion and accuracy (Campbell & Skinner, 2004; Lynch et al., 2009; Madaus, Kehle, Madaus, & Bray, 2003; Moore,

Waguespack, Wickstrom, Witt, & Gaydos, 1994), and (d) improve bedtime behavior of a pre-school child **(**Robinson & Sheridan, 2000). Current findings extend the external validity of the mystery motivator game to a new student population, geographic location, and content area (i.e., 10^{th} grade math).

Current findings also indicated that a *functional* relationship existed between the use of the mystery motivator game and pupils' homework completion and accuracy. That is, the use of the game *produced* predictable improvements in pupils' homework performance. When the game was played many more students completed homework and earned higher grades. When the game was removed, pupil performance on both outcomes dropped immediately and noticeably. These findings are quite important. When told that they could earn rewards for meeting daily criteria but they didn't know whose performance would be checked, *all* students responded positively by completing more homework *and* at higher accuracy levels. Identifying class-wide interventions that are effective for all, feasible to implement, and socially acceptable is very important in an era of evidence-based practice (Cook, 2011; Cook & Cook, 2010; Detrich, Keyworth, & States, 2008).

The mystery motivator game was also pretty easy to use and both the teacher and pupils enjoyed using it. The teacher said that the intervention was easy to use and did not take significant time away from class. In fact, the teacher felt that the students were much more productive while they were playing the game. The students seemed to enjoy playing the game and showed much enthusiasm when they got to select rewards. The investigator liked the intervention as well. She felt it was easy-to-use, effective, and highly motivating. These findings are consistent with previous research that showed positive consumer satisfaction evaluations for mystery motivators (e.g., Moore et al., 1994; Schandling & Sterling-Turner, 2010). The teacher

also felt that the game was fair, took little time and effort, and really helped students' to do better on math homework. Students also seemed to like playing the mystery motivator game. In particular, they loved earning rewards and the "mystery" of not knowing whose performance would be evaluated daily.

Perhaps one of the most important "lessons" from this study is that the use of simple contingent rewards can go a long way in improving pupils' homework performance. Once they were given an opportunity to win something, students worked much harder and more accurately in hopes that they might "win". More importantly, the present findings suggest that students' "typical" performance reflected motivational rather than skill deficits. That is, the students had the skills to complete homework at much higher accuracy levels, but they were not doing so under normal teaching conditions. The mystery motivator game, therefore, provided sufficient motivation to get all students to do more work in mathematics.

Although present findings were positive and encouraging, there are some important study limitations to consider when interpreting these findings. First, the study was conducted with only one group of students (N =20), in one geographical location, and in one narrow facet of the academic curriculum (i.e., math homework completion and accuracy). Generalizations to other grade levels, geographic settings, subject areas or outcome measures are not warranted at this time. Second, the study was conducted for a relatively short duration (4 to 5 weeks) and no generalization and maintenance data were collected. It is not appropriate to conclude, therefore, that the same effects would be obtained over a longer time period and/or that benefits would spread to other areas of pupils' math performance (e.g., quiz and test grades and participation rates in class) and/or be sustained in the absence of the intervention. Future research, therefore,

should include longer intervention durations and explicit generalization measures for examining potential "spillover effects".

The present results are also limited because the investigator served as primary data collector and evaluator. Although procedures were used to monitor fidelity of implementation (i.e., fidelity assessments) and inter-scorer agreement, one cannot rule out potential experimenter bias effects at this time. Future researchers should use independently-trained data collectors to the maximum extent possible. Finally, study implications are clouded by the fact that the investigator could not verify that students completed their own homework assignments. It is quite possible that someone else helped them or even completed the work for them so that they might earn rewards.

In summary, this study examined the effects of the mystery motivator game on the homework completion and accuracy rates of a 10th grade, math class in a rural school district in Western New York. Current findings indicated that the game produced substantial increases in both the percentage of students completing math homework each day and the accuracy with which they did so. In addition, pupils seemed to get along better and work harder when they were playing the game. These improvements were made with a minimum of teacher time an effort and with generally high levels of pupil satisfaction. Obviously, much more work must be done on the mystery motivator game. First, there needs to be additional replications. Can the game be used effectively in other subject areas and at different grade levels? What other academic, behavioral, and interpersonal outcomes can be improved by using the mystery motivator game? Will teachers continue to use game after formal contact with researchers is gone? Will students ever get tired of playing the mystery motivator game? These questions among many others challenge future practitioners and researchers. In evidence-based practice

era, educators need classroom interventions that are powerful enough to improve all pupils' performance and yet easy enough to use even with high school math students.

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Figure 1 shows the effects of the intervention package on 10th grade students' math homework completion rates.

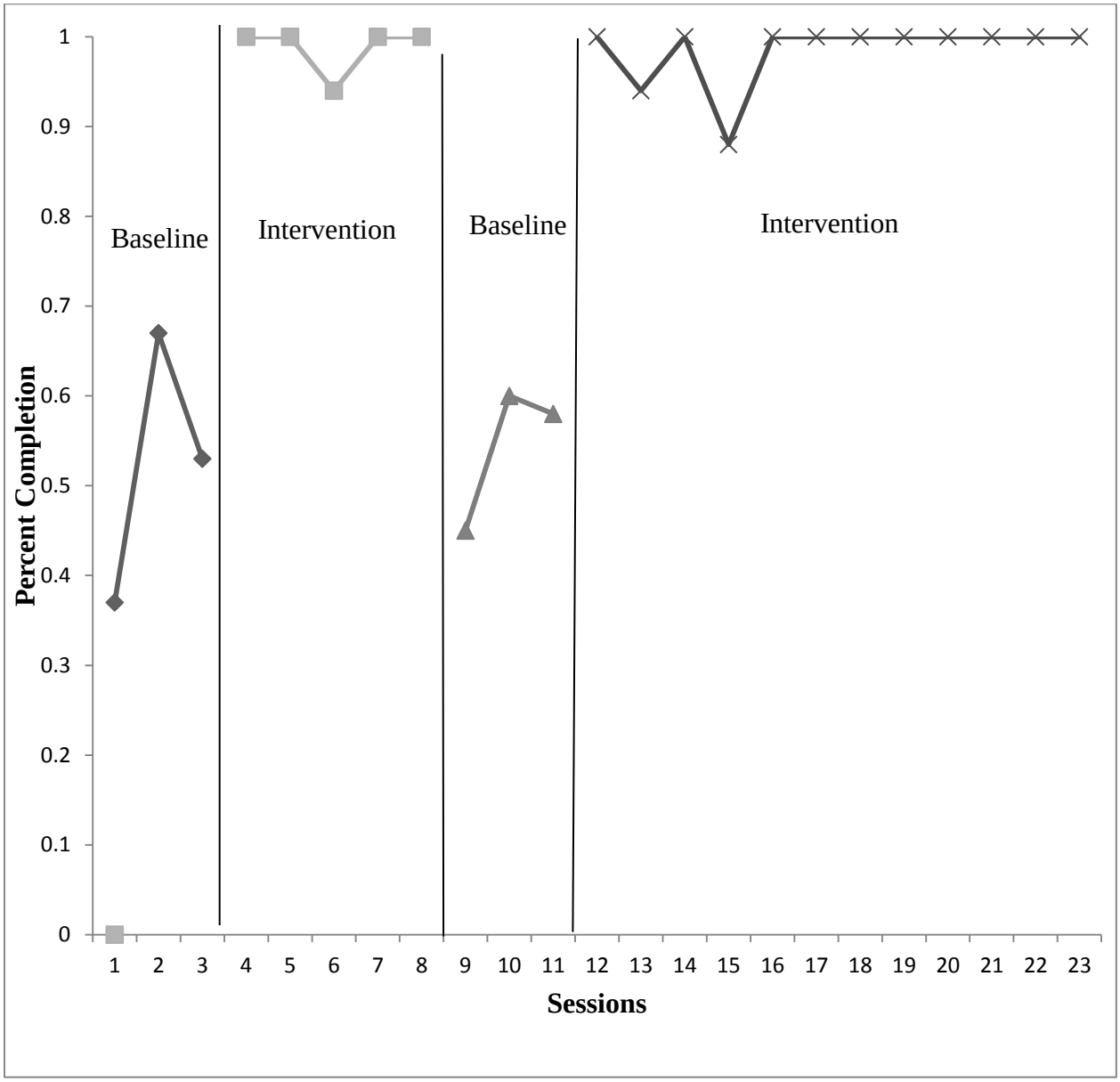

Figure 2 shows the effects of the intervention package on 10th grade students' math homework accuracy.