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Token economy used to increase performance in solving algebra problems for high school students

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TOKEN ECONOMY USED TO INCREASE PERFORMANCE IN SOLVING ALGEBRA PROBLEMS FOR HIGH SCHOOL STUDENTS

by

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ABSTRACT

Token Economy Used to Increase Performance in Solving Algebra Problems for High School Students

by

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The purpose of this investigation was to evaluate the effects of using a token economy approach to increase the performance in solving algebra homework quizzes for two high school boys. The program included tokens that could be redeemed for candy or extra credit points to encourage the students to try harder to check over their answers on homework quizzes before handing them in to be graded. Permanent product was used to record the scores of the homework quizzes and a comparison of baseline data and intervention data was done with a reversal design. The results showed that the students did not show improvement given the tokens as reinforcement for the correct number of problems on the homework quizzes.

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CHAPTER 1

INTRODUCTION

Research has shown that 5.73% of the student population ages 6-17 in the United States has a learning disability, many of whom have a disability in mathematics (U.S. Department of Education, 1999). At one high school in Las Vegas, students need three math courses and must pass the mathematics proficiency test with a score of 65 or better in order to graduate. Forty-eight percent of the students, however, fail the test the first time. Students with a learning disability are included in this overall percentage. The purpose of the present study was to improve the math skills of students with a learning disability in mathematics by increasing the number of correct problems on math homework quizzes. Hopefully, this will enhance their ability to successfully complete the required math courses and pass the proficiency test in order to graduate.

The relation between student performance and math scores is a key element for student success in mathematics. Many students rush through their work and quizzes, causing lower scores because they make careless errors. When students take their time, show all their work, and check over their answers their grade reflects the extra time spent on the work. Grades on homework and quizzes are a reflection of how a student is achieving in class. Students who maintain a C or better in class are average students. Average students put in the extra time and effort it takes to maintain their grade compared to

students who maintain a D. Those students with a D only do the minimum to pass the class. The attitude of the student is reflected throughout the years in high school and can be measured by their score on the proficiency test. Students who do not like math and who only do what it takes to get the lowest D to pass the class are faced with reality when they receive their score from the proficiency test and they do not pass. Students who have a learning disability in mathematics often fall into this category.

Many students are self-motivated and do what it takes to be successful in math. Students who have a learning disability are at a disadvantage because they may already feel as though they cannot do the work and that they are not as smart as their classmates. They have the ability to do the math, but there is a learned helplessness that many of the students feel. Teachers can help students understand that they can do the work by teaching strategies, giving praise, or using motivational techniques.

Significance of Study

In many states, students are required to pass a proficiency exam in order to receive a high school diploma. Many students who have a learning disability are held to the same standards as their peers who do not have a disability (Bursuck, Harniss, Epstein, Polloway, Jayanthi, & Wissinger, 1999). When educators understand how students learn, process information, use strategies, and what is their knowledge base, skill level, and motivation for learning then effective instruction can take place (Monatgue, 1996). Therefore, the investigation evaluates the effects of using a token economy to increase the performance in solving algebra quiz problems.

Definition of Terms

Algebra 1A class is a class that teaches half of the algebra, which is taught in a regular Algebra 1 class. Students essentially take algebra for two years, learning the first half of algebra in the Algebra 1A class and the second half of algebra in an Algebra 1B class. The algebra curriculum is taught at a slower pace for the students who have difficulty in math. Students who have a math learning disability have a difficult time processing math. Many students with a math learning disability find in difficult to organize and interpret information when they are trying to interpret an algorithm (Cawley & Miller, 1989; Cawley, Miller & School, 1987; Scruggs & Mastropieri, 1986; Marsh & Cooke, 1996). Real numbers in an algebra curriculum include instruction in adding, subtracting, multiplying, and dividing negative and positive numbers. The real numbers include whole numbers, fractions, and decimals.

Token economy system is a motivational technique used by many teacher, parents, and schools to encourage students to display desirable behaviors (Lazarus, 1990). Tokens may be given out on pieces of paper reading "1 Token," plastic chips, or written down on a record sheet.

Statement of the Purpose

One motivational strategy is a token economy. A token economy could be used to encourage students to take their time and become more aware of what they are putting on their papers. This should increase the number of correct problems students have on their papers before they hand them in for a grade. This study evaluates the effectiveness of using a token economy to encourage students to take their time, show all their work, and check over their answers. Students who want the tokens will most likely be more aware

of what they are doing on their papers. A student's increased performance on quizzes will help them to become successful in math by improving their grades and therefore making them feel successful. When students are successful and they like what they are doing their self-esteem is raised. The success a student can feel in a math class could potentially be the same success a student can feel when taking the proficiency test.

Research Question

The question that this study addresses is:

1. Is a student with a learning disability in mathematics able to improve math scores with an increased performance rate using a token economy?

CHAPTER 2

REVIEW OF RELATED LITERATURE

Learning Disabilities and Mathematic Performance

Students with a learning disability in mathematics exhibit behaviors, which are different from their peers who do not have a math weakness (Bryant, Bryant, & Hammill, 2000). These behaviors initially prompt general classroom teachers to refer students who potentially may have a learning disability to be tested. General classroom teachers refer students based on their classroom achievement and behavior. Many of the referrals do not occur until the upper-elementary grades for testing of a math disability compared to a referral for reading and spelling in the early grades (Anderman, 1998). Students with a learning disability approach math problems differently than their peers. The cognitive strategies that are needed to solve many of the math problems are not apparent in the students and therefore referrals are done later (Anderman, 1998). Students who are not referred until middle school are at an even greater disadvantage. Studies have shown that the transition from elementary to middle school is very difficult for students in their achievement, motivation, and attitudes about school (Anderman, 1998). A middle school environment creates stressful competition for grades, relative ability, and rote memorization at a time when students need an environment where they can experience independence, growth, cooperation, and creativity (Anderman, 1998). Anderman (1998)

conducted a study that showed students who did not change schools until the ninth grade had better achievement scores in math and science whether they had a learning disability or not.

Students with a learning disability in mathematics spend more time completing homework compared to their non-disabled peers (Bursuck, et al., 1999). Most students have at least 30 minutes to 1 hour of homework a night. Homework provides independent practice that is required to develop important skills and knowledge of the subject material. Students with learning disabilities are held accountable to the same standards as their non-disabled peers when they are included in the general education classrooms. Students with a learning disability spend more time completing their homework because they run into so many more difficulties while trying to complete their assignment. Educators should help the students by reminding them of due dates of assignments and provide parents with a list of suggestions to help their child. Parents need to check their child's homework daily and regularly attend parent-teacher conferences (Bursuck et al., 1999).

Students with a learning disability in math use fewer problem-solving strategies compared to their non-disabled peers (Jordan & Hanich, 2000). Students who have difficulty in math will have problems with rapid fact retrieval and problem-solving skills compared to their peers. Students who have math and reading difficulties experience problems in conceptualization and execution of calculation strategies (Jordan & Hanich, 2000). Geary, Hoard, and Hamson (1999) found that students who had math difficulties but were good readers had a better knowledge base of counting principles than the students who had math and reading difficulties (Jordan & Hanich, 2000).

Jordan and Hanich (2000) tested four groups of second graders by giving each student a series of tasks to assess their thinking across four areas of math: number facts, story problems, place value, and written calculation. The groups consisted of students with math difficulties only, students with math and reading difficulties, students with reading difficulties only, and students without any math or reading difficulties. The students with math and reading difficulties performed worse than the students without any difficulties and the students with just math difficulties only performed worse in the area of story problems compared to the students without any difficulties (Jordan & Hanich, 2000). All the students used strategies to calculate and count (i.e. verbally or with their fingers). The students who have math and reading difficulties made many errors when they used counting strategies compared to the other groups of students. Students who have math difficulties only do not experience the same types of problems counting and are successful with this strategy (Jordan & Hanich, 2000).

Student's views of their own competence, performance, and their understanding of different learning situations are important components of a student's competence in the classroom (Meltzer, Roditi, Houser, & Perlman, 1998). Students who have learning disabilities may rate themselves equally with their peers when it comes to achieving in school. These ratings are higher than ratings from teacher evaluations and standardized achievement tests. Meltzer, Roditi, Houser, and Perlman (1998) found that students with learning disabilities rated themselves as strategic and competent in most academic areas. They rate themselves as average to above average in academic areas such as reading, writing, spelling, math, and organization, but their self-ratings were lower that the average student. Teachers in the study rated students with a learning disability as below

average in their academic performance overall compared to student self-ratings. The teachers' perceptions of students with a learning disability, in their actual performance displayed in the classroom, was lower than the students' perceptions of themselves. Although, teachers did rate the effort that students with disabilities put towards their work as close to their peers (Meltzer et al., 1998).

Students who are identified as having a learning disability have problems with their intellectual abilities (e.g., low Verbal IQ and high Performance IQ) or patterns of achievement (e.g., poor arithmetic and satisfactory reading) (Silver, Pennett, Black, Fair, & Balise, 1999). Students are tested for visual-spatial, auditory-linguistic, psychomotor, memory, and problem-solving abilities. Differences in these areas enable educators to group students together and give instruction that will be beneficial to meet their specific needs. Students with a learning disability who only have arithmetic disabilities display verbal strengths and visual-perceptual-organizational weaknesses (Silver et al., 1999). Knowing this, educators can develop plans designed specifically for the students with arithmetic disabilities only. Silver, Pennett, Black, Fair, and Balise (1999) tested students ages 9 to 13 who were identified as having arithmetic disabilities only, arithmetic and reading disabilities, arithmetic and spelling disabilities, and arithmetic, reading, and spelling disabilities. Nineteen months after initial testing, intervention was implemented. Intervention included special education services, private math tutoring without special education, special education plus tutoring, other forms of intervention such as summer school, or no intervention (Silver et al., 1999). Retesting took place after another 19 months. The arithmetic disabilities group continued to show problems whether they received intervention or not. Half of the students who displayed arithmetic and spelling

disabilities improved in the area of arithmetic and were no longer categorized as having an arithmetic disability. The group that made the least amount of progress was the group of students with an arithmetic, reading, and spelling disability. Since they are deficient in so many areas it is more difficult for any of the interventions to make a significant difference. Any change in this group was in their arithmetic scores but not in their reading or spelling. The group of students who displayed arithmetic and reading disabilities did make gains in their arithmetic but not in reading. Overall, most of the groups increased their ability in arithmetic with intervention (Silver et al., 1999).

Mainstreaming students with disabilities into the regular classroom is the way many educators, advocates, and parents want to see learning take place for these students. For most of the day, students will spend their time in a regular classroom and may receive special services part of the day. Students who have learning disabilities that are in regular classroom settings are at a disadvantage especially if they are in secondary school because teachers' focus on content coverage (Scanlon, Deshler, & Schumaker, 1996). Most secondary teachers are unwilling to teach strategies because of the high content of curriculum they need to cover in a school year (Scanlon et al., 1996). Scanlon, Deshler, and Schumaker (1996) conducted a study that focused on whether teachers could teach learning strategies and content to students at the same time. In order for learning to take place for many students, teaching needs to be exciting, engaging, and make students feel successful. Twelve middle school social study teachers participated in the study. Half of the teachers were the experimental teachers and the other half became the comparison teachers. A strategy called ORDER was designed so all students could benefit. It was integrated into the social studies content that was taught daily and the students were

taught to use it independently. The ORDER strategy has five steps: Open your mind and take notes, Recognize the structure, Design an organizer, Explain it, and Recycle it (Scanlon et al., 1996). The students pre- and post-tests were compared and many of the students did not show gains. The researchers noted that the scores of the students with learning disabilities showed the strategy might have been more effective with them than with the general education students without disabilities. Many of the students in the study felt they did not know the strategy well after it was taught to them and the teachers were not satisfied with how well the students could use the strategy overall. Problems also lie in how teachers feel about the curriculum. Teachers feel that they need to move on and teach the curriculum even if all students did not master the material (Scanlon et al., 1996).

Teachers that employ mnemonic instruction for their students with disabilities into their curriculum show academic improvement for these students (Greene, 1999). Greene (1999) conducted a study on using mnemonics to recall multiplication facts with 23 elementary and middle school students who were enrolled in resource rooms or special day class programs. Students were presented with peg-words and peg-phrases that corresponded to the numbers in the form of an algorithm. Flashcards were used to test students on their multiplication facts with one side containing the algorithm and the other side containing the traditional form of teaching multiplication facts. When tested, the students who learned their multiplication facts using the mnemonic method were able to retain their math facts better than the students who learned them using the traditional method. The students also retained their multiplication facts for a longer period of time (Greene, 1999).

When teachers use strategies for instruction and use student's learning characteristics to teach in their classroom it is called the "interwoven approach" (Karp & Voltz, 2000). This approach lets teachers be flexible in their teaching so it helps all the different types of learners in the classroom. The interwoven approach leads to three other types of instruction that benefits different types of learners: explicit instruction, apprenticeship instruction, and constructivist instruction. The explicit instruction is when the teacher leads the students in the learning process. It is a direct instruction approach where teacher routines are highly organized in a demonstration-prompt-practice sequence (Karp & Voltz, 2000). For math, this approach is highly effective in the classroom. The students are posed with questions that guide the students to self-question when solving problems and the steps of the problems are modeled by the teacher. Then students can follow the model of the steps when they practice the problems themselves. The apprentice instruction lets the student be the apprentice that is trying to master a math task that is a part of their life (Karp & Voltz, 2000). The teachers only teach when it is needed and instead there are learning activities for the students. The approach incorporates the different types of learners in the classroom. Some learners are higher and some are lower, but all can contribute to learning the content. Lastly, the constructivist instruction is based on the knowledge that a student already has and lets the student construct meaning in their own way from their own experiences (Karp & Voltz, 2000). Independence is the number one goal in this instruction. Students are taught to become independent learners and the learning experience is their responsibility. Students must discover learning rather than follow a teacher's instruction. Because many students with learning disabilities need a structured environment for learning, the constructivist

instruction may not always be the best type of learning environment for them (Karp & Voltz, 2000).

Token Economy

Strategy instruction works for many students because they have trouble remembering the steps it takes to complete a problem. Students who understand the process to complete a problem but make errors along the way may need a different type of strategy. Strategies such as token economies may work well with these students. Token economies employ a strategy that should get students to recognize when they have made errors in their computation.

Token economy systems are often used to improve social skills or academic performance of children. It is a type of reinforcement technique that employs tokens or points to students who display desirable behaviors (Lazarus, 1990). The token economy system is easy to use for teachers and parents since the stimulus to the child is a token. The tokens only have value when the child redeems them (Charlop-Christy & Haymes, 1998). The children can use their reading, math, and language skills with the token system. They need to budget their tokens and compare values of items they wish to purchase along with seeking friends' recommendations for rewards (Lazarus, 1990). Numerous studies have been conducted to investigate token economy systems.

A cooperative home-school token economy works with both environments (Lazarus, 1990). In this system, children are allowed to earn tokens for either school or home and they can spend their tokens in either setting. The motivational factor here is the

increased choices for rewards. Parents also get the added benefit of not only improved academic performance, but improved social behaviors at home (Lazarus, 1990). Teachers are also glad because there is increased parent involvement and awareness of student activities. Daily checks in the student token book lets parents know how their child is doing in school and teachers know how the child is doing at home (Lazarus, 1990). Involving the parents takes time; parents need to be trained in how the program works. In a 2-hour training session, parents should be able to come up with a list of desired behaviors they would like their child to exhibit (e.g., take out the trash, wash the dishes, study for science). Next, they need to price each task for how much it is worth. If it is an everyday task that happens more than once it might be worth only 2-points compared to a big task that happens once a day worth 10-points (Lazarus, 1990). Once the tasks and behaviors are selected, then the rewards need to be chosen and priced. Parents working together can come up with fair rewards for the children that will be satisfying for each individual child (e.g. favorite meal cooked, television time, movie pass).

Cavalier, Feffetti, and Hodges (1997) investigated the effects of a self-recording token economy to self-motivate the appropriate behavior of two children with learning disabilities. They wanted to improve not only their social behavior but also their academics so they could eventually receive instruction in general education. The two students, age 13 and 14, were not making progress academically because of their inappropriate verbalizations. The experiment was done using a multiple-baseline-across-subjects experimental design (Cavalier et al., 1997). The sessions were conducted twice a day for 50-minutes each. An explanation of the inappropriate verbalizations the

students were displaying was read to each child and they were given an event-recording sheet. Each child needed to make a slash mark for each time they talked-out. They were to be accurate in their recording. The experimenters modeled the procedure for them. At least 85% accuracy for four consecutive sessions needed to be achieved when compared to the experimenter's data. If the performance criteria was met, then they got to have free time for 15-minutes, go to McDonald's after school on Friday, or have some privileges increased (Cavalier et al., 1997). During the next two phases, checks were only done once a day to maintain the self-recording accuracy. The self-management continued until no more than three inappropriate verbalizations for one 50-minute session occurred.

Green and Gilbert (1994) conducted a study to improve the behavior of seventh and eighth grade self-contained children with learning disabilities. An incentive program was designed to increase motivation and improve self-concept. The children were involved in creating the classroom rules, consequences, and the incentives. When the children completed assignments or displayed appropriate behavior they were rewarded with imitation money (Green & Gilbert, 1994). When the children displayed inappropriate behavior or had incomplete assignments, their consequence was to lose their imitation money. The children could spend the money on a number of incentives and at the end of the quarter take part in an incentive auction (Green & Gilbert, 1994). There were checklists administered to determine if the intervention worked. The results of the pre- and post-tests showed that there was a decreased level of disruptive behavior, although incomplete assignments increased along with the number of tardies. Since the disruptive behavior decreased, the amount of discipline time in the classroom decreased.

Fachin (1996) observed a second grade child, with Attention Deficit Hyperactivity Disorder (ADHD) that would not stay in his seat, spoke out of turn, and showed aggressive behavior towards others and property. A token economy was established at school and at home. Rewards consisted of television time, dessert, and video-game time at home (Fachin, 1996). The child could earn play money for desirable behaviors. The first three months of the school year the unwanted behaviors decreased although not to satisfaction. Fachin (1996) continued to implement the token economy along with other plans to help his behavior. The ADHD needed some specific attention. The child's desk was moved in front of the room, peer tutoring was rotated so the child could work with different children on different tasks, and relaxation techniques were taught so the child could calm himself down. In the last month of school, Ritalin was prescribed. This showed the most difference. Fachin (1996) noticed that the child felt good about himself and earned the most money he had ever earned. There were still days he was more active than others, but the behavior plan of the token economy along with medication seemed to help him achieve success in the classroom (Fachin, 1996).

Stover (1994) assessed on-task behavior and inappropriate talking-out while implementing a token economy with a behavior contract. The children were nine seventh and eighth graders in a self-contained emotional support classroom (Stover, 1994). The children were taught how the system would work and the experimenter modeled the inappropriate behavior. The teacher used a clicker to signal the children and researcher when there was inappropriate behavior (Stover, 1994). In order for the children to earn tokens they had to be active learners. They needed to be able to work on worksheets, projects, and experiments without disruptive behavior. The children were given ten

tokens a day and every time they made inappropriate verbalizations they lost a token. They could earn an extra token if they got their question of the day correct (Stover, 1994). There was also bonus candy for the child who had the most points for the week. The teacher posted a bar graph, which showed the children's daily earnings so they could see their progress and compare it to the rest of the class. Every day the children had a chance to redeem their tokens for rewards. Fading out did not take place until ten sessions were complete. During the fading out phase, the daily maximum number of tokens that could be earned was decreased each day for five days (Stover, 1994). The results showed that the students increased their on-task time and decreased inappropriate behavior. The contract helped gain the commitment of the children to improve behavior and accept the consequences of losing tokens. The children usually chose rewards daily in the form of candy or soda (Stover, 1994). Most of the students did not hold out for large items or items that were not edible. Overall, the students liked the rewards and found that it was motivating (Stover, 1994).

It is hypothesized that a student with a learning disability in mathematics is able to improve math scores with an increased performance rate using a token economy. Specifically, the researcher predicted that if students are encouraged to try harder by giving tokens for the number of correct problems on a homework quiz the students should reduce their amount of careless errors.

CHAPTER 3

METHODOLOGY

Subjects

Subjects in the study were two high school boys with a learning disability in math. At the high school they attended they were enrolled in an Algebra 1A cooperative class where there is a general education teacher and a special education teacher teaching together for their last class of the day. They were selected because the students did not consistently achieve well on their quizzes or tests while performing well in other class work (i.e. homework, taking notes). Approval for this study was granted by the Social Behavioral Sciences Institutional Review Board on May 8, 2002.

Student 1 is a Caucasian boy, age 15. He is in the tenth grade. He has an intelligence score of a 94 along with stanine scores of a 4 in math, a 4 in language, and a 3 in reading. He attended a study skills class for one period of the day to receive special services.

Student 2 is a Hispanic boy, age 15. He is in the tenth grade. He has an intelligence score of an 84 along with stanine scores of a 3 in math, a 4 in language, and a 4 in reading. Although he is eligible for special services, he is in all general classes.

Materials and Setting

Research took place at the students' high school located in a large urban school district in the South West. The students attended an Algebra 1A class for their last class of the day. The learning environment was in the classroom with 17 students total in the room. The students both sat in the front of the room. Student 1 sat in front of the teacher and Student 2 sat to the left of the teacher.

The students received math instruction with adding, subtracting, multiplying, and dividing real numbers (i.e. integers, fractions, and decimals). Although instruction took place with the lights off, for a clear view of the overhead, natural light was illuminated by a large window in the back left corner of the room. The students used their own materials to take notes (i.e. paper, pencil). Quizzes were made on the computer and were copied on paper for the students.

Tokens were given out on a 2-inch by 2-inch piece of paper, which read "1 Token." Candy and extra credit were given as motivators when the students redeemed their tokens. Starburst, Snicker bars, and Air Heads were given out as candy and extra credit points were given on 2-inch by 2-inch pieces of paper which read "1 Extra Credit Point."

Procedure

An ABAB reversal design was used to evaluate the effectiveness of a token economy on the number of correct problems on a homework quiz of two high school students with a math learning disability. Permanent product was used to record the number of correct problems the students completed during the homework quiz of algebra problems consisting of multiplying, dividing, adding, and subtracting real numbers. The students

took a homework quiz within the first 15 minutes of class consisting of 10 problems similar to the previous night's homework (i.e. -3+6, -5*8, -40/-8). For example, single and double digit integers, like and unlike denominators in fractions, mixed fractions, and one, two, and three decimal place value problems all using multiplication, division, addition, and subtraction week by week. Baseline data was collected for 5 days. At the conclusion of the first baseline phase, the first intervention stage began.

During each phase, the teacher/researcher modeled the steps taken in order to solve a problem, read the directions, and showed the work needed to solve the problem. Teaching techniques included warm-up problems from the previous day's assignment, checking homework, answering questions from previous night's homework, and a homework quiz on the previous night's homework. The students completed the homework quiz, which was graded for accuracy and given back the next day. The number of tokens each student received was determined by the number of correct problems the students received on their homework quiz. The tokens were given out when the homework quiz was handed back to the students. The students received one token for each correct problem. The students kept their tokens in their notebook until Friday when the tokens could be redeemed for reinforcements of candy or extra credit to use on major test. Starburst, Snicker bars, and Skittles cost 10 tokens, Air Heads cost 5 tokens, and 1 Extra Credit point to use on a major test cost 3 tokens. After the homework quiz, students took notes on the day's lesson while the teacher modeled the problems on the overhead. Students then worked on problems in class while the teacher monitored their progress and answered any questions. Students were assigned homework from the day's lesson.

The first intervention phase was implemented for nine days. At the conclusion of the first intervention phase, the intervention was withdrawn and a second baseline phase was conducted for five days. At the conclusion of the second baseline phase a second intervention phase was implemented for five days. The study was implemented five days a week for five weeks.

CHAPTER 4

RESULTS

The investigation was to see if a student with a learning disability in mathematics is able to improve math scores with an increased performance rate using a token economy. Student 1 and Student 2's number of correct problems on a homework quiz appears in Figure 1. During the five baseline sessions, Student 1 had a mean baseline score of 6.2 with a range of 3 to 9 points. In the first intervention phase he had a mean score of 6.8 with a range of 4 to 10 points. The second baseline phase Student 1 had a mean score of 6.8 with a range of 4 to 10 points and for the second intervention phase he had a mean score of 8.2 with a range of 6 to 9 points.

Student 2 had a mean baseline score of 6.0 with a range of 4 to 8 points and a mean score of 5.3 for the first intervention phase with a range of 0 to 9 points. In the second baseline phase, Student 2 had a mean score of 5.0 with a range of 3 to 7 points. For the last intervention phase, Student 2 had a mean score of 6.0 with a range of 5 to 7 points.

Student 1 increased his score by 0.5 points from the first baseline phase to the first intervention phase. His mean stayed the same from the first intervention phase to the second baseline phase when the tokens were not given out. For the second intervention phase, his mean increased from the second baseline by 1.4 points.

Student 2 decreased his score from the first baseline phase to the first intervention

phase by 0.7 points. He decreased also from the first intervention phase to the second baseline phase by 0.3 points. In the second intervention Student 2's mean increased by 1.0 points from the second baseline phase.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Discussion

The purpose of this study was to determine whether the implementation of a token economy would improve the math scores of two high school boys with a learning disability. Prior to this study, based on teacher report, the students did not check over their work on their quizzes and tests before they handed them in therefore their grade was not showing their potential. The question, which was researched, was could a token economy improve the performance on quizzes for students with a learning disability in math. The students had good note taking skills and good grades for their class work and homework. The results showed that the tokens given for the number of correct problems did not improve quiz scores. Student 1 obtained a mean of 6.2 for the first baseline phase and a 6.8 for the first intervention phase, improving by 0.5 points. He obtained a 6.8 for the second baseline phase, which was the same mean as the first intervention phase. An 8.2 was obtained for the second intervention phase, which was an increase. Student 2 obtained a mean of 6.0 for the first baseline phase and a 5.3 for the first intervention phase, a decrease in 0.8 points. A mean of 5.0 for the second baseline phase was obtained, which was a decrease from the first intervention phase. An increase to a mean of 6.0 for the second intervention phase was obtained.

These results do not show a functional relationship because there was not an overall increase in the students' scores from the baseline phases to the intervention phases of the reversal design. There also was not a significant drop in scores from the first intervention phase to the second baseline phase to show that the intervention of a token economy had an affect upon the students while taking the homework quiz. The design allowed for the baseline data to be shown first. The baseline data show the students can accurately calculate real number problems, but they are not always successful to receive a grade that is 70% or more correct.

Limitations of the Study

There were three out of five days of consistent baseline data for the implementation of the first intervention phase to begin. During the first intervention phase, Student 1's scores were consistent between 4 and 10 points. There was no set pattern to his scores. Student 1 was absent twice during the five weeks of the study and he made up his homework quizzes after he completed the homework for the quiz. He consistently did his homework on a daily basis. He did have days of frustration when he did not understand something or did not feel confident in his ability. Many times he would get the majority of his homework and class work problems correct (80% to 100% accuracy) but did not perform as well on his homework quiz (as low as 40%). He may have made small errors that earned him a lower grade, which did not necessarily reflect his knowledge on the material. Test anxiety may also have been a factor for the lower scores. He answered many questions during lessons and asked questions also. Student 1 always had all his materials for class (i.e. book, notebook, pencil) and he was also on time to class. He was

concerned about his grade in the class and would check his grade every Friday when they were posted. He maintained a C average in the class until the study started and then his grade slowly increased until he brought his grade up by 10 percentage points earning a B for the quarter. He had started getting extra help from a tutor after school 1-2 times a week at the time the study started. His father set up a program for him at the tutoring place to get him extra help to bring his grade up. Many of the days he went to tutoring he asked for extra work because he needed more to work on while he was there. Student 1 always redeemed his tokens for the extra credit points.

Student 2 did not always have his homework completed or he only had half of the homework completed. This may have affected his grades on his homework quizzes during both the baseline phases and the intervention phases. During the first intervention phase many of his scores were between 4 and 10 except for two of the scores were a 1 and 0. These two scores could be because the student did not do his homework but also because he had a bad day. Student 2 was absent four times during the study and he made up those quizzes after he completed the homework for the quiz. Even though he did not always have his homework completed, he always had his materials for class (i.e. book, notebook, pencil). Student 2 would bring in weekly progress reports for the teacher to fill out his grade and would make-up any assignments that he was missing. He was earning a high F in the class before the study and brought his grade up by 11 percentage points to end the quarter with a D. He needed to bring his grade up in order to play football in the fall. The football coaches checked-up on him regularly, during the study, to make sure he was progressing. Student 2 used half of his tokens to buy candy and the other half to get extra credit points.

A factor that could have affected the boys' performance was that they were hungry. Their math class was after lunch and they may have missed lunch due to making up a test for another teacher or forgetting their lunch money. Moreover, these students may not have had enough sleep the night before because of something that happened at home. This may have influenced their ability to concentrate at school. Many high school students stay up late not realizing that school starts early and they need enough sleep in order to be alert the next day.

Since permanent product recording by the teacher was used to check the quizzes there was the possibility of error (Alberto & Troutman, 1999). Data is no longer available to check the reliability of the scores.

Implications of the Study For Future Research

Previous researchers demonstrated that token economy systems benefit many students. Improved social skills or improved academic performance may be demonstrated when token economy systems are used (Lazarus, 1990). Most token economy systems are used to improve behavior and frequently academic performance improves as well. It is a type of reinforcement technique that employs tokens or points to students that display desirable behaviors (Lazarus, 1990). The students in this study did not display behaviors that distract them from not performing well on quizzes (i.e. talking out, looking around the classroom, not have materials for class). In this study, the desirable behavior was to increase the number of correct problems on a homework quiz.

In the future it would be interesting to conduct this study from the beginning of the school year. Many of the students need more time to retain information learned in the classroom.

Another possibility for future research is to have the students redeem their tokens at the end of the class period. If the students get a daily reward that is concrete this may influence them to study their homework to be prepared for a homework quiz the next day.

Since the students with learning disabilities were in a classroom of students without learning disabilities, it would be interesting to conduct research on how the whole class did with the tokens and the homework quiz scores. It also would be interesting to compare a class with students that have a disability and ones that do not have a disability to a class with students that do not have any disabilities.

Although a token economy may change behavior it may not always change academic performance and teaching learning strategies to improve academic performance may be needed for the learning process to take place. Secondary students may also need realistic motivators in order for a token economy to work in the classroom (i.e. gift certificates to a fast food restaurant, driving lessons, music CDs).

Practical Implications

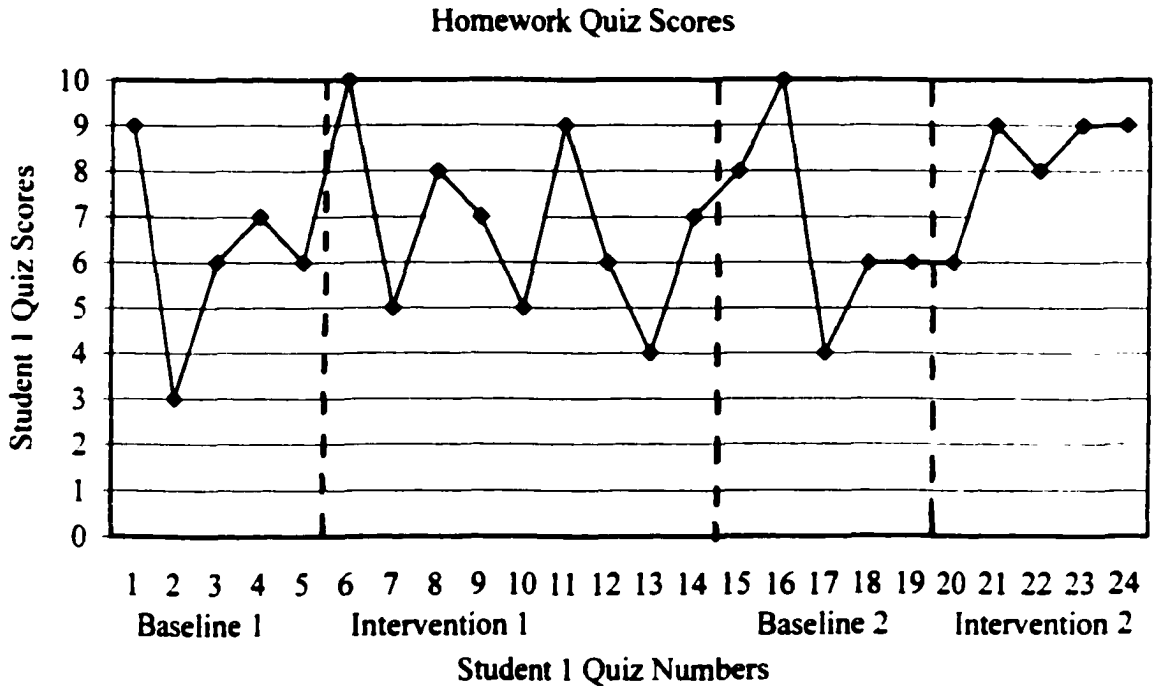
Both Student 1 and Student 2 improved their mean scores in the second intervention phase. This was the last week of school and since both students were trying to improve their grade overall they might have tried to obtain good grades on their homework quizzes to not only improve their class grade but to redeem their tokens for extra credit to use on the last major test. They may have understood that the tokens could be used for extra credit and it would benefit them to earn the tokens. Since both of their grades were improving in the class, it was to their benefit to do better on the homework quizzes. The motivation may have been their improved grades in the class not the tokens they were

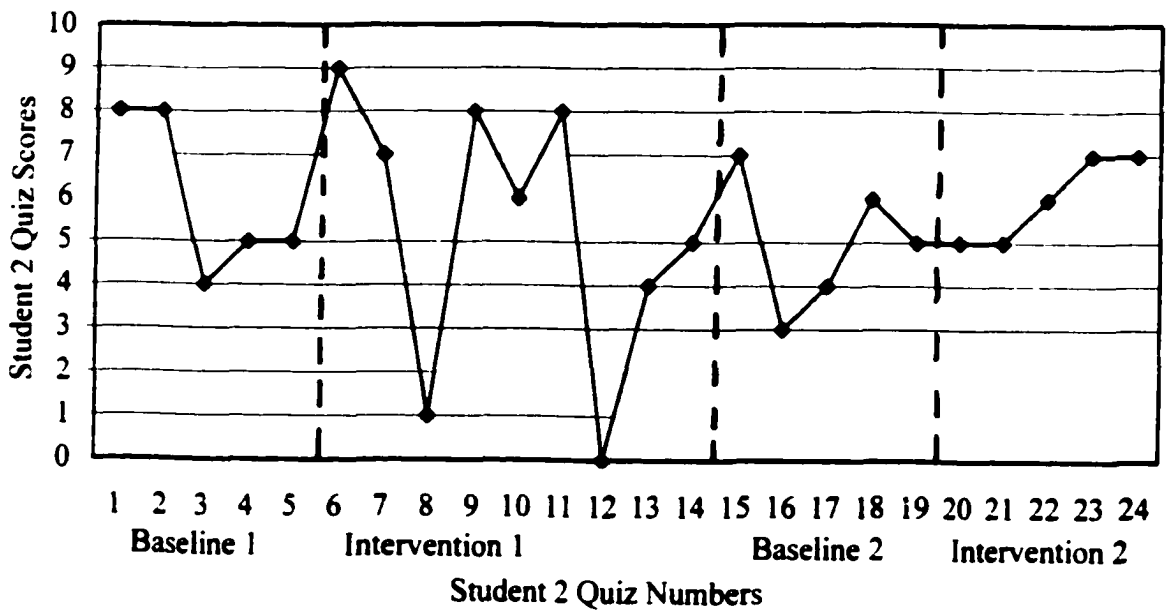
receiving for their effort. Overall, the students' quarter grades increased by a letter grade which helped both students' semester grade to end with a C so they can move on to the next level of Algebra, Algebra 1B.

APPENDIX I

FIGURE 1

Figure 1





APPENDIX II

CONSENT FORMS

UNLV
University of Nevada, Las Vegas

Informed Consent

General Information:
I am Kari Maes, a Masters student in the Special Education Department at the University of Nevada, Las Vegas.

Purpose:
I am asking for your child's participation in a research project. In high school, students need three math courses and need to pass the mathematics proficiency test with a score of 65 or better in order to graduate. Forty-eight percent of students, however, fail the test the first time. The purpose of the present study is to improve the math skills of students with a learning disability in mathematics in order to enhance their ability to successfully complete the required math courses and pass the proficiency test in order to graduate.

Procedure:
Daily there will be a homework quiz that is similar to your child's homework problems. Your child will be given tokens for every correct problem they get when I hand back the homework quiz the next day. On Fridays, your child can redeem their tokens for candy, pencils, or extra credit point to use on a major quiz or chapter test.

Risks and Benefits:
The benefit of your child's participation is for him/her to become aware of the importance of improving their accuracy on quizzes and tests. This study focuses on the importance of retaining information learned during class lectures and studied during independent practice. The risks are minimal. Your student may feel uncomfortable when answering the questions on the homework quiz.

Cost to Subjects:
There will be no compensation for your child's participation. The cost is time spent on the homework quiz questions. The students should spend approximately 7 to 15 minuets answering the questions daily.

Confidentiality:
Student anonymity is assured. All data collected will be kept completely confidential. Records will be maintained in a locked facility for at least three years after the completion of the study.

Contact Information:
If you have any questions regarding this research, please contact myself, Kari Maes at 799-5790, or my advisor, Dr. Nathanson at 895-1101 in the UNLV Department of Special Education. For questions involving the rights of research subjects, please contact the UNLV Office for the Protection of Research Subjects at 895-2794.

UNLV
University of Nevada, Las Vegas

Voluntary Participation:
Student participation is strictly voluntary and they may withdraw from participation at any time. Please feel free to ask any questions you may have about the information being provided to you about this study.

Participant Consent:
By signing below, you are acknowledging your understanding of the information provided and agree for your child to participate in this study.

_____ _____
Signature Date

UNLV
University of Nevada, Las Vegas

Youth Assent Form

General Information:
I am Kari Maes, a Masters student in the Special Education Department at the University of Nevada, Las Vegas. You have been chosen to participate in a study I am doing for UNLV for the completion of my master degree. The study will use different methods to improve your quiz and test scores.

Procedure:
Daily there will be a homework quiz that is similar to your homework problems. You will be given tokens for every correct problem you get when I hand back the homework quiz the next day. On Fridays, you can redeem your tokens for candy, pencils, or extra credit points to use on a major quiz or a test.

Benefits of Participation:
The benefits should be that your quiz and test scores improve which will help your grade.

Risks of Participation:
You may feel uncomfortable answering some of the questions on the homework quiz. You may ask for help during the quizzes and I will explain any question to you in more detail.

Cost to Subjects:
There will be no compensation for your participation. The cost is time spent on answering the homework quiz questions. You should spend approximately 7 to 15 minutes answering the questions daily.

Confidentiality:
Student anonymity is assured. All data collected will be kept completely confidential. Records will be maintained in a locked facility for at least three years after the completion of the study.

Voluntary Participation:
If you do not want to participate in the study, you do not have to. If you want to withdraw at any time during the study, you may.

Contact Information:
If you have any questions regarding this research, please contact myself, Kari Maes at 799-5790, or my advisor, Dr. Nathanson at 895-1101 in the UNLV Department of Special Education. For questions involving the rights of research subjects, please contact the UNLV Office for the Protection of Research Subjects at 895-2794.

UNLV
University of Nevada, Las Vegas

Consent Forms:
A consent form will be sent home for your parents/guardians to sign. You may discuss with your parents/guardians if you want to participate or not. A copy of the Youth Assent form will be given to you to keep.

Participant Consent:
By signing the assent form you agree to participate in the study.

_____ _____
Signature of Student Date

_____ _____
Signature of Researcher Date

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Thesis Title: Token Economy Used to Increase Performance in Solving Algebra Problems for High School Students

Thesis Examination Committee:
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Committee Member, Dr. Susan Miller, Ph. D.
Committee Member, Dr. Joe Crank, Ph. D.
Graduate Faculty Representative, Dr. James Crawford, Ph. D.