THE EFFECTS OF THREE JARS AND MYSTERY MOTIVATORS ON HOMEWORK COMPLETION AND ACCURACY IN A 2ND GRADE CLASSROOM

By

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CERTIFICATION OF PROJECT WORK

We, the undersigned, certify that the project entitled ***THE EFFECTS OF THREE JARS AND MYSTERY MOTIVATORS ON HOMEWORK COMPLETION AND ACCURACY IN A 2ND GRADE CLASSROOM by Christina Kestner***, Candidate for the Degree of Master of Science in Education, Curriculum and Instruction in Inclusive Education, is acceptable in form and content and demonstrates satisfactory knowledge of the field covered by this project.

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Abstract

Homework is a strategy used by teachers to promote the understanding of content and student mastery through practice. Academic benefits of homework include retention of new knowledge and better understanding of class material. Homework completion and accuracy are essential for student success in school. However, research shows students may lack self-discipline and the academic skills required to complete homework assignments (Rathvon, 1999). Therefore, classroom teachers need effective, efficient and socially acceptable interventions to improve homework performance among their students. The present study examined the effects of the three jars intervention on homework completion and accuracy in a 2nd grade general-education classroom. The three jars game produced immediate and noticeable improvements in pupils' completion and accuracy over teacher-led instruction. Pupils rated intervention goals, procedures, and outcomes quite favorably and the teachers found it to be effective and efficient. Implications for future research and practice are discussed.

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Introduction

When children consistently and accurately complete their homework they do better in school (Cooper, Robinson, & Patall, 2006; Little, Akin-Little, & Newman-Fig, 2010; Madaus, Kehle, Madaus, & Bray, 2003; Olympia, Sheridan, Jenson, & Andrews, 1994; Paschal, Weinstein, Walberg, 1984; Trautwein, 2007; Trautwein, & Ludtke, 2006). The academic benefits associated with homework include better understanding and retention of content material (Gajria & Salend, 1995), promoting the mastery of new material through practice (Olympia et al., 1994), and demonstrating student mastery of content material (Epstein & Van Voorhis, 2001). Homework performance has also been associated with positive academic achievement of students (Cancio, West, & Young, 2004). In contrast, when students fail to complete homework or do it with many errors, there are numerous negative outcomes (Olympia et al., 1994). Unfortunately, the literature also suggests that there are many students who fall into this category and their difficulties begin early in their school careers. Since homework completion and accuracy has multiple academic benefits and their absence produces long-term negative educational effects, researchers have studied many ways to improve these important pupil outcomes.

One interesting set of classroom-based interventions are group contingencies. Litow and Pomroy (1975) defined group contingencies as temporal arrangements in which common consequences (e.g., rewards) are based on the behavior of: (a) one person in the group, (b) a part of the larger group, or (c) each member of the group meeting performance criteria. They further identified *independent* group contingencies as situations in which each individual student receives rewards if s/he met performance criteria. One example of independent group contingencies is common, norm-based student grading systems. All students in class have the

same expectations for a specific grade and each student is responsible for their own performance. The *interdependent* group contingency, in contrast, was described by Litow and Pumroy as a strategy where students earned rewards if *every* member of the group or a specified sub-group reached certain performance levels; students were interdependent on one others to gain rewards. Finally, a *dependent* group contingency is in effect when the performance of one or a few group members determines access to rewards for the entire group (Litow & Pumroy, 1975). For example, everyone earns 3 minutes of free time if Eric refrains from fighting on the playground. All three group contingencies were shown to: (a) reduce inappropriate classroom behavior and (b) increase academic achievement (e.g., McKissick, Hawkins, Lentz, Hailly, & McGuire, 2010; Skinner, Skinner, & Burton, 2009; Theodore, Bray, & Kehle, 2004). Moreover, group contingencies are relatively inexpensive, time efficient, easy to implement, and generally well-accepted by teachers and students (Heering & Wilder, 2006).

Given the importance of consistent and accurate homework completion and the potential effectiveness of group contingency interventions, the present study was conducted. The study examined the effects of an intervention package consisting of (a) interdependent and dependent group contingencies with randomized components and (b) mystery motivators on the homework completion and accuracy rates of a 2nd grade math class. Three opaque jars containing paper slips were used to randomize: (a) target behaviors (completion versus accuracy), (b) criteria (80% to 100%), and (c) rewards. Included among unknown rewards were a series of mystery motivator paper slips (Jenson, Rhode, & Reavis, 1993). This research partially replicates studies by Reinhardt, Theodore, Bray, and Kehle (2009) and Theodore, Dioguardi, Hughes, Aloiso, Carlo, and Eccles(2009). The primary research question is: What effects will the three jars game, a combination of dependent and interdependent group contingencies with randomized

components and mystery motivators, have on the math homework completion and accuracy rates of 2nd grade students in Western New York? Relatedly how did students and the feel about the three jars intervention? More specifically, how positively did participants rate three jars in terms of the importance of its goals? Acceptability of procedures? And satisfaction with intervention outcomes? Before proceeding to the methodology, a brief illustrative review is provided of the following topics: (a) group contingencies and (b) mystery motivators.

Group Contingencies Group contingency interventions have been successful in classroom environments because they are inexpensive, time efficient, easy to implement, and generally well-liked by teachers and students (Heering & Wilder, 2006; Skinner et al., 2009). Research indicates that all group contingency programs (i.e., independent, dependent, and interdependent) were equally effective in improving pupils' academic and behavior performance in general and special education classrooms (e. g., Baer & Richards, 1980; Hansen & Lignugaris-Kraft, 2005; Hulac & Benson, 2010; Little et al., 2010; Lynch et al., 2009; Theodore, Bray, & Kehle, 2004; Thorne & Kamps, 2008; Skinner et al., 2009). However, each contingency type (i.e., independent, dependent, and interdependent) had their own advantages and disadvantages based on subject and setting variables (Baer & Richards, 1980).

Skinner, Cashwell, and Dunn (1996) described *independent* group contingencies as requiring the *same* criteria for reinforcement for all students; however, the rewards are given individually based on the *independent* performance of each student. Independent group contingencies are used quite frequently in norm-based grading systems and common classroom and behavior management plans. While research shows that independent group contingencies are quite effective and perceived as fair by students, teachers, and parents, concerns were raised that they were not efficient, time-saving interventions for routine classroom management (Skinner et

al., 1996). Some additional negative side effects associated with independent group contingencies included: (a) legal and ethical issues, (b) lying or stealing to get rewards, (c) diminished performance in other academic domains, (d) variable reward strength among pupils and (e) the creation of a *class system* (i.e., winners and losers) in the classroom (Skinner et al., 1996). Given the potential negative side-effects of independent group contingencies, many researchers have recommended the use of interdependent and dependent group contingencies.

Dependent group contingencies are interventions in which all group members are rewarded based on the performance of one or a few other members (Litow & Pumroy, 1975). For example, it can be the performance of the randomly-selected targeted student(s) who determines whether or not the whole class earns rewards (Heering & Wilder, 2006; Theodore, Bray, Kehle, & DioGuardi, 2003). Since student's peers are involved in the intervention as part of the process for behavioral change, student socialization and cooperation are improved as a result of the intervention (Theodore et al., 2003). Dependent group contingency interventions have practical advantages for classroom teachers as well. Because all-or-none of the students receive access to reinforcement, this should reduce interpersonal student conflicts (Campbell & Skinner, 2004). Research has also shown that dependent group contingencies increase on-task behavior in general and special education classrooms (e.g., Hansen & Lignugaris-Kraft, 2005; Tankersley, 1995), increase homework completion and academic achievement (e.g., Lynch et al., 2009; Reinhardt et al., 2009; Theodore et al., 2009), and reduce disruptive pupil behavior (Heering & Wilder, 2006; Kelshaw-Levering et al., 2000).

Finally, *interdependent* group contingencies are those in which all group members are rewarded based upon their collective performance (Litow & Pumroy, 1975). For example, the class earns a pizza party when they read 100 books independently; all students get homework

passes when the class average on math quizzes is at least 80%; and pupils receive one free question on an upcoming test when everyone in class completes designated work assignments. Under interdependent contingencies, pupil access to positive consequences depends on them and their peers. Students are interdependent and must work together if everyone is to benefit. Because all-or-none of the group receives consequences, these contingencies are fairly easy to implement (Skinner et al., 2009). Interdependent group contingencies are also integral parts of educational interventions with strong empirical support (e.g., cooperative learning, [Johnson , Johnson, & Holubec, 1991; Slavin, 1991]; Class Wide Peer Tutoring, [Greenwood, Maheady, & Delquadri, 2002]; Peer Assisted Learning Strategies, [Fuchs, Fuchs, Mathes, & Simmons, 1997]; and the Good Behavior Game [Tingstrom, Sterling-Turner, & Wilczynski, 2006]).

Given their relative efficacy and reported ease of implementation, one might expect more wide-spread use of group contingencies in school. Yet, this may not be the case. There are some issues, for instance, that may limit the use of group contingencies (Skinner et al., 1994; Skinner et al., 2009). First, it can be difficult to select consequences that are equally appealing or motivating to all class members. 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 will not work hard to reach their goals. Second, it is difficult to set appropriate criteria for an entire class of students. Goals may be set too high for some, yet too low for others. Those in the former group may not expend much effort because the goal is perceived as unattainable, while the latter may not work hard because such effort is not necessary for success. Third, some students and teachers may view interdependent and dependent contingencies as unfair; well-behaved and higher performing pupils, in particular, may not earn positive consequences because their peers performed poorly.

They may scapegoat or intimidate their offending classmates. Finally, there are also a few students who may sabotage group contingencies to prevent classmates from winning. They may intentionally misbehave or perform poorly just so nobody wins that day. There are at least two ways to prevent or minimize these concerns: (a) randomizing contingency components and (b) keeping them unknown or a mystery to students (Hulac & Benson, 2010; Skinner et al., 2009).

Randomization was a technique used initially to keep students attentive and engaged in class (Kehle, Madaus, Baratta, & Bray, 1998). The first experimental analysis of group contingencies with randomized components was conducted by Kelshaw-Levering, Sterling-Turner, Henry and Skinner (2000). They compared the effects of interdependent group contingencies with two variations on the disruptive behavior of 12 second grade students. In one variation, the teacher randomized rewards using an opaque jar that contained the names of a variety of potential incentives (e.g., free time, extra recess, and special snacks). Students were told that they must receive 36 or fewer checkmarks in order to select a reward from the jar. The teacher then marked disruptive behaviors using a simple monitoring checklist. At the end of class, the teacher counted the marks and if the total was 36 or less, then the teacher selected a student to pull a paper slip out of the reward jar. The reward was then given to the entire class. If the criteria were not met, then students were told that they couldn't pick a reward today but that they should try harder next time.

In the second variation, all contingency components (i.e., target behaviors, criteria, target students, and rewards) were randomized through the use of four opaque jars. The first jar was labeled "behaviors" and contained paper slips with the names of target behaviors (e.g., talk outs, out of seat, and off task) and reward criteria or the word "all" indicating that all behaviors were monitored. The second jar was labeled "whole class or individuals". This jar determined whose

behavior(s) were evaluated against the criteria. If whole class was selected, then all disruptive behaviors were counted. However, if an "individual" paper slip was selected, then the teacher picked from the third jar labeled, "names", that contained paper slips with all children's names. If "individual" was selected from the second jar and "Maria" chosen from the third, then her performance was checked against the target behavior and criteria. If the class or individual met the criteria, then a randomly selected student was chosen to pick from the rewards jar (Jar #4). On days when criteria were not met, students were simply told that they could not choose from the rewards jar today and they were encouraged to try harder the next time. Both interdependent group contingencies produced immediate and noticeable improvements in pupil behavior, with the four jars generating more consistently low disruptive behavior rates. Additional studies (e.g., Popkin & Skinner, 2003; Theodore, Bray, &Kehle, 2004; Theodore, Bray, Kehle, & Jenson, 2001) have essentially replicated the positive effects of using a series of jars to randomize contingency components. In a related study, Murphy, Theodore, Aloiso, Alric-Edwards, and Hughes (2007) appeared to be the first to use interdependent group contingencies with "mystery motivators" (i.e., randomly selected unknown rewards). The researchers used the intervention package to improve the behavior of 9 pre-school students enrolled in a Head Start program. Students exhibited a variety of inappropriate behaviors (e.g., touching others, moving around, and being off-task) during instructional rug time. The teacher posted classroom rules (i.e., keep hands and feet to yourself, sit and stand appropriately, and stay on task) and told students that if everyone received five or fewer checks on their monitoring sheets, then the entire class could select one of 12 picture cards from the mystery box. Researchers found that the intervention produced immediate improvements in all target students' disruptive behavior rates.

Mystery Motivators Mystery motivators are incentive systems designed to deliver unknown rewards to pupils for appropriate behavior (i.e., in this case increasing homework completion and accuracy) (Jenson et al., 1993). To date, this intervention package has also been used in at least 11 published research studies. These studies have found that interdependent group contingencies with mystery motivators can: (a) improve students' homework completion and accuracy rates (Moore, Waguespack, Wickstrom, Witt, & Gaydos, 1994; Madaus, Kehle, Madaus, & Bray, 2003), (b) decrease a wide range of disruptive pupil behaviors (Mottram, Bray, Kehle, Broudy, & Jenson, 2002; Theodore, Bray, & Kehle, 2003), and (c) enhance interpersonal interactions among students at the primary and secondary levels (Kehle, Bray, Theodore, Jenson, & Clark, 2000; Musser, Bray, Kehle, & Jenson, 2001). Moore and colleagues (1994) conducted one of the first mystery motivator studies. They examined the effects of unknown rewards in the form of mystery motivator envelopes on the homework completion and accuracy of two groups of elementary school students. The researchers found that unknown rewards were highly effective in improving the academic productivity of a group of struggling learners. Madaus, Kehle, and Bray (2003) also conducted research on homework completion and accuracy using mystery motivators. Five 5th grade students from two general education classes participated in the study. The dependent variable was the number of mathematics homework assignments completed and their respective accuracy percentages. Using an A-B-A-B reversal design, Madaus et al found that mystery motivators were effective for all students . Students showed an improvement in completed mathematics homework assignments.

Mottram et al also demonstrated that mystery motivators can be used to reduce disruptive student behavior as well. These researchers found that target students engaged in a variety of disruptive and annoying behaviors during initial baseline. They set up a behavior change

program in which students were given unknown, mystery rewards contingent on decreases in the disruptive classroom behavior. Once again, the researchers found that mystery motivators produced immediate and noticeable improvements in pupil behavior. Musser and colleagues (2001) also showed that mystery motivators can be used to decrease disruptive classroom behavior. In this instance, the researchers were working with a small group of students in a self-contained special education program for students with serious emotional disturbance. Once again, mystery motivators produced immediate and highly effective improvements in pupil behavior. Finally, Schandling and Sterling-Turner (2010) demonstrated that mystery motivators can also work for older students. Working with a group of high school science students, the researchers told students that they could earn mystery surprises by improving their performance in science class. Once again, pupil performance was consistently better when students had opportunities to earn mystery motivators.

Collectively, this illustrative literature review suggests that there are some potentially effective classroom-based interventions for improving pupils' homework completion and accuracy rates. Two intervention components in particular, interdependent and dependent group contingencies with randomized components and mystery motivators, were selected and combined into an intervention package called the three jars game. This study examined the effects of the three jars game on a group of 2nd graders math homework completion and accuracy rates.

Method

Participants and Settings

The study was conducted in a 2nd grade general education classroom in a small (480 students) rural elementary school in Western New York. There were 19 students (11F, 8M) in

class ranging in age from six eight years old. Most students (85%) were Caucasian, while two were Hispanic and one was African-American. Three students had IEPs for attention, refocusing, and auditory deficits. The classroom teacher was approached initially by the primary investigator concerning any possible homework completion or accuracy problems in any of her classes. The teacher, a Caucasian female with approximately 15 years of teaching experience, noted the following concerns with pupil performance in one mathematics class: (a) failure to complete work and (b) low accuracy rates on completed work. The teacher noted further that some students were not doing well academically and their failure to complete assignments was contributing to the difficulties. The classroom teacher actually implemented the Three Jars intervention while the primary investigator assisted with material development, pupil training, data collection and analysis, and the conduct of inter-rater reliability and fidelity assessments. The investigator, a Caucasian female with two years of part-time teaching experience, was not aware of which pupils and behaviors were targeted and monitored each day.

Dependent Variables

There were three target behaviors: (a) homework completion, (b) homework accuracy, and (c) consumer satisfaction ratings of the three jars intervention. The first variable was the percentage of students who turned in completed homework assignments each day. This was determined by checking the homework box immediately after the morning bell rang. Student papers with written attempts made on each item were recorded as "completed". The number of completed papers was then divided by the number of students present each day and multiplied by 100% to derive a daily percentage completion rate. The second dependent variable was the percentage correct on completed homework assignments. Papers were graded by the classroom teacher and returned to students, usually the next day. All results were then entered on to the

attached data collection sheet (see Appendix A). The teacher recorded homework scores on sheets that contained randomly assigned numbers for each student. As such, the investigator was unaware of each pupil's performance. Homework completion and accuracy percentages were then aggregated daily and displayed on simple line graphs across experimental phases.

To ensure that data were being collected accurately and consistently inter-scorer agreement levels were calculated on 25% of randomly selected sessions across all experimental conditions (i.e., once per experimental phase). The teacher and investigator independently scored a sampling of pupils' papers for completion and accuracy. Inter-scorer agreement was calculated on an item-by-item basis. If both raters scored an item in the same way (i.e., both completed or correct) then the item was deemed an agreement (A). If the individuals marked an item differently (i.e., one complete-one incomplete or one correct-one incorrect), then the item was deemed a disagreement (D). Inter-scorer agreement was then calculated as the number of agreements divided by the number of agreements plus disagreements multiplied by 100%. Agreement levels averaged .92 over the course of the investigation and ranged from .86 to 1.00. This suggests that the data were trustworthy (Kennedy, 2005).

The third dependent variable was pupils' social validity ratings of the three jars intervention. Immediately after the final study session, pupils completed a 20-item, 5-point, Likert-type scale *anonymously* and *independently* (see Appendix B). The survey asked pupils to rate the intervention in terms of: (a) the *importance* of intervention goals, (b) *acceptability* of intervention procedures, and (c) *satisfaction* with intervention goals. Pupil ratings were also aggregated and presented in tabular fashion by item.

Independent Variable

The independent variable in the present study was three jars. Three jars is an intervention package that consists of: (a) interdependent and dependent group contingencies with randomized components, (b) pre-establish reward criteria, and (c) unknown rewards in the form of mystery motivators. To ensure that the three jars intervention was being implemented as intended a 13-item fidelity checklist was created (see Appendix C). The checklist was used initially to familiarize the classroom teacher with three jars and then as a guide when training students during a brief (20-minute) training session prior to formal data collection. The investigator used three opaque jars to randomize group contingencies and to keep them unknown or a "mystery" to students. Initially, she targeted two specific behaviors (a) homework completion and (b) homework accuracy and set varying criteria levels ranging from 80% to 100%. On separate paper slips, the investigator wrote the name of each target behavior and corresponding criteria from 80% to 100%. For example, one paper slip read homework completion - 80%, while another said homework accuracy – 90%. The separate paper slips were then place into the first opaque jar labeled "behaviors". Each day, the teacher randomly picked one paper slip from the first jar; this determined which target behavior and criterion must be met that day. So for example, if the teacher selected "homework accuracy – 90%", that meant that the criteria for the entire class to earn a reward was at least a 90% correct on daily homework. The target behavior and criterion was *not* shared, however, with the class.

After the target behavior and criterion were selected, the teacher picked a paper slip from Jar #2 labeled, "who" to determine whose paper was graded. Jar #2 contained one paper slip with the words "whole class" written on it, 5 paper slips with the words table 1, 2, 3, 4 and 5 written on them respectively, and 19 paper slips with the names of each pupil written on them. If the

"whole group" paper slip was selected, then the class' *average* was compared to the criterion. If the target behavior and criterion was "homework accuracy -90%, then the class average had to be 90% or higher for the entire class to earn a reward. If an individual pupil's name was selected, then s/he must have 90% correct or higher on his/her homework for the class to earn a reward. Once again, target student selection was done *privately* and not revealed to the class. Since students did not know whose behavior was being evaluated, they tried harder to meet the daily criterion (e. g., Kelshaw et al., 2000; Skinner et al., 1994). On days when a "table" was selected, then all student work at that table was averaged to see if it met the completion or accuracy criterion. On days when the class met criteria, the teacher announced that the criterion was met and selected one student to pick a paper slip from Jar #3 labeled "rewards". This jar contained approximately 20 paper slips containing the of material, activity, and/or novel rewards (e.g., stickers, art supplies, no homework coupons, drop work dots, 5-minutes free time, and preferred seating arrangements). Possible reward ideas were elicited from students by having them submit written ideas into a "reward suggestion box" during the project. The investigator then selected appropriate and inexpensive consequences to include in the third jar. Whichever reward was selected was shared by the entire class at the most immediate and practical time.

Among the 20 possible rewards were five paper slips with the words "mystery motivator" written on them. Mystery motivators included a series of highly decorated, sealed envelopes that were displayed prominently in the classroom (i.e., hanging from the ceiling). On those days when the criterion was met and a "mystery motivator" paper slip was selected, the students voted on which envelope to open to see what they won. On days when the criteria were not met, the class was simply encouraged to try harder the next day. The class was never told whose behavior was being monitored on days when criteria were not met.

To ensure that the three jars intervention was implemented as intended, independent fidelity checks were taken during 25% of the intervention sessions. The investigator observed the teacher implementing three jars and recorded the number of procedural steps that were present and absent. Fidelity of implementation was then calculated as the number of steps present divided by the number of steps present and absent times 100%. The mean fidelity ratings averaged .96 with a range of .92 to 1.00. This suggested that three jars was implemented with a high degree of accuracy.

Experimental Design and Procedures

An A-B-A-B single case research design was used to examine the effects of three jars on second graders' homework completion and accuracy rates. This particular design is capable of establishing functional relationships by showing that pupil performance changes, when and only when, the intervention is given or removed (Kennedy, 2005). The primary investigator contacted the classroom teacher initially to explain the nature of the intervention. The teacher said that she was willing to participate and the building principal provided her approval. After pupil and parent consent was obtained the study begin. It started with the reviewed homework at the beginning of each class, introduced new content for the day, provided some guided practice opportunities, and then allowed students to work independently at their seats. The previous night's homework was turned in before the bell rang to begin class. It was typically graded by the teacher and returned to students as soon as possible. Homework completion and accuracy was monitored for a *minimum* of four sessions or until performance stabilized. Baseline data served three primary functions: (a) to determine if there was a need for intervention, (b) to target homework goals for intervention, and (c) to predict future homework performance if existing instructional conditions were maintained.

After baseline data stabilized, the three jars game was introduced to the children during a brief (30-minute) training session. Children were told that they would be playing a game each day and the purpose was to get more students to complete their math homework and to help them get better grades overall. The investigator pulled sample paper slips from each jar and explained how they would be used each day during the game. Children were asked to respond in unison to investigator questions about what each paper slip meant. After students were correctly following appropriate procedures, formal data collection began. The classroom teacher taught in the same manner and with the same curriculum materials with the following differences. First, three opaque jars were displayed prominently in class (i.e., on teacher's deck). Second, the teacher quickly reviewed the rules for playing the three jars game and then proceeded to pick paper slips from the first two jars. She then reminded the class once again that she would be checking on their homework completion and accuracy. While students worked independently, the teacher checked the target student(s) papers for completion and accuracy. During the last few minutes of class, the teacher announced whether or not the criterion was reached and if they could pick a paper slip from the third jar.

After pupil data stabilized during the first intervention phase, the three jars game was removed. Students were told that they wouldn't be playing the game for the next week but that they should continue to complete their math homework and get the best grades that they can. After the second baseline data stabilized, the three jars game was re-introduced to the class. After the last study sessions, students completed the consumer satisfaction surveys independently and anonymously.

Results

The effects of the three jars game on the 2nd grade class' homework completion rates can be seen in Figure 1. As shown, approximately two-thirds (i.e., 68%) of the class turned in math homework on a daily basis. This percentage was quite variable, however, with a range of 55% to 81% turning in completed assignments. When the three jars game was introduced, the percentage of students completing math homework increased immediately and noticeably to a mean of 86% (range = 78% to 91%). This represented about an 18% increase in the number of students who completed math homework and there was only one overlapping data point across the first two experimental phases. When three jars was removed, the percentage of students completing math homework decreased once again to an average of 72% (i.e., slightly higher than first baseline) with a range of 68% to 78%. There were no overlapping data points between the first intervention and second baseline phase. Finally, when the three jars game was implemented once again, the percentage of students completing math homework increased to an average of 84% (range = 78% to 91%). There was only one overlapping data point between the final two adjacent phases.

Data related to the effects of the three jars game of 2nd graders' math accuracy can be seen in Figure 2. As depicted, the class' math homework average during typical teacher instruction was about 65% or a D grade. Like completion, accuracy rates were quite variable during baseline ranging from 49% (F) to 77% (C+). When three jars were implemented the class' math homework average increased to 78% (C+) or the equivalent of a 13% increase over initial baseline levels. Intervention scores ranged from 73% to 83% and there was only one overlapping data point between adjacent phases. When the three jars intervention was removed, the class' math homework average fell again to 68% or about one letter grad lower than the first

intervention phases. There were no overlapping data points between the second baseline and first intervention condition. When three jars were put back into effect, the class' math average increased once again to a mean of 81% (range = 77% to 87%). Once again, there were no overlapping data points between the final two experimental phases.

Student responses to the consumer satisfaction surveys can be seen in Table 1. As shown, students rated most intervention goals quite highly. They reported, for example, that it was very important (4.8) for students to complete their math homework assignments and to do well in 2nd grade math class. Pupils also reported that it was important for other students to do well in math class. In terms of procedural acceptability, students seemed to like all of the procedural components. They rated playing the jars game the highest (4.9), followed closely by picking from Jar #3 to find out rewards (4.8), picking a mystery motivator envelope (4.3), and picking from Jar #2 to see whose homework was checked. The lowest rated procedural component (3.8) was using Jar #1 to determine if completion or accuracy was targeted that day. In terms of satisfaction, pupils provided their highest ratings for "three jars should be done in other classes" (4.3). Pupils generally reported being satisfied with their performance during three jars (4.1), that the game helped them to complete more homework assignments (4.0), and that the jars helped them to learn math content better (3.8). The only item receiving a mean rating below 3 was "can three jars be harmful to other students" (2.1).

Discussion

The present findings suggest that the three jars game was effective in improving a group of second graders' math homework completion and accuracy rates. The current results are highly consistent with a robust research line that shows that interdependent and dependent group contingencies can: (a) improve academic performance (Lynch, et al., 2009; Popkin & Skinner,

2003; Reinhart et al., 2009; Sharp & Skinner, 2004; Theodore et al., 2009), (b) reduce disruptive behavior (e.g., Christ, & Christ, 2006; Kelshaw-Levering et al., 2000; McKissick et al., 2010; Theodore et al., 2001; Theodore et al., 2004; Theodore, Bray, Kehle, & Jenson, 2001), and (c) facilitate room-to-room transitions (Campbell & Skinner, 2004). Three jars, therefore, might serve as a useful intervention for teachers who have numerous students who struggle to complete homework accurately. The intervention might be equally applicable to the completion of "in class" work. These data extend the effectiveness of three jars to a new student population, geographic location, and different outcome variable.

The current findings were also consistent with previous research on the positive effects of mystery motivators on pupil performance (e.g., Madaus et al., 2003; Moore et al., 1994; Mottram et al., 2002; Murphy et al., 2007; Musser et al., 2001; Robinson & Sheridan, 2000; Schandling & Sterling-Turner, 2010). Here, the positive effects of three jars were extended to another student population in a different geographical location and using other curriculum materials and outcomes. When three jars were in effect, approximately 15% more students completed and turned in their math assignments (i.e., baseline M = 70% versus intervention M = 85%). More importantly, class averages on math homework assignments increased from 66% to79% when three jars were used. This represented just over a one letter grade improvement in the class' math average (i.e., D to C+). Most impressively, all but two pupils had higher completion and accuracy averages when three jars were being used instead of typical teacher-led instruction. The fact that so many children changed their behavior even though the teacher was only monitoring one or a few pupils' performance indicates that they were all working harder to meet criteria (Kelshaw-Levering et al., 2000; Skinner et al., 2009).

The present findings also indicated a *functional* relationship between three jars and pupils' homework completion and accuracy rates. When three jars were used more students completed assignments and had higher grades during 21 of 24 comparisons (88%). When the game was removed, pupil performance on both outcomes decreased immediately and noticeably. The importance of these findings cannot be under-estimated. When told that they could earn rewards for meeting randomly selected target behaviors and criteria, students responded positively by completing more work 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 jars intervention also appeared to be feasible and socially acceptable to both teachers and pupils. The students seemed to really enjoy playing the game and showed much enthusiasm and anticipation when awaiting results. The classroom teacher liked the intervention as well. She felt it was easy-to-use, effective, and highly motivating. She even noted that she might continue to use it after the study. These findings are consistent with previous research that showed positive consumer satisfaction evaluations for jars-related studies (Kelshaw-Levering et al., 2000; Skinner et al., 2009). The classroom teacher felt that the intervention was fair, took little time and effort to implement, and produced improvements in pupils' math performance. Students appeared to be equally positive about intervention goals, procedures, and outcomes. They reportedly liked most if not all procedural components and were satisfied with intervention outcomes. There was one exception to these reactions, however. One student simply did not want to play the three jars game and he refused to complete any homework assignments during baseline or intervention phases. Eventually, the teacher and investigator decided to exclude him

from game competition because he was sabotaging it for others. Similar concerns were noted elsewhere in the group contingency literature (e.g., Litow & Pomroy, 1975; Skinner et al., 2009). It may have been more appropriate to begin with short duration "time out" and increased opportunities to win before moving to long-term exclusion from game-related activities. In any case, more attention should be focused on the perceived fairness of interdependent group contingencies in future research.

Although current findings are positive, there are a number of important study limitations to consider when interpreting these results. First, the study was conducted with only one group of students (N =17), 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, and subject areas 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 generalize to other areas of math performance (e.g., in class work completion, quiz performance, and active participation in class) and/or be sustained in the absence of the intervention. As such, future research should include longer intervention durations and explicit generalization measures for examining potential "spillover effects".

The present results are limited as well because the investigator also served as primary data collector and evaluator. Although procedures were used to monitor fidelity of implementation (i.e., fidelity assessments), one cannot rule out potential experimenter bias effects at this time. Future research should utilize independently-trained data collectors to the maximum extent possible. Finally, present findings are limited somewhat by the presence of a

few overlapping data points. Although students did noticeably better when three jars were being used, there were also a few instances where intervention means slightly below baseline conditions. This suggests merely that intervention effects were not always better than teacher-led instruction. On the positive side, many teachers would welcome a classroom-based intervention that gets more students to complete their homework assignments and at higher accuracy levels.

In summary, this study examined the effects of the three jars game on the homework completion and accuracy rates of a 2nd grade class in Western New York. Present findings indicated that three jars increased both the percentage of students completing math homework each day and the accuracy with which they did so. These improvements were made with a minimum of teacher time and effort and with generally high levels of pupil satisfaction. The only concern raised was one student's lack of responsiveness. Obviously, much more work must be done on the three jars game. First, there is a need for additional replications. To what other subject areas and grade levels can it be used effectively? What other academic, behavioral, and interpersonal outcomes can the three jars game be used to improve? Do teachers continue to use the jars game after formal interventions and contact with researchers are removed? Do students ever get tired of playing the jars game? These questions among many others can and should be addressed by future practitioners and researchers. In an era of evidence-based practice, classroom teachers must have access to and support in the use interventions that are powerful enough to improve all of their pupils' performance and yet be fairly easy to implement and socially acceptable to pupils and teachers alike.

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Figure 1 shows the effects of the three jars game on 2nd grade students' homework completion rates.

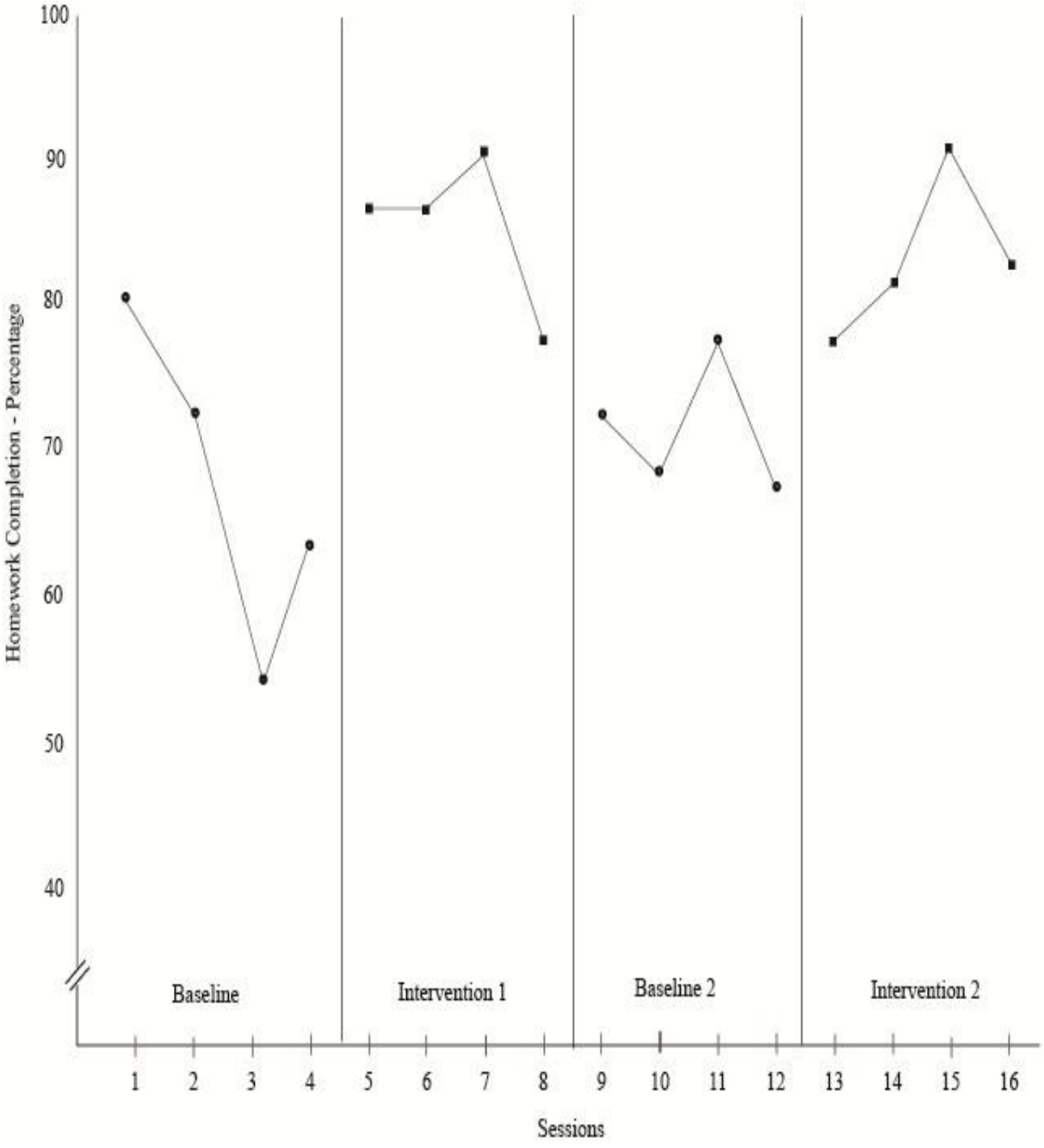

Figure 2 shows the effects of the three jars game on 2nd grade students' math homework accuracy.

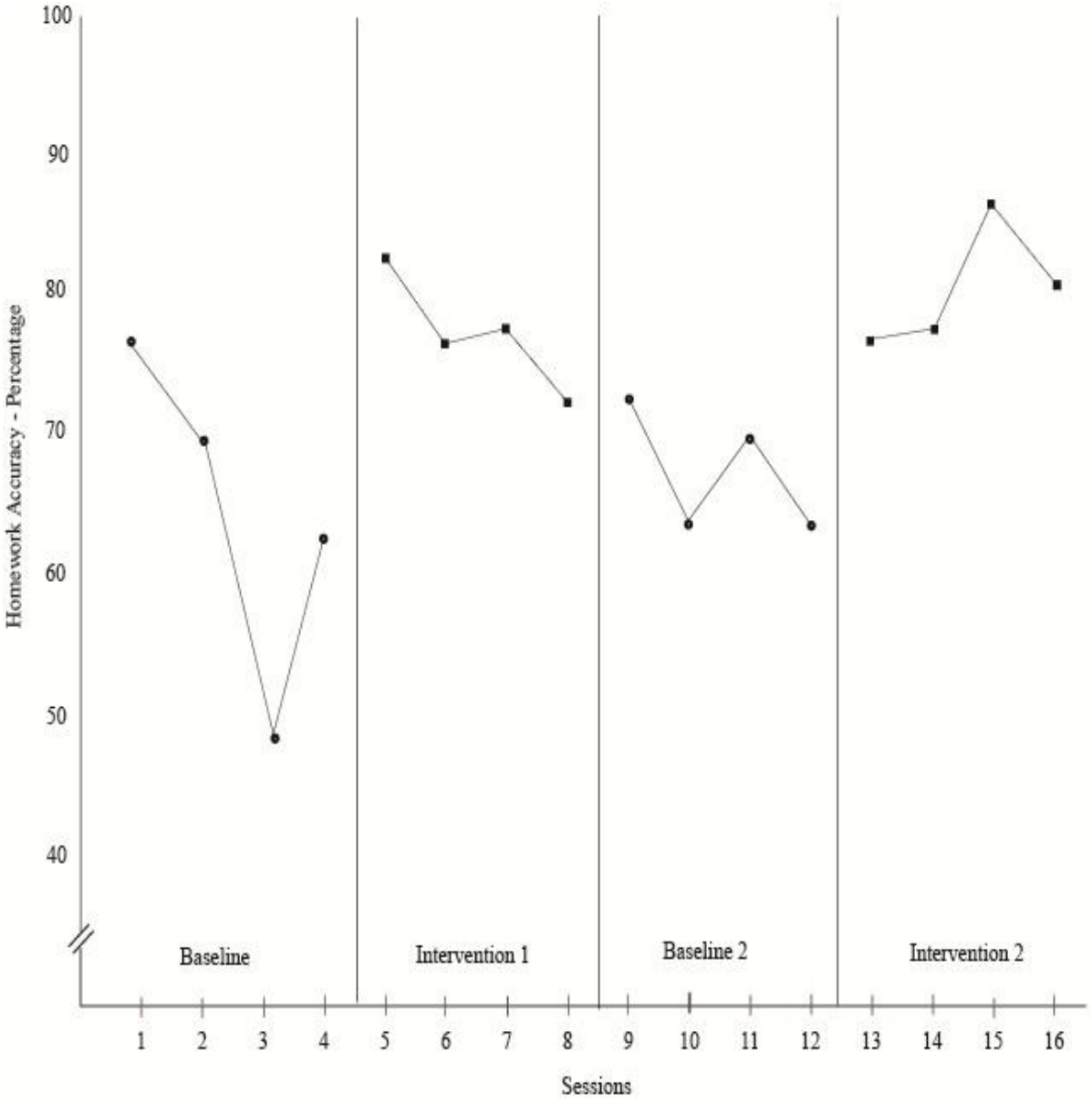

Table 1. Mean consumer satisfaction ratings by 2nd grade pupils.

Items	Mean
How important is it for you to do well in **2nd grade (Math)** class?	4.7
How important is it for **other students** in your class to do well in Math class?	4.4
How important is it for students to **complete homework assignments** in Math class?	4.8
How did you feel about not knowing what level of performance would be selected for evaluation (i.e., everyone completed their homework with 85% accuracy, student #5completed their homework with 90% accuracy)?	4
How much did you like **completing accurate homework assignments** each day?	4
How much did you like **using Jar #1 to determine which the homework completion and homework accuracy goal** for each day?	3.8
How much did you like **using Jar #2 to figure out whose homework completion and homework accuracy** would be monitored each day?	4.1
How much did you like **using Jar #3 to find out what rewards the class earned** that day?	4.8
How much did you enjoy **playing the 3 Jars game**?	4.9

How much did you like **picking one of the mystery motivator envelopes**?	4.3
How satisfied are you with **your overall performance** in Math class?	3.9
How satisfied are you with your performance when using **3 Jars**?	4.1
How much did the 3 Jars Game **help you learn** Math content better?	3.8
How much did 3 Jars **help you to complete** homework assignments?	4
Does 3 Jars seem like something that **should be done** in other classes?	4.3
Could 3 Jars **be harmful** to other students?	2.1
How **fair** was 3 Jars to everyone in class?	3.5
Did other students think that **you were smarter** after using 3 Jars?	3.2
How do you feel about the overall effect of the intervention on your homework behavior?	4.1
How did you feel about not knowing which reward you world get?	3.9

Appendix A

Data Collection Sheet: Homework Completion and Homework Accuracy

Week:# ***Date:***

Jar Info	Tuesday		Wednesday		Thursday		Friday	
Jar #1 Goal								
Jar #2 Student(s)								
Jar #3 Reward								
Student#	**Tuesday Completion**	**Tuesday Accuracy**	**Wed Completion**	**Wed Accuracy**	**Thurs Completion**	**Thursday Accuracy**	**Friday Completion**	**Friday Accuracy**
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								

19								
20								
21								
Notes								

Appendix B

Consumer Satisfaction Survey

Three Jars

Directions:
Please read each item aloud to your students and ask them to *circle the number* that best represents their feelings about that particular item. Emphasize the importance of completing the rating *individually and privately.*

I. Importance of Instructional Goals

1. How important is it for you to do well in **2nd grade (Math)** class?

1	2	3	4	5
Not at all		somewhat important		very important

2. How important is it for **other students** in your class to do well in Math class?

1	2	3	4	5
Not at all		somewhat important		very important

3. How important is it for students to **complete homework assignments** in Math class?

1	2	3	4	5
Not at all		somewhat important		very important

4. How did you feel about not knowing what level of performance would be selected for evaluation (i.e., everyone completed their homework with 85% accuracy, student #5completed their homework with 90% accuracy)?

1	2	3	4	5
Not at all		some did		everyone did

II. Acceptability of Instructional Procedures

5. How much did you like **completing accurate homework assignments** each day?

1	2	3	4	5
Not at all		OK		Liked it a lot

6. How much did you like **using Jar #1 to determine which the homework completion and homework accuracy goal** for each day?

1	2	3	4	5
Not at all		OK		Liked it a lot

7. How much did you like **using Jar #2 to figure out whose homework completion and homework accuracy** would be monitored each day?

1	2	3	4	5
Not at all		OK		Liked it a lot

8. How much did you like **using Jar #3 to find out what rewards the class earned** that day?

1	2	3	4	5
Not at all		OK		Liked it a lot

9. How much did you enjoy **playing the 3 Jars game**?

1	2	3	4	5
Not at all		somewhat		Liked it a lot

10. How much did you like **picking one of the mystery motivator envelopes**?

1	2	3	4	5
Not at all		some		Liked it a lot

III. Satisfaction with Strategy Outcomes

11. How satisfied are you with **your overall performance** in Math class?

1	2	3	4	5
Not at all		somewhat satisfied		very satisfied

12. How satisfied are you with your performance when using **3 Jars**?

1	2	3	4	5
Not at all		somewhat satisfied		very satisfied

13. How much did the 3 Jars Game **help you learn** Math content better?

1	2	3	4	5
Not at all		some		a lot

14. How much did 3 Jars **help you to complete** homework assignments?

1	2	3	4	5
Not at all		some		a lot

15. Does 3 Jars seem like something that **should be done** in other classes?

1	2	3	4	5
Not at all		maybe		definitely should

16. Could 3 Jars **be harmful** to other students?

1	2	3	4	5
Not at all		maybe		definitely could

17. How **fair** was 3 Jars to everyone in class?

1	2	3	4	5
Not fair at all		Somewhat fair		Very fair

18. Did other students think that **you were smarter** after using 3 Jars?

1	2	3	4	5
Not at all		some did		everyone did

19. How do you feel about the overall effect of the intervention on your homework behavior?

1	2	3	4	5
Not at all		some did		everyone did

20. How did you feel about not knowing which reward you world get?

1	2	3	4	5
Not at all		some did		everyone did

Additional Comments/Suggestions:

Appendix C

Three Jars Intervention

Fidelity of Treatment Record

Investigator: _____ Date: _____

Observer: _____

Time session began: _____ Time session ended: _____

***Directions**:* Observe the investigator as s/he implements the intervention and use the scoring code below to note the presence and/or absence of each tutoring component.

Scoring Code: + Goal demonstrated

\- Goal not demonstrated

NA Not applicable

General Implementation

_____ 1. Investigator selects the homework completion and accuracy goal and the investigator announces the goal for students to earn reinforcement. The investigator selects the student(s) who need to meet the goal; the student(s) names remain anonymous to the class. The reward is selected if the student(s) meet the goal.

_____ 2. Investigator announces possible rewards if students successfully meet the pre-established criteria.

_____ 3. Possible rewards were identified by seeking pupil input (e.g., asking them, watching them, having them complete reinforcement menus, and/or using suggestions from anonymous box). (You may need to ask investigator how rewards were identified).

_____ 4. Classroom rules are posted and reviewed by the investigator.

_____ 5. Investigator has a checklist of student names and spaces to record checks for target behaviors.

_____ 6. Investigator provides a halfway check to entire class.

_____ 7. Three labeled jars are visible in classroom; Jar #1 is homework completion and homework accuracy goals, Jar #2 is student(s) and Jar #3 labeled rewards.

_____8. At the beginning of the class period when the students are getting out their homework assignments, investigator selects a piece of paper from Jar #1 to identify target homework goal (i.e., 100% homework completed and 80% accurate, 90% homework completed and 75% accurate).

_____ 9. Investigator then selects a slip of paper from Jar #2; (pieces of paper with the words "whole class" or a specific student printed on them).

_____ 10. Investigator then evaluates pupil performance on basis of first two jar selections; if pupils meet pre-established criteria, then investigator congratulates students and randomly selects one pupil to pick a reinforcer from Jar #3.

_____ 11. If individual or group fails to reach criteria, then investigator announces that they did not meet the criteria and encourages them to work hard the following day

_____ 12. Teacher does not mention name of individuals when criteria is not reached.

_____ 13. Following session, investigator makes a smooth transition to the next instructional activity.

Total _____/13 (Please record the number of behaviors observed plus the number of NA)

_____ % Procedural fidelity

Anecdotal Comments:_____

_____

_____

_____