
RESEARCH INTO PRACTICE

Enhancing Academic Performance in a Classroom Serving Students With Serious Emotional Disturbance: Interdependent Group Contingencies With Randomly Selected Components

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Abstract. A modified multiple baseline across behaviors design was used to evaluate the effects of an interdependent group contingency program with randomly selected contingency components on the academic performance of an intact middle-school class serving five male students with serious emotional disturbance (SED). During the initial intervention phase, students had to meet a randomly selected criterion (e.g., 80% or 90% class average) on daily spelling assignments to earn a randomly selected group reward. Mathematics and then English daily assignment performance were added to the program in subsequent phases, and target assignments (i.e., either spelling, mathematics, or English) and criterion were randomly selected. Results show educationally valid increases in academic performance as target assignments were added to the program.

Students with social-emotional disorders often present with idiosyncratic behavior problems and academic skill deficits that require distinct prevention and treatment programs across students. Because those who educate secondary students with SED are charged with doing much individual programming, they may implement individual contingency management programs where each student has distinct target behaviors, goals, or criteria, and distinct consequences based on those behaviors (Englemann, 1991). However, teachers often find it difficult to manage (implement, evaluate, and adjust as needed) multiple individual contingencies (Bushnell, Wrobel, & Michael,

1968; Hall, 1991; Rhodes, Jenson, & Reavis, 1992). One solution to this problem may be to implement randomized interdependent group contingency programs designed to reinforce academic behaviors (Skinner, Cashwell, & Dunn, 1996).

A substantial researcher base supports the effectiveness of group contingencies. For example, in their meta-analysis of interventions designed to decrease inappropriate classroom behavior, Stage and Quiroz (1997) found that group contingencies were more effective than any other intervention studied. Other researchers have used group contingencies to enhance students' academic performance (e.g., Green-

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wood, Delquadri, & Carta, 1997; Shapiro & Goldberg, 1990; Slavin, 1991).

Litow and Pumroy (1975) classified group-oriented contingency as independent, interdependent, and dependent (Litow & Pumroy, 1975). With independent group contingencies all students have the same target behavior, criteria for receiving consequences, and the same consequences. Students receive access to those consequences contingent upon their own behavior. Independent group contingencies are common in general education environments. Because each student receives access to the same consequence, for the same behavior, based on *her or his own performance*, independent group-oriented contingencies are considered fair by students, educators, and parents (Stewart & McLaughlin, 1986; Turco & Elliott, 1990). However, because students with SED often have idiosyncratic levels of academic skill development and are likely to react differently to similar contingencies, it can be difficult to implement independent group-oriented contingencies in classrooms that serve students with SED (Skinner et al., 1996).

With dependent group contingencies, all students receive access to consequences contingent upon a particular student meeting a particular goal (e.g., everyone gets pizza if Johnny does not fight this week). Dependent group contingencies can place much pressure on individual students, may encourage students to threaten or aggress against target peers, and may be considered unfair because access to reinforcement is based solely on another student's behavior (Baer & Richards, 1980; Gresham & Gresham, 1982; Hayes, 1976). Thus, dependent group contingency programs may be inappropriate for use in classrooms with students who already engage in high rates of antisocial behavior (Skinner et al., 1996).

With interdependent group contingencies, all students receive access to consequences contingent upon some aspect of the group's behavior (e.g., everyone receives pizza if the class averages 80% on a spelling test). These contingencies have many applied advantages. Educators need to manage only one contingency, while addressing the behavior of the entire class (Gresham & Gresham, 1982). The

probability of any student receiving access to reinforcement is increased when her or his peers perform well. This intertwining of consequences can encourage cooperation across a diverse student body (Jenson, 1978; Slavin, 1987; Sulzbacher & Houser, 1968).

With interdependent group contingencies, all-or-none of the students in the classroom receive access to reinforcement. This characteristic of interdependent group contingencies may allow for efficient reinforcement within classroom settings and reduce negative side effects associated with procedures where some students earn reinforcers and others do not. For example, with individual and independent group-oriented reinforcement programs, students who do not receive access to reinforcers may steal, belittle (e.g., "candy is for babies"), or purchase reinforcers (e.g., buy a big bag of candy and bring it in to school). When all class members receive access to reinforcers, these side effects may be reduced (Skinner, Skinner, Skinner, & Cashwell, 1999; Skinner, Skinner, & Sterling-Turner, 2002). Also, interdependent group contingencies may discourage social side effects that may occur when some students earn rewards and others do not (Cashwell, Skinner, Dunn, & Lewis, 1998). For example, students may classify peers who earn rewards as "geeks" (rewards for academic behaviors) or "teacher's pets" (rewards for social behavior) and those who do not earn rewards as "dumb" (rewards for academic behavior) or "bad" (rewards for social behavior). Because they often require fewer resources, many educators may prefer activity reinforcers to tangible reinforcers. When all-or-none receive access to reinforcers, it is much easier to employ activity reinforcers. For example, suppose only students who behave well get to go on a field trip. Someone is needed to supervise those who do not earn the activity. Although another teacher could supervise these students, they may be more likely to misbehave as their classmates engage in an enjoyable activity (Skinner et al., 1996).

As with all other types of contingency management programs, there are limitations associated with interdependent group-oriented contingencies (Skinner et al., 1996). First, the

consequence is the same across students. For some students the consequence may be reinforcing and have a strong effect on their behavior. For others, it may be neutral and have no effect on their behavior. For others still, the consequence, which is designed to be reinforcing, may actually be punishing. Thus, these students would be encouraged (i.e., negatively reinforced) for doing poorly and for hindering their peers' performance.

Another limitation is associated with the criterion. When the class perceives that they cannot meet a criterion, the contingency may have a minimal effect on behavior (Skinner et al., 2002). For example, suppose a class is told that they will have 30 minutes of extra recess at the end of the day, provided the group uses appropriate verbal behavior for the entire day. If during the first 5 minutes of the school day, an individual student uses inappropriate language (e.g., swears), then the contingency designed to enhance appropriate behavior is removed and the entire group may spend the remainder of the school day using inappropriate verbal behavior. This example serves to highlight another limitation associated with interdependent group contingencies. When the target behavior is public, and one or several students engage in behaviors that cause the group to lose access to reinforcers, other members of the group may aggress against this student (Speltz, Shimamura, & McReynolds, 1982).

A final concern is that targeting one behavior may have an effect on other behaviors (Mace, McCurdy, & Quigley, 1990; Myerson & Hale, 1984; Stokes & Baer, 1977). For example, if a reinforcement program is structured to increase spelling test performance, a teacher may find that class performance in mathematics decreases as they choose to allocate more of their time and energy to spelling.

One solution to these problems may be to alter contingencies to make them less discriminable to students (Freeland & Noell, 1999; Freeland & Noell, 2002; Stokes & Baer, 1977). Skinner et al. (1996) describes how randomizing contingency components could be used to make contingency components less discriminable and mitigate many of the negative side effects associated with interdependent

group contingencies. If reinforcers are randomly selected from a pool, then it is possible to have at least some consequences that are high quality reinforcers for *each student* within this pool (Moore, Waguespack, Wickstrom, Witt, & Gaydos, 1994). If the criterion is randomly selected, then students never reach the point where they could be sure that they can no longer earn the group reinforcer. If the behavior being targeted is less public and randomly chosen, then students may not be able to identify students whose behavior results in the group failing to earn access to reinforcement (Pigott & Heggie, 1985; Speltz et al., 1982). Additionally, when the target behavior could include many different desirable behaviors, students increase the probability of earning reinforcement by increasing all of their desirable behaviors and by encouraging their peers to do the same (Skinner et al., 2002).

Only two studies have been reported in which multiple components of a group contingency were randomized. Kelshaw-Levering, Sterling-Turner, Henry, and Skinner (2000) evaluated the effects of group contingency programs on inappropriate behavior in a general education second-grade class. One program included randomly selected target behaviors, criteria, and reinforcers. Results showed that the program was effective, and randomizing all components, as opposed to merely randomly selecting the reinforcer, was slightly more effective in reducing inappropriate behavior levels. In a follow-up study, Theodore, Bray, Kehle, and Jenson (2001) found that a similar program was effective in reducing the disruptive behaviors of five SED students. However, no studies have been conducted that examined the effects of an interdependent group-oriented contingency with randomly selected target behaviors, criteria, and reinforcers on *academic* performance.

The current study was designed to extend research on interdependent group contingencies with randomized contingency components to academic target behaviors. A modified multiple baseline across behaviors design was used to investigate the effects of a randomized group contingency program on the daily academic performance of secondary stu-

dents with SED across spelling, mathematics, and English. New target behaviors (i.e., target assignments) were sequentially added to the contingency program in order to (a) demonstrate experimental control, (b) determine if such a program could be used to enhance academic performance across content areas without requiring additional resources (e.g., additional reinforcers), and (c) determine if sequentially increasing the pool of target behaviors would decrease desirable behaviors that had been increased in the previous phases.

Method

Participants and Setting

All five students from an intact self-contained classroom serving students with SED participated in this study. The students, all males, were enrolled in a segregated school for students with SED in the southern U.S. Approximately 95% of the students at the school were eligible for free lunch. The participants' ages ranged from 11 to 14 years old, and they were currently in Grades 6 to 8. Four students were Caucasian and one was African American.

All participants had been diagnosed as SED. Based on the criteria described in the State Department of Education Manual for Tennessee (Tennessee Division of Special Education, 1993), in order to be diagnosed as SED, a child must exhibit to a marked degree one or more of the following: (a) inability to learn, which cannot be explained by intellectual, sensory, health, or specific learning disability factors; (b) inability to build or maintain satisfactory interpersonal relationships with peers, teachers, and other significant persons; (c) inappropriate types of behavior or feelings under normal circumstances; (d) general pervasive mood of unhappiness or depression; or (e) tendency to develop physical symptoms or fears associated with personal or school problems. More specific data on each student's disabilities could not be obtained due to school administrators' concerns about confidentiality. In order to conduct the current study, consent was required from each student's parent.

The primary experimenter was a third-year doctoral student in school psychology. She

developed the program, trained the teacher and teaching assistant, and assisted with training the students. The classroom teacher and her teaching assistant implemented the program. The teacher was in her second year of teaching. The teaching assistant had 5 years of experience.

All students participating in the study sat at individual desks. The desks were arranged facing the teacher's desk and the front chalkboard. However, students would sometimes move their seats (e.g., in a circle) depending upon scheduled activities.

Informed Consent

Prior to beginning this study, informed consent was obtained from the teacher, each of her students' parents, the principal of the school, the school district institutional review board, and the university institutional review board. After these consents were obtained, assent was obtained from each student.

Materials

Materials for the current study included rewards, shoeboxes, index cards, teacher manuals, and daily written independent seatwork assignments, quizzes, and exams. A list of rewards can be found in the Appendix. The teacher wrote names of group rewards, group criteria, and target behaviors on index cards. Three shoeboxes were covered with colored construction paper and used to store index cards that contained rewards, criteria-target behaviors, and suggestions for rewards.

During this study, daily written independent seatwork assignments, quizzes, and exams were not altered. Instead, students continued to work on spelling, mathematics, and English tasks that were part of their typical school routine and included in their individual education plans (IEP). Students were placed in each of these curricula at different levels and progressed through their IEP objectives at different rates. Thus, students rarely received the same assignments and no attempts were made to equate assignment difficulty within or across students.

Mathematics, spelling, and English assignments included worksheets from different

curricula workbooks and teacher-constructed assignments. Mathematics assignments, quizzes, and exams typically required students to complete computation problems, including word problems, figure problems, and pictorial problems. English assignments, quizzes, and exams varied considerably and include assignments that required selection responses (e.g., circling the verb), production responses, (e.g., writing sentences using the following adjectives), matching responses, and multiple-choice questions. Spelling assignments were varied and included word finds, cross word puzzles, writing words in a sentence, and matching word to definitions. Exams required student to write words as a teacher read them aloud. In most instances, teachers' manuals were used to evaluate student performance.

Design and Dependent Variables

A modified multiple baseline across target behaviors design was used to evaluate the effects of the group contingencies on students' academic performance. The three target behaviors were academic performance on independent seatwork assignments (including quizzes and tests) in spelling, mathematics, and English. The design included four phases. During baseline, no additional consequences were received for performance in spelling, mathematics, and English. During the intervention phases, interdependent group contingencies were implemented. Across all intervention phases, students received access to rewards contingent upon the class average percent correct on daily independent assignments. Rewards were randomly selected, as was the criterion for earning the reward.

During the first phase of intervention, rewards were delivered contingent upon the students meeting a randomly selected criterion for spelling performance. Additional target behaviors were sequentially added, rather than replaced (hence a *modified* multiple baseline across behaviors design) to the intervention. During the second intervention phase, rewards were delivered contingent upon meeting a randomly selected criterion for either spelling or mathematics performance. During the final phase, English performance was included as a

target behavior. Thus, rewards were randomly selected and delivered contingent upon meeting a randomly selected criterion for either spelling, mathematics, or English performance.

Each day, students were given independent seatwork assignments in spelling, mathematics, and English that were evaluated for accuracy by the teacher or teaching assistant. Items that were not completed were scored as incorrect. For each assignment, teachers calculated the percent of items correct. These data served as the dependent variables for this study and also were used by the teachers to monitor students' progress and performance and assign grades. The class mean accuracy on spelling, mathematics, and English assignments served as the primary dependent variables and decisions regarding which behavior to target and when to alter phases were based on these data. Mean accuracy levels were calculated by summing each student's percent correct on each assignment and then dividing by the number of students who attended school that day. All students' scores were included unless a student had to miss a significant portion of class time for other activities (e.g., parent-teacher conference). For each subject area, individual student performance (i.e., percent correct) also was measured.

Experimental Procedures

Baseline. During this phase, no additional contingencies were implemented for the targeted academic behaviors. Typical classroom procedures during this phase included independent group-oriented and individual contingencies for academic and social behaviors. Students received grades contingent upon their own academic performance on independent seatwork, tests, and homework. Privileges and praise were delivered for appropriate social and academic behavior. Students earned *Bonus Bucks* that could be exchanged for the opportunity to engage in specific activities (e.g., playing on the computer) or tangible rewards (e.g., fruit). Also, consequences were delivered contingent upon inappropriate and disruptive behaviors (e.g., in-school suspension for aggressive behavior).

Teacher preparation. The primary experimenter conducted a training session before the intervention was implemented. First, the experimenter spent about 10 minutes reviewing the program with the teacher and teaching assistant. Next, the experimenter provided the teacher and teaching assistant with a seven-step treatment protocol typed on sheets of white paper. The experimenter, teacher, and teaching assistant then reviewed baseline data and selected the initial target behavior. Spelling was selected because the class average performance was low and showed a clear decreasing trend.

Next, criteria were established. Criteria were selected based on teacher judgment of students' abilities and baseline data. The teacher wrote "spelling" on 30 index cards. For each index card the teacher wrote a criterion. The 30 criteria were as follows, one index card with "25%," three with "50%," three with "70%," four with "80%," four with "85%," five with "90%," five with "95%," and five with "100%." These index cards were then placed in a shoebox, which was labeled "Goals." Although the index cards in this shoebox technically contained performance criteria and target behaviors, the term *goals* was used to enhance communication with students (e.g., when describing the program, label on the shoebox).

Student training and reinforcer generation. The teacher, teaching assistant, experimenter, and students met for one 30-minute group session at the beginning of the school day. The experimenter introduced herself to the class and explained that an *Academic Reward Game* would be implemented. The experimenter explained to the class that they would be able to earn a reward based upon their performance on in-class assignments. Students were told that either everyone or no one would receive rewards. The students and teacher then suggested various group rewards and the teacher wrote these rewards on the chalkboard. The teacher gave examples for various group rewards (e.g., 15 minutes of computer time, 10 minutes of music, extra *Bonus Bucks*). From this list, the teacher then selected rewards that were acceptable. The teacher excluded some tangible rewards that were resource inefficient (e.g., ice cream, toys) and included primarily

activity reinforcers that required few resources (e.g., playing games).

Once the teacher selected rewards for inclusion in the reward pool, she wrote the rewards on index cards and placed them in a shoebox labeled "Rewards." The teacher then placed a Suggestion Box on an activities table and informed students that they could write suggestions for other group rewards at anytime during the study. Students were told that the teacher could choose to include these rewards in the Rewards Box if she felt they were appropriate. See the Appendix for a list of rewards that were included in the Rewards Box.

Next, the experimenter told the class that they could earn these rewards if they met certain academic goal(s). The teacher told the students that their first goal would be to improve their daily spelling grades. The teacher informed the students that she would randomly select a reward from the shoebox at the end of each school day if students met a specific criterion for spelling accuracy. The teacher also told the students that the entire class would earn the reward only if the class average performance met the criterion.

Next, the teacher told the class that the goal also would be randomly selected. At this point, she showed the class the Goals Box and randomly selected a card and read the target behavior and criterion (e.g., class average of 90% in spelling). The teacher then explained that if the class met or exceeded this goal she would randomly select a card from the Rewards Box and all students would receive access to the randomly selected reward. Although students typically received the reward the next school day, the specific time that the reward was delivered was at the teacher's discretion. The teacher told the students that if they did not meet the chosen goal she would not select a reward from the Rewards Box, but that they would have an opportunity to earn a reward the next day.

The teacher selected several other examples of goals and rewards, informed students of the number of cards with each criterion included in the Goals Box, answered specific questions with respect to the program, and summarized the program. She reminded the

class that they could make suggestions for other rewards by filling out an index card and placing it in the Suggestion Box. The Goals Box was placed next to the Rewards Box on the teacher's desk.

Intervention procedures. During the intervention phases, typical classroom procedures and reinforcement contingencies remained in place and the interdependent group contingency program with randomized components began immediately after student training. Thus, at the end of the school day the teacher announced that it was time to determine if the group earned the reward for spelling performance. First, she randomly selected an index card from the Goals Box. She then checked her grade book where the teacher or the teaching assistant had calculated or estimated (e.g., if all student scored above 95% and the criteria was 80% there was no need for the teacher to immediately calculate the class's exact average) the group's average spelling accuracy. The teacher then announced the criterion and whether the class met this criterion. If they met the criterion, the teacher randomly selected a reward and announced which reward they would receive. The teacher returned the reward and goal index cards to their respective shoeboxes so that they could be selected again on another school day. These procedures were continued for 9 school days.

Student training and procedures for randomized target assignments. After 9 school days of the interdependent group contingency targeting spelling accuracy, mathematics was *added* as a possible target assignment. Again, in the morning a training session was run in which the teacher described this change in the Academic Reward Game. Specifically, the teacher told the students that mathematics goals would be added to the Goals Box and explained to the student that in order to increase their chance of earning rewards, they would have to do well in *spelling and mathematics*. The number of index cards with the specific goals were identical to those used for spelling. For example, there were four index cards with "mathematics" and "80% accurate" and five index cards with "mathematics" and

"90% accurate." Thus, there were now 60 index cards in the Goals Box, 30 targeting spelling and 30 targeting mathematics.

This program with randomly selected rewards, criterion, and target assignments was then run for 9 school days using procedures that were identical to those used during the initial intervention phase. However, because they could not be sure which target behavior would be selected, the teacher and teaching assistant had to have evaluated and recorded each student's spelling and mathematics performance before the end of the day, so that they could quickly calculate or estimate the class mean accuracy on both spelling and mathematics assignments.

After 9 school days, English performance was added. Again, the teacher and the experimenter decided to use the same number of cards with the same criterion as those used for spelling and mathematics. The teacher wrote these criteria (e.g., English, 80% accurate) on index cards. She showed and described these index cards to the students. The teacher then added these cards to the Goals Box (now 90 cards) and told the students that in order to increase their chance of earning the rewards, they would now have to do their best on spelling, mathematics, and English assignments.

Procedures were identical to those described earlier, except now the teacher and the teaching assistant had to score each student's performance on three assignments (spelling, mathematics, and English) before the end of each school day so that the class average could be quickly calculated or estimated. This final phase of the current experiment was run until the teacher decided to halt procedures because the end of the school year was approaching and the students had many different activities planned.

Interscorer Agreement

Individual assignments were first scored by the teacher or teaching assistant. The primary experimenter independently scored a randomly selected sample of 20% of the in-class assignments. Interscorer agreement was then calculated for each assignment on an item-by-item basis. The number of agreements was di-

vided by the number of agreements plus disagreements and multiplied by 100. The mean total interscorer agreement for accuracy was 96.7%. Interscorer agreement was not 100% because there were discrepancies in scoring English assignments, which sometimes required subjective evaluation.

Treatment Protocols

The classroom teacher and teaching assistant were presented with checklists to use to help them implement the intervention with integrity. The teacher(s) used the checklist to self-record their daily treatment-related behaviors. Daily, the teachers recorded whether they

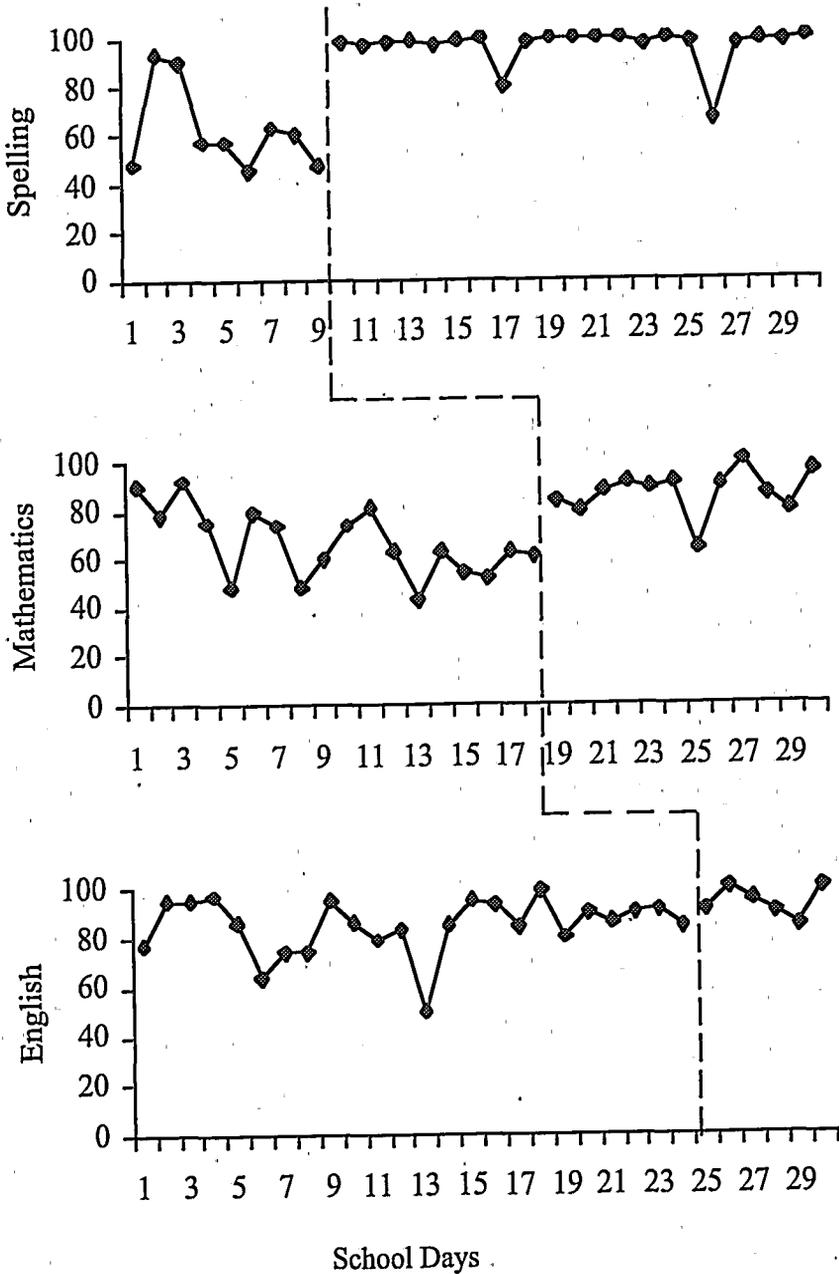


Figure 1. Classwide average daily grades in spelling, mathematics, and English across baseline and intervention phases.

Table 1
Average Percent Correct and Letter Grades on Daily Assignment
for Baseline and Intervention Phases Across Academic Content
Areas and Students

Student	Spelling				Mathematics				English			
	Baseline		Intervention		Baseline		Intervention		Baseline		Intervention	
	X	Grade	X	Grade	X	Grade	X	Grade	X	Grade	X	Grade
One	93.3	A	97.7	A	68.4	D	89.8	A	85.6	B	98.0	A
Two	69.0	D	92.3	A	64.7	D	86.6	B	80.2	B	92.0	A
Three	26.2	F	96.3	A	72.4	C	86.1	B	72.9	C	90.0	A
Four	90.7	A	98.5	A	58.0	F	80.4	B	86.8	B	100.0	A
Five	0.0	F	89.5	A	63.7	D	84.0	B	87.7	B	79.0	C
Class	62.2	D	96.2	A	66.6	D	86.6	B	85.7	B	93.3	A

(a) collected in-class assignments, (b) accurately scored the class in-class assignments, (c) randomly selected an index card from the Goals Box before the end of the day, (d) told the class the goal and whether they met the goal, (e) randomly selected a reinforcer from the Rewards Box (if goals was met), and (f) delivered the reward if the criterion was met (typically the next school day). Self-recording data suggested that integrity was maintained 100% of the time. The teachers reported that the checklist helped with integrity and that the students would remind her to carry out this intervention at the end of each day.

Results

Figure 1 displays the class average daily assignment scores (i.e., percent correct) for all three academic subject areas during baseline and intervention phases. Table 1 presents the mean data across students and each student's average percent correct data for spelling, mathematics, and English for baseline and intervention phases. Table 1 shows that the class average data during baseline phases were lowest for spelling (62.2%, *SD* = 17.7), followed by mathematics (66.6%, *SD* = 14.55), and English (85.7%, *SD* = 11.29). The class average performance during the intervention phase in-

creased to 96.2% (*SD* = 8.12) for spelling, 86.6% (*SD* = 9.2) for mathematics, and 93.3% (*SD* = 6.3) for English. Effect sizes were calculated for each subject area by dividing baseline and intervention phase mean differences by the weighted pooled standard deviation across phases. Results showed the strongest effect size for spelling (*ES* = 3.01), followed by mathematics (*ES* = 1.65) and English (*ES* = .84).

Figure 1 shows that average spelling performance during baseline was variable with a decreasing trend. After the group contingency targeting only spelling performance was implemented, spelling performance increased immediately and remained strong throughout the entire intervention phase, except for Days 17 and 26. As additional subject area assignments were added to the group contingency, the class average spelling performance remained high.

Figure 1 shows a decreasing trend in baseline mathematics performance. After mathematics assignments were added to the randomized group contingency, the class showed an immediate improvement in their mathematics performance. As with spelling, intervention data were more stable than baseline data. Students' mathematics performance tended to improve as the intervention

progressed. When English was added to the group contingency (i.e., School Day 25), students' mathematics performance decreased. This decrease in mathematics performance occurred only for the first school day (i.e., Day 25) that English performance was included in the group contingency.

English performance was more variable during baseline than during the intervention phase and no clear trend is evident during either phase. After English assignment performance was added to the randomized group contingency, performance was more stable. Although average performance in English was higher during the intervention phase, an immediate increase in performance did not occur after English was added to the group contingency.

Although effect size data are often used to provide an indication of strength of an intervention, a clearer understanding of the effect of this intervention may come from analyses of student grades. In this classroom, a rather common grading scale was used where 89.5–100% = A, 79.5–89.5% = B, 69.5–79.5% = C, 59.5–69.5% = D, and any score below 59.5 = F. Based on this scale, Table 1 shows socially significant or educationally valid increases in individual student performance across content areas. For spelling, the 2 students who performed A work continued to do so after the intervention was implemented and the 3 students with D or F averages all improved to A level performance. With respect to mathematics performance, during baseline 1 had a C average, 1 an F average, and 3 had D averages. After mathematics was added to the intervention, all students improved their performance to A or B levels. In English, Student 3 improved from a C average to an A average and 3 of the 4 students who all were doing B work during baseline improved to an A average, with only Student 5, slipping to a C average. However, Student 5 was absent for all but 2 days during the English intervention phase, making it difficult to draw conclusions based on comparisons across phases.

Discussion

Although Skinner et al. (1996) provided a compelling rationale for randomizing group

contingency components, the current study is the first to investigate the effects of randomizing interdependent group contingency components on the academic performance of students with SED. Visual analysis of Figure 1 showed immediate, stable, and educationally valid increases in spelling and mathematics performance after the intervention was applied to these target behaviors. When English was added to the pool of target behaviors, increases were not as dramatic. Because their baseline performance in English was strong, ceiling effects may have influenced English performance. Analysis of effect size data and individual student grades demonstrate large and educationally valid improvements in student performance after the target behaviors were added to the intervention. Thus, the current study supports the use of interdependent group contingencies with randomized contingency components for enhancing the academic performance of students within self-contained classrooms serving secondary students with SED. Future research is needed to address limitations of the current study and extend the research base associated with these promising strategies.

In the current study, teachers followed IEP objectives and moved students through daily assignments based on their individual progress. Thus, daily assignments, quizzes, and tests were not controlled or equated. This is an experimental weakness that likely introduced some uncontrolled variability across daily performance. However, the current results show that intervention yielded effects that were sufficient in magnitude to overcome this uncontrolled variability (Barlow & Hersen, 1984). Because effect sizes may have been reduced by this uncontrolled variance, future experimental researchers should conduct similar studies with tightly controlled dependent variables to obtain a more precise measure of effect size.

In the current study, students who were performing well in baseline continued to perform well during intervention phases. However, students who were performing poorly showed dramatic improvements. For example, average daily spelling performance increased from 26% to 96% for Student 3, and from 0%

to 90% for Student 5. These changes suggest that these students had the skills to perform assigned academic work but were choosing not to engage in assigned tasks. Educators should use similar procedures only when students have the skills to perform target behaviors (e.g., instructional level skills), as strengthening reinforcement associated with tasks that students cannot perform is likely to frustrate students (Gickling & Thompson, 1985).

Sequentially adding randomly selected target behaviors to the program has applied implications that warrant future investigation. In the current study, starting with only one target behavior (spelling) may have increased the probability of the students earning the reward during the initial phase of the study. This early success may have enhanced the effectiveness of the program (Sulzar-Azaroff & Mayer, 1986). Future researchers should determine if sequentially adding target behaviors enhances the effectiveness of similar prevention and intervention procedures.

One concern with reinforcement programs is that targeting one class of behaviors may cause decreases in other desired behaviors (Mace et al., 1990; Myerson & Hale, 1984). This was not the case in the current study. As randomly selected target behaviors were added, students had to both enhance their performance on the new target behavior and maintain their performance on previously targeted behaviors in order to maintain the same chance of earning rewards. Results show that performance increases on assignments that had been previously included in the program were maintained throughout the course of the study. Future research is required to confirm and extend these findings related to randomizing target behaviors and criteria.

Another important applied implication associated with sequentially adding randomly selected target behaviors is related to maintenance. One way to enhance maintenance is to require the same level of performance (i.e., same target behavior and criteria) while gradually reducing reinforcement for these behaviors (Stokes & Baer, 1977). In the current study, reinforcement remained constant, but behavioral requirements were gradually increased as

target assignments were added. Future researchers should determine if this gradual increase in response requirements enhances maintenance of target behaviors after interventions are withdrawn.

In the current study, the interdependent group contingency program was added to a classroom that already employed individual and independent group contingencies. Future researchers should investigate interdependent group contingencies with randomized components in isolation and compare the effects of such programs with individual and independent contingency programs. Additionally, researchers should conduct component analysis studies to determine which variables are necessary and sufficient to bring about desired changes in behavior. For example, researchers should determine if goal settings and feedback are sufficient to bring about desired changes, or whether the additional reinforcers used in the current study are needed.

Future researchers should also address internal and external validity limitations associated with the current study. In the current study, the degree of change (e.g., effect size) decreased as each subsequent target behavior was added to the contingency. This may have been caused by ceiling effects or by sequence effects. Additionally, future researchers should determine if the process of increasing target behaviors without enhancing reinforcement diluted the contingency and caused the program to be less effective as phases progressed.

Researchers should determine if such procedures would be effective across students (e.g., age, gender, ethnic background, SES), settings (general education classroom, larger classes), teachers (general education teachers), and target behaviors (e.g., prosocial target behaviors). In the current study, the class included only 5 students. One concern with interdependent group contingencies is that as group size increases, effects on behavior may decrease (Hayes, 1976). In order to determine if such a procedure could be used in a general education classroom, research investigating the relationship of group size to intervention effectiveness is needed. During the final phase of

the current study, two teachers had to grade only 5 students' performance on three separate assignments before the end of the school day. It may be difficult for educators with larger classes (e.g., 20 students) to perform these evaluation tasks this efficiently. Future researchers may want to determine if randomly selecting one student and determining if this student's performance met a randomly selected criteria would enhance the efficiency of the current procedure, without reducing the effectiveness (see Gresham & Gresham, 1982). In the current study, students were given new discrete assignments, quizzes, or tests, each school day. Future researchers should determine if similar procedures are effective when contingencies are administered less often with tasks that are associated with less objective scoring (e.g., at the end of a 1-week period when students are working on more continuous projects).

One reason students with SED are placed in self-contained classrooms is that their inappropriate behaviors are disruptive and prevent classmates from learning. Whereas interdependent group contingencies could increase disruptive behaviors (e.g., students threaten peers in an attempt to enhance their performance), it is possible that interdependent group contingencies that target academic behaviors might decrease disruptive behaviors because any behavior that prevents peers from performing academic behaviors also reduces the probability of all students earning the reward. Future research is needed to determine if the current or similar programs that target academic behaviors also alter appropriate and/or inappropriate classroom social behaviors.

Enhancing students' daily academic performance may improve learning rates. However, in the current study only daily assignment performance was measured. Longitudinal studies are needed to determine if the current or similar intervention procedures could be used to prevent and remedy learning problems and problems associated with learning skill deficits (e.g., low academic esteem, high rates of escape-avoidance motivated behavior), which are common in students with SED (Bos, Coleman, & Vaughan, 2002).

Enhancing the academic performance of students with SED can be challenging. The current study showed how randomizing various components in an interdependent group contingency program could cause educationally valid improvements in the daily academic performance across subject areas and across students with SED. In unstructured interviews that followed the completion of this study, the teacher and students reported that they liked the program. The teacher indicated that she would use the program the following school year. Although both the teacher and the teaching assistant indicated that they found the intervention easy to implement and resource efficient, they also reported that they had to focus on grading each student's performance before the end of the day because they now had much more to grade as students were completing much more work. Although these informal reports are helpful, future research with more participating teachers and students is needed to evaluate the social validity of the current intervention. In the current study, teachers were provided with treatment protocols. Although teachers self-recorded treatment integrity data, no systematic study of integrity was taken. Future researchers should collect more valid integrity data and determine if these protocols increased treatment integrity.

Although the current novel program has many potential psycho-educational applications, many questions remain unanswered. Future researchers should evaluate the effects of interdependent group contingencies with randomized components on students' academic achievement, prosocial behavior, anti-social behavior, and escape-avoidant behavior in both special education and general education classrooms. Additionally, because these procedures employ less discriminable contingency components, researchers should investigate issues related to maintenance and generalization of behavior change.

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Appendix

Rewards included in the Reward Box

- 30 minutes on "Carmen Sandiego" (a word and math detective game)
- 30 minutes on the "flight simulator"
- 30 minutes on "Gizmos and Gadgets" (building science chemicals, airplanes, and math problems)
- 30 minutes of free game time
- 15 minutes of "Silent Ball" in the room
- 15 minutes of a math computer game
- 100 Bonus Bucks (that could be traded into the store for drinks, fruit, water, novelty toys)
- 150 Bonus Bucks (that could be traded into the store for drinks, fruit, water, novelty toys)
- One game of "Fruit-Basket Turnover"
- Play a card game with a staff member
- A movie

A vertical bar on the left side of the page, consisting of a yellow-to-white gradient with a small red diamond at the top.

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Serving Students With Serious Emotional Disturbance:
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