To the Graduate Council:

I am submitting herewith a dissertation written by Teresa Ann Mazzuchi entitled "The Relative Effectiveness of Positive and Negative Consequences in Contingency Contracts to Increase Daily Arithmetic Performance." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Psychology.

Richard A. Saudargas, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

THE RELATIVE EFFECTIVENESS OF POSITIVE AND NEGATIVE CONSEQUENCES IN CONTINGENCY CONTRACTS TO INCREASE DAILY ARITHMETIC PERFORMANCE

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Teresa Ann Mazzuchi

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DEDICATION

This dissertation is dedicated to both of my parents--to my father who did not live to share in the happiness of completion but whose pride and understanding of my ambition will always remain and to my mother who picked up where dad left off in her encouragement and understanding. I cherish them both for the opportunities they gave me and for the love they expressed, which made it all worthwhile.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to my committee--Dr. Robert Wahler, Dr. Kenneth Newton, and Dr. Charles Thompson--for their guidance in the preparation of this dissertation. I would like to express my gratitude to the chairman of my committee, Dr. Richard Saudargas, not only for his time and assistance in planning and evaluating this study but particularly for his patience and sense of humor without which I would surely not have endured.

Appreciation is also extended to each of my brothers and sisters for the emotional support they gave from the beginning to the very end. I am especially grateful to my husband, Fred, for his patience, quiet urging, and overwhelming confidence.

I would like to express my thanks to Patsy McCulley for typing the final copy of this dissertation and to all of my friends who waited without doubting.

ABSTRACT

The relative contribution of two contract components, positive contingencies for meeting the terms of a contingency contract, and negative consequences for failure to meet the contract terms were examined with four elementary school students who had low levels of completion and accuracy on daily arithmetic assignments. A series of single subject reversal designs were used for the four subjects. Each of the subjects was exposed to a contract which contained positive and negative consequences, positive only consequences, and one which contained negative only consequences. The results for two students showed that inclusion of a negative component in contracts for elementary students was not necessary and that use of a positive component alone is sufficient in maintaining high levels of completion and accuracy in daily math assignments. The results obtained for two other students were rendered uninterpretable due to lack of teacher consistency in delivery of feedback and consequences.

While the females in the study preferred the contract which contained only the positive component, the males preferred the contract with both positive and negative contingencies. The students' preferences had no effect on their performance in the different contract

conditions. The students functioned as well on the positive as on the positive and negative contracts.

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I. INTRODUCTION

Contingency contracting is a behavioral technique that has been used successfully in the modification of a wide variety of behaviors in both children and adults. Several researchers have strongly advocated the inclusion in a contract of negative contingencies for failure to fulfill the responsibilities of the contract as well as positive contingencies for compliance to the contract terms (Craighead, Kazdin, & Mahoney, 1976; Mann, 1972; Stuart, 1971; Stuart & Lott, 1972). However, there has been little research which has investigated the relative effectiveness of these two major component parts within a contingency contract. Therefore, the purposes of the present study are to compare the relative contribution of two contract components, positive consequences for meeting the terms of the contract, and negative consequences for failure to meet the contract terms on increasing the completion and accuracy rates of daily arithmetic assignments.

There is agreement in the literature that a typical contingency contract may contain as many as five components (Craighead et al., 1976; Homme, Csangi, Gonzales, & Rechs, 1970; Mann, 1972; Stuart, 1971). First, the contract should be written and signed by all parties to the agreement, between a student and a teacher, for example. Second, a clear specification of behavioral expectations for all

parties agreeing to the contract should be included. Third, there should be positive consequences for meeting the contract terms. Fourth, there should be a negative consequence for failure to meet the terms of the contract. The fifth component, bonus clauses for meeting the contract terms over prolonged periods of time, is not considered necessary in all contracts.

Although there is agreement that a contingency contract may contain both positive and negative consequences, a review of the literature on contingency contracting reveals that, with the exception of one study (Mann, 1972), there has been no systematic research on the relative contribution of positive and negative consequences to the effectiveness of contracts. All contracts reviewed have contained positive consequences for meeting the terms of the contract, but no study has examined a contract with only negative consequences for failure to meet the terms of the contract. A few studies have contained only positive consequences (e.g., Berry, Apolloni, & Cooke, 1977), while most contain both positive and negative consequences (e.g., Lando, 1977; Siggers, 1977).

In research with adults, contracts containing only positive consequences have been used to modify behaviors such as drug use and dependency (Hall, Cooper, Burnmaster, & Polk, 1977), obesity (Harris & Bruner, 1971), and personal hygiene skills (Berry et al., 1977). Obesity and

drug use and dependency have also been effectively changed with contracts containing both positive and negative consequences (Aragona, Cassady, & Drabman, 1975; Boudin, 1972; Tobias & MacDonald, 1977; Willner, 1977). In addition to obesity and drug use, contracts containing both positive and negative consequences have been used with adults to decrease smoking (Lando, 1977; Rovner, 1976; Winett, 1973) and alcoholism (Miller, 1972). Typical positive consequences in studies with adults have been rewards of money or return of surrendered personal valuables. Negative consequences in research with adults have been loss of money or loss of personal valuables.

In research with children, contracts containing only positive contingencies have been successfully used to increase test performance (Bristol & Sloane, 1974; Kabler, 1977), decrease school phobia (Cretekos, 1977), decrease obesity (Dinoff, Rickard, & Colwick, 1972), and to modify on-task and disruptive classroom behaviors (Bardill, 1972; Pines, 1977). On-task and disruptive behaviors have also been effectively modified with contracts that contained both positive and negative components (Ardoff & Weaver, 1975; Siggers, 1977; White-Blackburn, Semb, & Semb, 1977). In addition, a contract containing both positive and negative consequences was used to maintain appropriate classroom behaviors learned from a preceding intervention strategy (Litzenberger & Trusty, 1977). Typical positive

consequences used with elementary school students have been free time in the classroom, food treats, small toys, or extra privileges. Negative consequences for elementary school students have been loss of points toward a final grade or other punishers left up to the teacher, such as loss of recess.

Out of all the research conducted on contracting, only one study compared the effectiveness of a contract using only positive contingencies to a contract using both positive and negative contingencies. Mann (1972) in a study of weight loss concluded that a positive contingency condition alone was not sufficient in modifying weight loss and that a negative component was essential. The implication that a negative component is necessary in contracts has not been established in relation to other behaviors. It therefore appears that there is a need to further investigate the role of the negative component in those contracts dealing with other behaviors.

The major purposes of the present study were to compare the effectiveness of a contingency contract with both positive and negative consequences to those contracts using either only positive or only negative consequences on increasing the completion and accuracy levels of daily arithmetic assignments of elementary school students.

The present study used sixth and third grade students as subjects. These students were chosen either

because they had the lowest percentage of daily math assignments completed or the lowest level of accuracy on daily assignments in their classrooms.

II. METHOD

Subjects and Setting

The elementary school is located in a small rural East Tennessee town and contains kindergarten through sixth grade. The average enrollment during the year was approximately 420 students.

Four students were selected from the 120 sixth and third grade students as subjects. The following selection criteria were used:

1. Each student was within the average range of intelligence as determined by the previous year's score on the Otis-Lennon Intelligence Test (April, 1979).

2. Each student had approximate grade level ability (± 1.0 years) in arithmetic on the basis of the previous year's California Achievement Test (April, 1979).

3. The students having the lowest percentage of math problems completed of those assigned or having the lowest percentage of problems correct of those completed from the sixth and third grade classes over a three to four week period were selected as subjects.

The following students were selected as subjects:

Doug had the lowest percentage of daily math assignments of the sixth graders. Over a three week period, Doug averaged 60 percent completion of his math assignments with an average accuracy level of 65 percent.

Mary had the second lowest math completion and accuracy levels of the sixth graders. She averaged 74 percent completion and 50 percent accuracy over a three week period.

John had the third lowest set of data for the sixth graders. Although John averaged 99 percent completion of his assignments, his accuracy level averaged 72 percent over a three week period.

Kathy, a third grade student, completed on the average of 85 percent of her assignments with an average of 74 percent correct over a four week baseline period.

Three teachers participated in the study. Ms. Garner, a sixth grade teacher, was 26 years old with five years of teaching experience. Ms. Lewis, another sixth grade teacher, was 43 years old and had 21 years of teaching experience. Ms. Walters, a third grade teacher, was 27 years old and had one year of teaching experience.

Dependent Variables

Arithmetic assignments. The major dependent variables were the percentage of math problems completed of those assigned and the percentage of problems correct of those completed. Each student received an average of 40 math problems every day. The math assignments were on each student's ability level and were to be completed in the one hour math period. The sixth grade students had math class

immediately following lunch period, whereas the third graders had math the last period of the day. The assignment completion and accuracy levels were to be collected daily by the classroom teacher, by no later than the end of each school day. Reliability on assignment completion and accuracy for each student was checked at least once during each experimental condition by the experimenter. One hundred percent agreement on percentage of completion and accuracy was obtained on each reliability check.

Procedures

A series of single subject reversal designs, involving three different intervention conditions, were used for the four subjects. The subjects were randomly assigned to one of two contract conditions. The initial contingency contract for three of the subjects contained positive and negative consequences followed by one with either positive or negative consequences. The fourth subject began on an initial contract with only positive consequences followed by one with both positive and negative consequences. The teachers were asked not to provide any additional instruction or attention to the contract students than was provided to the remainder of the class.

Following baseline, the students began the intervention phase. The contract remained in effect for a minimum of ten days. If the last four consecutive days of the ten were above criterion, a new contract was introduced

and signed; otherwise, the student remained on the same contract for at least five more days.

Baseline. The baseline period consisted of collecting the accuracy level and percentage of daily arithmetic assignments completed for each student during the second six weeks of school. Teachers were asked to provide the daily completion rate and the accuracy level for each student's math assignment. During the final week of baseline, the teachers were contacted by the experimenter and asked to arrange a meeting between a selected target subject and the teacher in order to explain the contract system to the student. This meeting took place the day that the first intervention was scheduled to begin.

During the meeting the teacher told the student that she was interested in using a contract system with the student as a means of improving the student's performance on daily math assignments. Each of the students agreed to use the contract to try and improve his/her arithmetic performance. The teacher asked the student to specify some activities that he or she enjoyed doing at school. The student generated two to four of his or her own positive consequences. The negative consequences were basically decided upon by the teacher after having the student mention two punishments that he or she would work hard to avoid receiving (paddlings were not to be considered by the teacher). The student was to be aware of his or her

performance on the math assignment by the end of the day throughout all baseline and contract conditions. If a student fulfilled the terms of the contract on any one day, the positive consequences were to be experienced that same afternoon. If a student failed to meet the contract terms, the negative consequences were often not experienced until that evening (in the case of extra homework), or until the following morning (in the case of loss of recess). For two of the sixth grade subjects, Mary and Doug, their teacher would often not grade their math papers until the following morning so that their consequences were often delayed by an entire day. However, the other two students, Kathy and John, were always informed the same day their assignments were turned in whether or not they had fulfilled their contract terms.

Positive and Negative Contract. A positive and negative contract contained both positive and negative consequences for meeting or failing to meet the contract terms (see Appendix A for sample contract). A student agreed to complete 100 percent of the math assignment with a 90 percent accuracy level in exchange for contingencies that were determined individually between the teacher and the student. For each of the sixth grade students, the rewards included 15 minutes' free time at the end of the day to listen to tapes, free read, or draw. For Kathy, the third grade student, the positive consequences consisted of

a choice between sweeping the classroom at the end of the day or being the leader in line to the buses in the afternoon. Negative consequences for failure to meet the contract specifications included a loss of recess time the next day or double homework that evening, depending on teacher preference, for all subjects. In the second administration of the Positive and Negative Contract for Mary, the negative consequence was changed to 15 minutes of physical exercise (sit-ups, jumping jacks, touching toes) under the teacher's supervision at the end of the day. Mary's negative consequence remained physical exercise for the duration of the study. Regardless of the consequences earned, each student was supposed to know, by the end of the day, whether the terms of the contract had been fulfilled.

Positive Only Contract. This contract specified only positive contingencies for 100 percent completion and 90 percent accuracy of daily arithmetic assignments (see Appendix B for sample contract). The positive consequences were the same as those specified in the Positive and Negative Contract.

Negative Only Contract. This contract specified only negative contingencies for failure to comply with the terms of the contract (see Appendix C for sample contract). There were no positive consequences for fulfilling the contract terms during this condition. The negative

consequences were the same as those specified in the Positive and Negative Contract.

The order of conditions for each student was as follows:

1. Mary - Baseline, Positive and Negative Contract, Positive Only Contract, Positive and Negative Contract, Positive Only Contract, Baseline, Positive and Negative Contract, Negative Only Contract, Baseline.

2. Doug - Baseline, Positive Only Contract, Positive and Negative Contract, Positive Only Contract, Baseline, Positive and Negative Contract, Negative Only Contract, Baseline.

3. John - Baseline, Positive and Negative Contract, Positive Only Contract, Baseline, Positive and Negative Contract, Positive Only Contract, Baseline, Positive Only Contract, Negative Only Contract, Positive and Negative Contract.

4. Kathy - Baseline, Positive and Negative Contract, Negative Only Contract, Positive and Negative Contract, Baseline, Positive Only Contract.

III. RESULTS

John maintained an average completion rate of 100 percent throughout the various contract conditions. The daily percentages of arithmetic accuracy are presented in Figure 1 for John. The percentage of problems correct for John averaged 72 percent during baseline and increased to 91 percent during the first positive and negative contract condition. John's performance remained high in the next contract condition as he averaged 92 percent accuracy on a positive only contract. A return to baseline brought about a lower accuracy level than the initial baseline condition, as John averaged 66 percent accuracy. Once again on the positive and negative contract, however, John's average accuracy level increased to 85 percent. The next condition was the positive only contract, on which his accuracy increased to an average of 91 percent. A third baseline condition showed a decrease in accuracy over contract conditions as John obtained an average accuracy level of 77 percent. Following baseline, a return to the positive only contract again resulted in an increase in accuracy level to an average of 93 percent. John's performance on the subsequent negative only contract decreased to an average accuracy level of 69 percent. Following the negative only contract, John was placed on a third positive

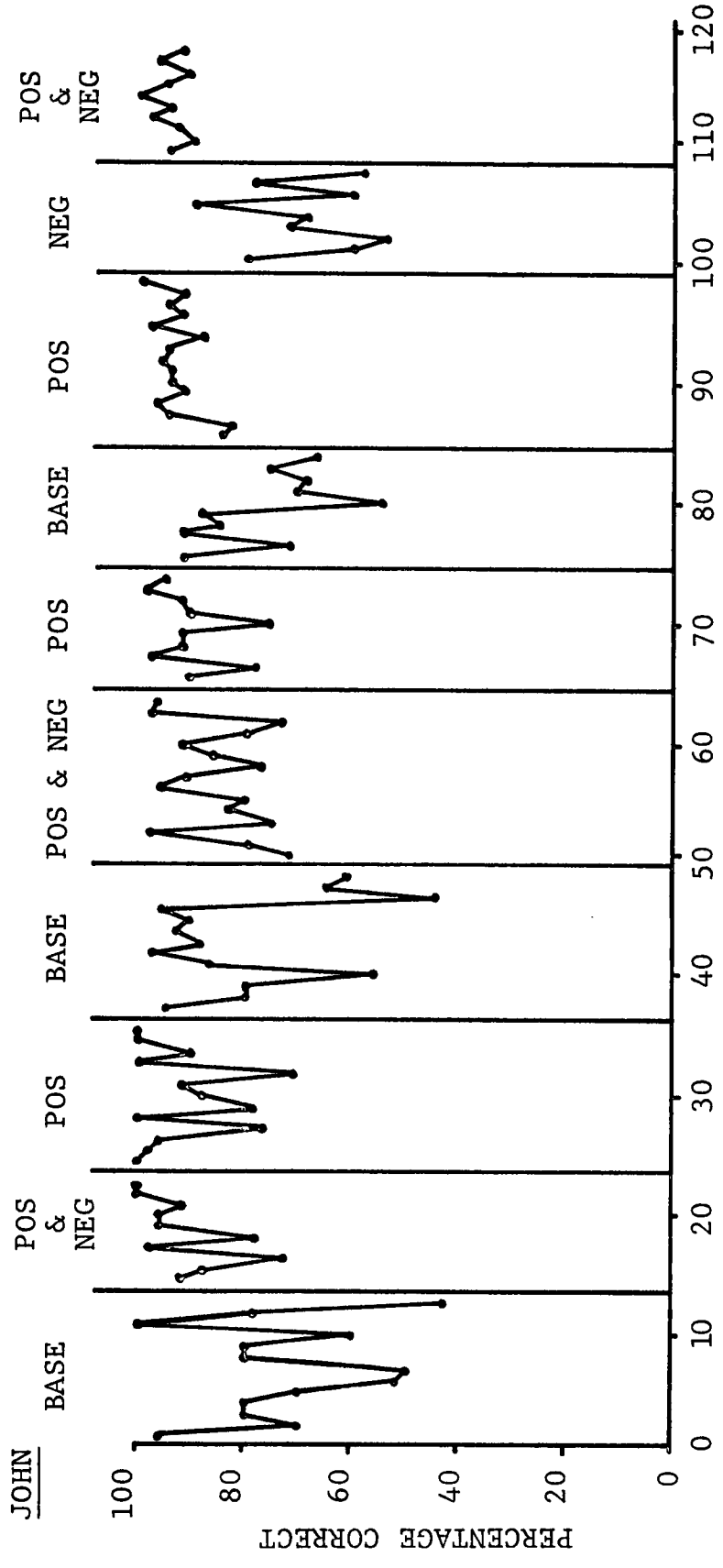

Figure 1. The Daily Percentage of Arithmetic Problems Correct of Those Completed Across Experimental Conditions for John.

and negative contract, where he averaged 95 percent accuracy over a two-week period.

The mean percentages completed and the mean percentages correct combined across experimental conditions for John are shown in Figure 2. The average percentage completion across baseline conditions for John was 99 percent with a mean of 100 percent completion across all contract conditions. The mean percentages correct for John were as follows: 76 percent across 36 days of baseline, 90 percent across 35 days of the positive and negative contract, 92 percent across 38 days of the positive only contract, and 69 percent on nine days of a negative only contract.

There was greater variability in John's percentage correct during the three baseline conditions, as accuracy levels ranged from 43 to 100 percent, 45 to 98 percent, and 55 to 92 percent, than in any of the contract conditions. The same range in accuracy levels was evidenced on each of the contract conditions for John, from approximately 70 to 100 percent, with the exception of the final positive and negative contract, on which his accuracy levels ranged only from 90 to 100 percent.

Table 1 shows the percentage of days above criterion across conditions for all subjects. During the initial baseline, John was above the 100 percent completion and the 90 percent accuracy criterion only 15 percent of the days.

JOHN

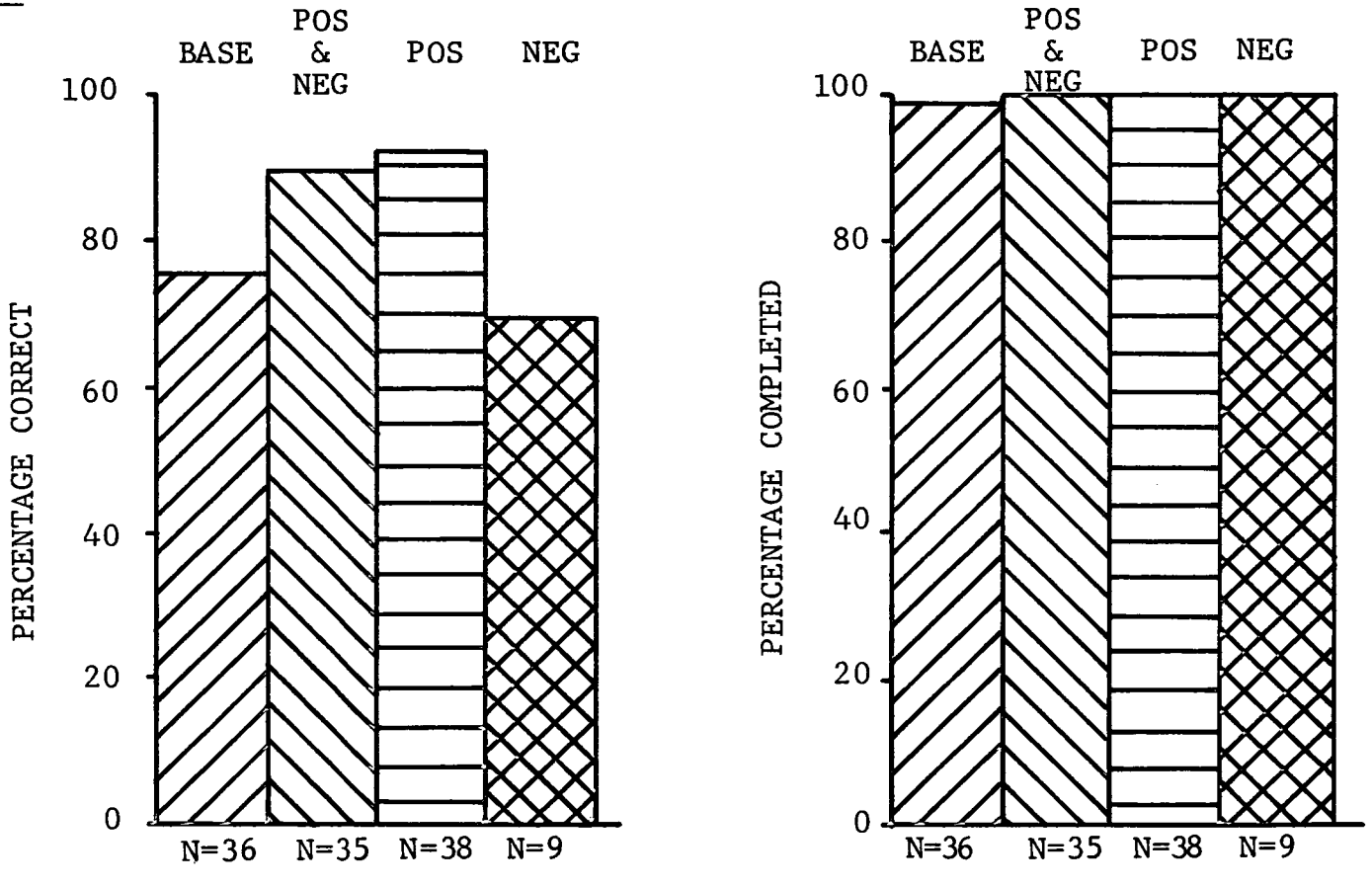

Figure 2. The Mean Percentage of Arithmetic Problems Completed and Correct Combined Across Experimental Conditions for John. The N's represent the total number of days in each condition.

TABLE 1

PERCENTAGE OF DAYS ABOVE CRITERION ACROSS EXPERIMENTAL CONDITIONS

Student	Experimental Conditions									
John	Base	P & N	Pos	Base	P & N	Pos	Base	Pos	Neg	P & N
	15%	70%	69%	38%	40%	80%	20%	80%	11%	100%
Kathy	Base	P & N	Neg	P & N	Base	Pos				
	11%	90%	9%	50%	38%	60%				
Mary	Base	P & N	Pos	P & N	Pos	Base	P & N	Neg	Base	
	0%	6%	1%	33%	40%	0%	23%	35%	100%	
Doug	Base	Pos	P & N	Pos	Base	P & N	Neg	Base		
	21%	60%	1%	40%	35%	27%	50%	33%		

When the positive and negative contract was introduced, John's performance increased to being above criterion 70 percent of the days, and remained high at 69 percent, when the condition was changed to a positive only contract. During the second baseline, John's performance dropped to being above criterion only 38 percent of the days and remained low when the second positive and negative contract was introduced (40 percent). Following the second positive and negative contract, John returned to a second positive only contract where he stayed above criterion 80 percent of the days. The percentage of time above criterion decreased again to 20 percent during the third baseline, but again increased to 80 percent during the following positive only contract. The percentage of days above criterion dropped to 11 percent during the negative only contract, but increased once more to 100 percent in the final administration of the positive and negative contract.

The daily percentages of arithmetic completion are presented in Figure 3 for Kathy. Kathy demonstrated some variability in completion rates across conditions. During baseline, Kathy averaged 85 percent completion of math problems. This figure increased to 100 percent completion when the positive and negative contract was introduced. When the condition changed to a negative only contract, however, Kathy's average completion rate dropped to 73 percent, which was below her original baseline figure. A

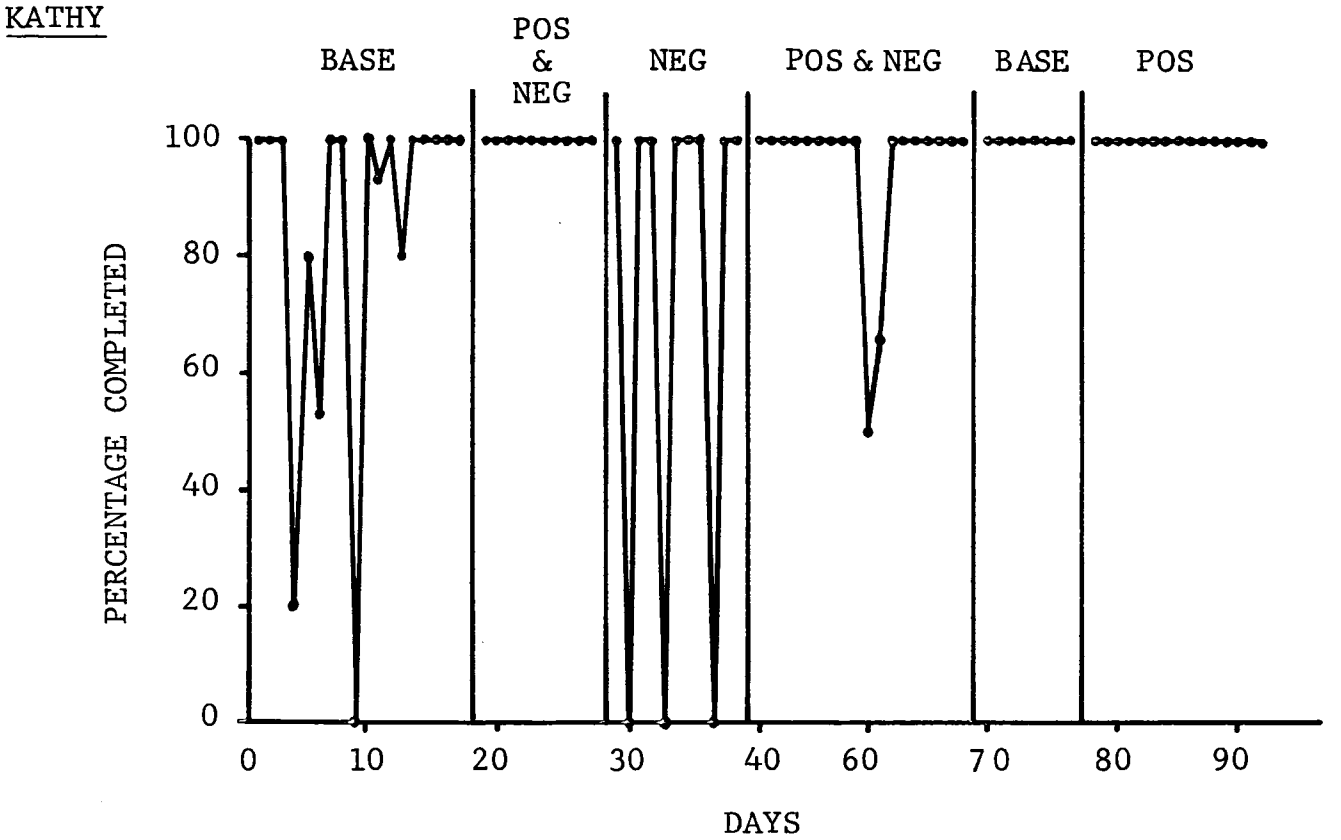

Figure 3. The Daily Percentage of Arithmetic Problems Completed Across Experimental Conditions for Kathy.

return to the positive and negative contract, however, resulted in an increase in Kathy's completion rate to an average of 95 percent. A return to baseline resulted in a completion rate of 100 percent. Following baseline, a positive only contract was introduced and her completion rate remained at 100 percent.

The daily percentages of arithmetic accuracy are presented in Figure 4 for Kathy. Kathy's average accuracy levels across conditions displayed a variability similar to the variability of her average completion rates. During baseline, Kathy averaged 72 percent accuracy. When the positive and negative contract was introduced, Kathy's performance increased to an average accuracy level of 94 percent. When placed on a negative only contract, Kathy's average accuracy fell to 59 percent, which was below her average baseline accuracy level of 72 percent. When the positive and negative contract was re-introduced, Kathy's performance increased to an average accuracy of 78 percent, but this figure was still not as high as the average accuracy level of 94 percent obtained in the first positive and negative contract. When Kathy was returned to baseline, the average accuracy level fell to 75 percent but again increased to 87 percent on the subsequent positive only contract.

The mean percentage complete and the mean percentage correct combined across experimental conditions for Kathy

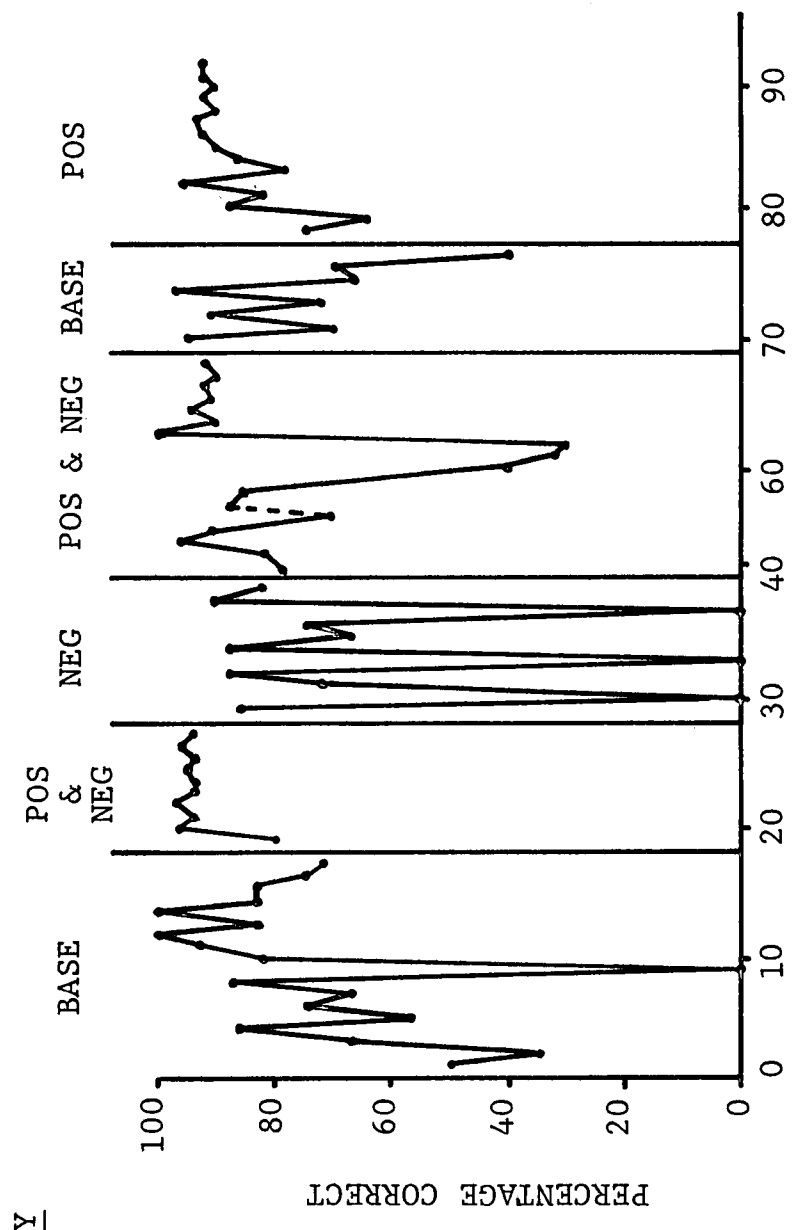

Figure 4. The Daily Percentage of Arithmetic Problems Correct of Those Completed Across Experimental Conditions for Kathy. The dashed line between days 44 and 57 indicates a 12-day period in which Kathy was absent for head lice.

are shown in Figure 5. The mean percentages correct for Kathy were as follows: 74 percent across 26 days of baseline, 86 percent across 28 days of the positive and negative contract, 59 percent on 11 days of the negative only contract, and 87 percent across 15 days on the positive only contract. Kathy's mean percentages completed were as follows: 93 percent across 26 days of baseline, 98 percent across 28 days of the positive and negative contract, 73 percent on the 11 days of the negative only contract, and 100 percent across 15 days of the positive only contract.

The range of Kathy's scores was highly variable during the baseline and negative only contract conditions. Kathy ranged from 0 to 100 percent completion on the first baseline condition with no range in completion on the second baseline condition. She ranged from 0 to 100 percent and 40 to 97 percent accuracy during baseline conditions, and she ranged from 0 to 100 percent completion and 0 to 91 percent accuracy during the negative only contract. Her range of scores was still somewhat variable in the positive and negative and positive only contract conditions, but the scores did not fluctuate as drastically as the scores in the baseline and negative only contract conditions. Kathy completed from 50 to 100 percent of her assignments in the positive and negative contracts with a range of 80 percent to 97 percent and 30 to 100 percent accuracy. The range of scores in the positive only contract was similar to those

KATHY

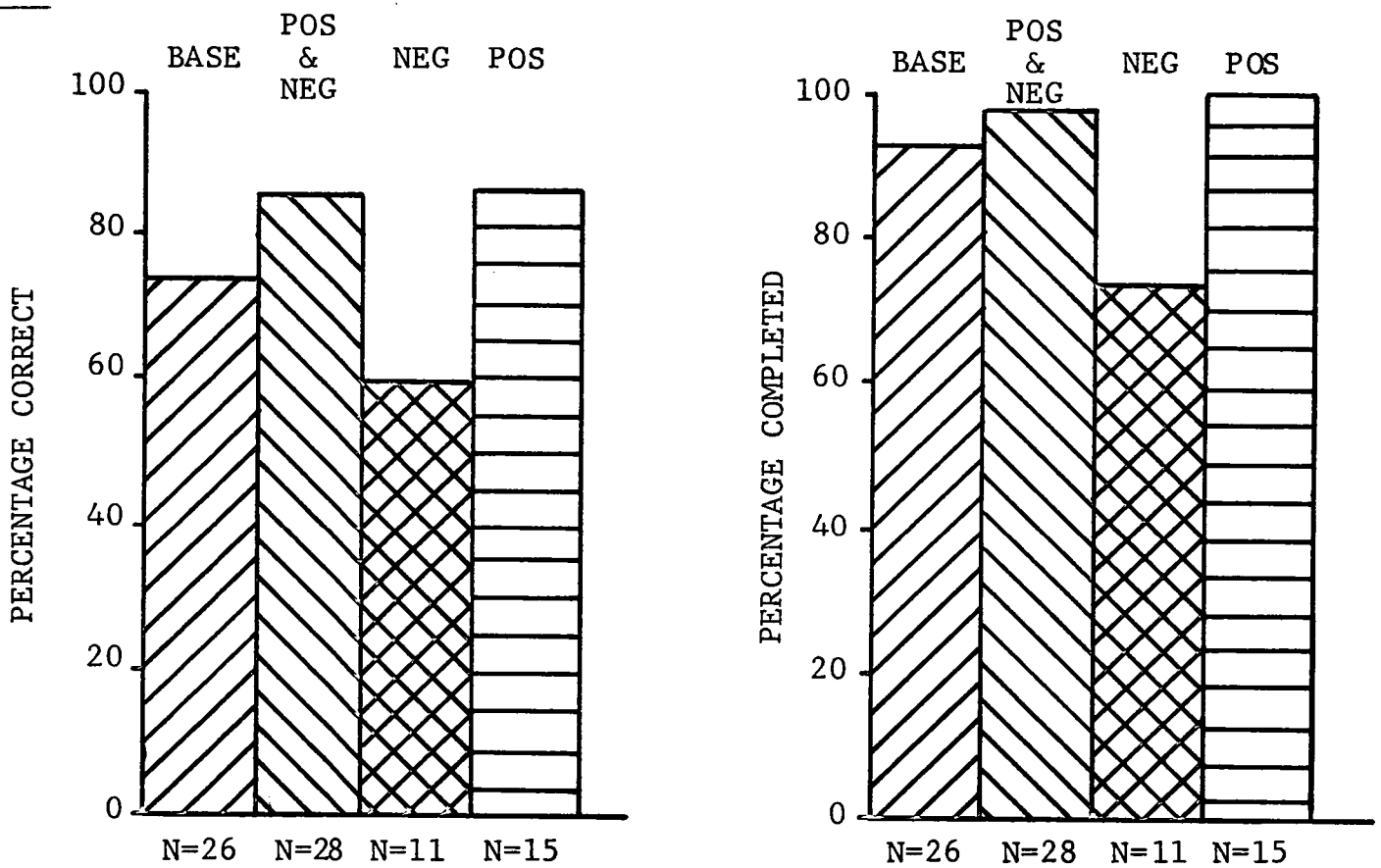

Figure 5. The Mean Percentage of Arithmetic Problems Completed and Correct Combined Across Experimental Conditions for Kathy. The N's represent the total number of days in each condition.

in the positive and negative contracts, with no range in completion and a range of 64 to 96 percent accuracy.

Table 1 (page 17) shows that Kathy was above criterion only 11 percent of the days during baseline. Kathy's performance improved when she began on the positive and negative contract, as she stayed above criterion 90 percent of the days. On the negative only contract, however, Kathy was above criterion only 9 percent of the time. A second administration of a positive and negative contract showed Kathy being above criterion 50 percent of the days. A return to baseline had Kathy above criterion 38 percent of the days, but the final positive only contract again improved her performance to being above criterion 60 percent of the days during the positive only contract condition.

Mary made no significant improvements in either assignment completion or accuracy level from her original baseline figures until during the second positive only contract and the remaining contract conditions. The daily percentages of arithmetic completion are presented in Figure 6 for Mary. Mary's completion rates averaged 76 percent in baseline, increased slightly to 82 percent during the positive and negative contract, decreased below baseline proportions to 48 percent during a positive only contract, and increased again to 87 percent with the second positive and negative contract. Mary's average completion rate remained high during the second positive only contract

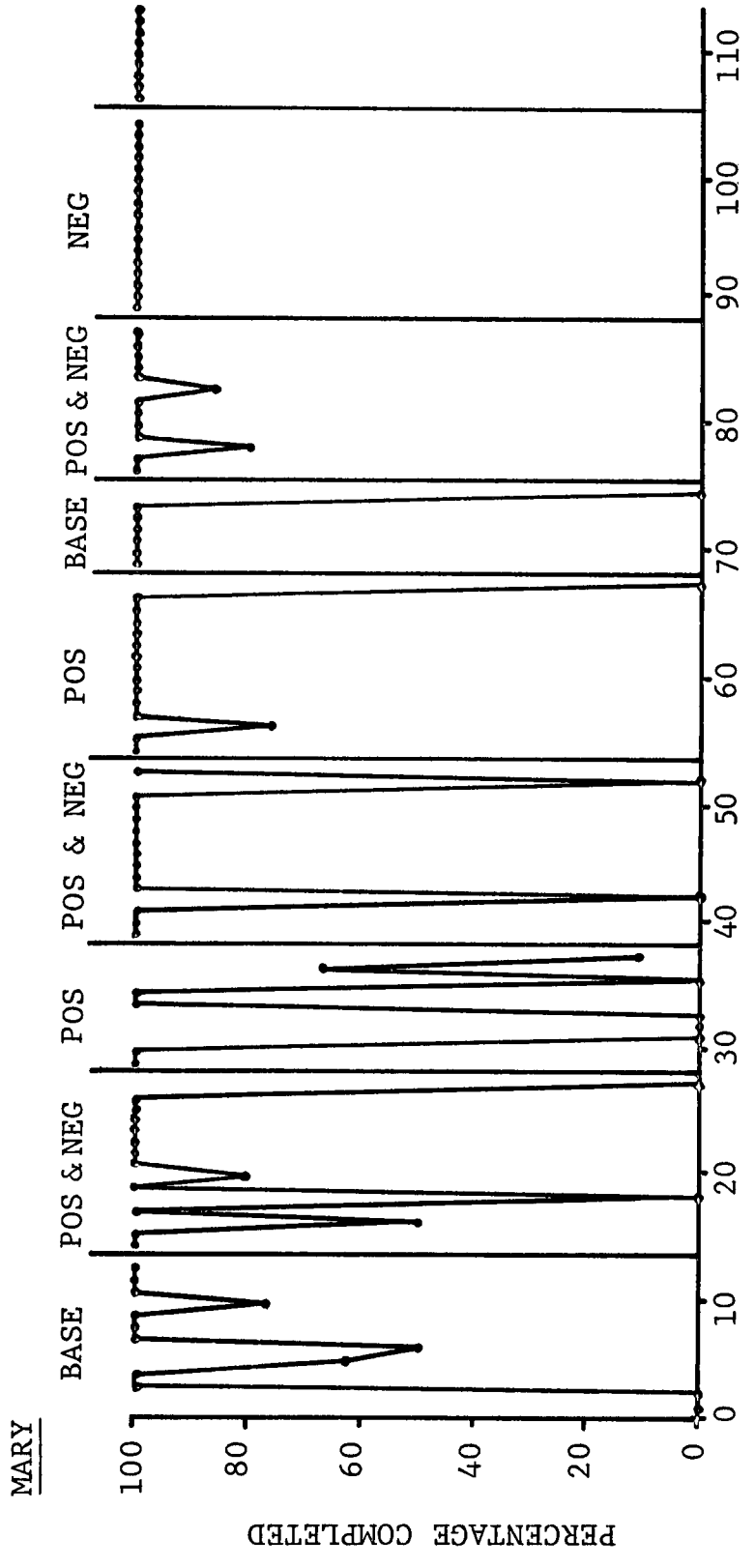

Figure 6. The Daily Percentage of Arithmetic Problems Completed Across Experimental Conditions for Mary. The negative contingency was changed to physical exercise in the second Positive and Negative Contract.

at an average of 92 percent, but decreased slightly to 86 percent with a return to baseline. Following the second baseline, Mary averaged 100 percent completion in the third administration of a positive and negative contract, the following negative only contract, and the last baseline condition.

The daily percentages of arithmetic accuracy for Mary are presented in Figure 7. Mary's average accuracy levels also showed little improvement, initially, over the original baseline. Mary averaged 59 percent accuracy during baseline, 54 percent during the first positive and negative contract, a drop to 30 percent during the first positive only contract, and a subsequent increase to 68 percent accuracy in the second positive and negative contract. Mary's accuracy level increased slightly to an average of 73 percent in the second positive only contract, dropped to 61 percent during baseline, and continued to increase to 76 percent during the subsequent positive and negative contract, 87 percent in the negative only contract, and 96 percent in the final baseline condition.

The mean percentage correct and the mean percentage complete combined across experimental conditions for Mary are shown in Figure 8. The mean percentages correct for Mary were as follows: 71 percent across 29 days of baseline, 66 percent across 43 days of the positive and negative contract, 56 percent across 25 days of the positive only

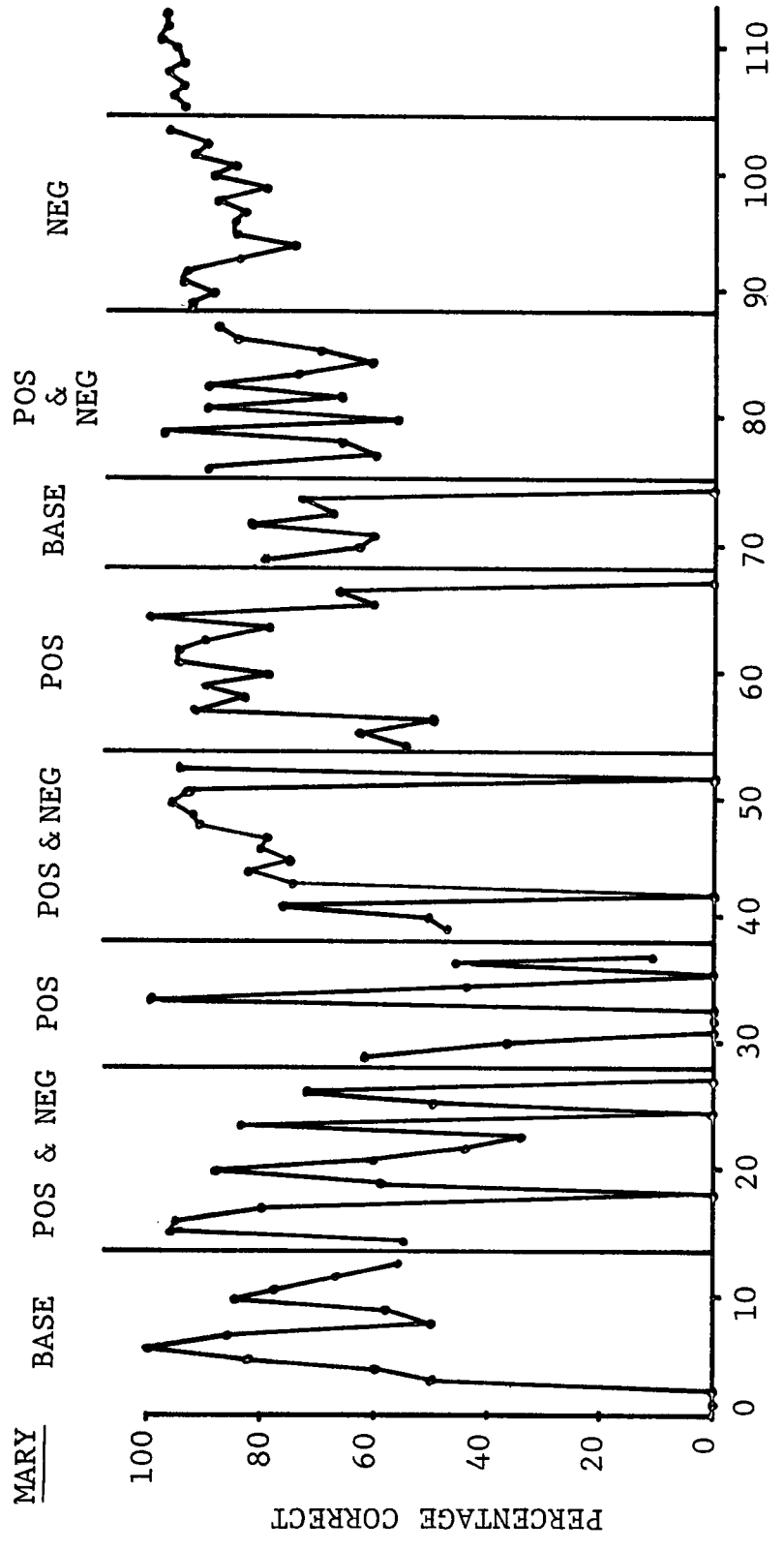

Figure 7. The Daily Percentage of Arithmetic Problems Correct of Those Completed Across Experimental Conditions for Mary. The negative contingency was changed to physical exercise in the second Positive and Negative Contract.

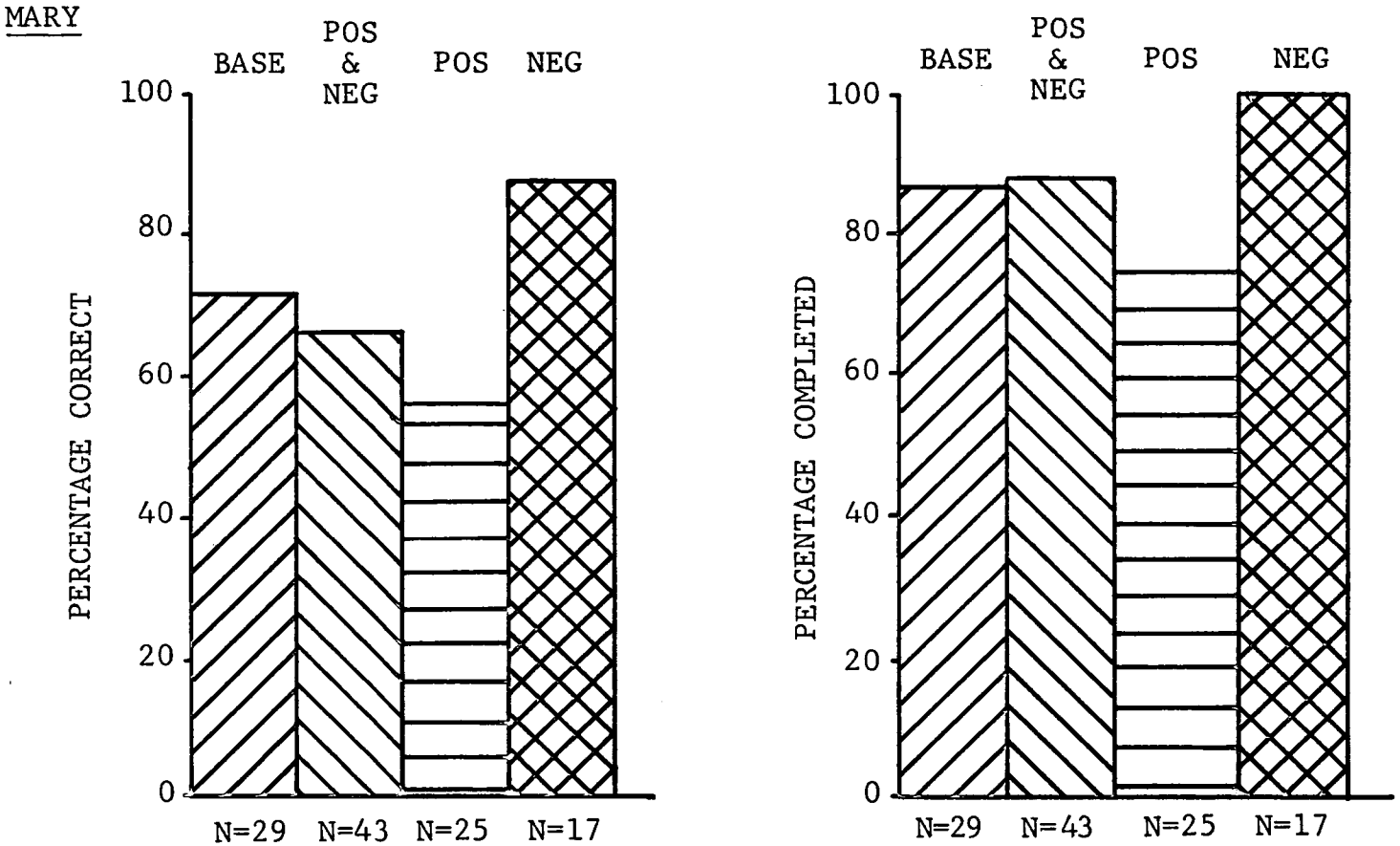

Figure 8. The Mean Percentage of Arithmetic Problems Completed and Correct Combined Across Experimental Conditions for Mary. The N's represent the total number of days in each condition.

contract, and 87 percent across 17 days of the negative only contract. Mary's mean percentages completed were as follows: 86 percent across 29 days of baseline, 88 percent across 43 days of the positive and negative contract, 74 percent across 25 days of the positive only contract, and 100 percent on the 17 days of the negative only contract.

Changing contract conditions had no appreciable effect on the range of completion or accuracy levels for Mary as they remained highly variable across all conditions except for the last three experimental conditions. On the last positive and negative contract, Mary ranged from 80 to 100 percent completion and 56 to 98 percent accuracy. She had no range in completion on the negative only or final baseline condition, and a range of 74 to 97 percent accuracy on the negative only contract with a range of 94 to 98 percent accuracy on the final baseline condition.

Table 1 (page 17) shows that the percentage of days Mary was above criteria went from 0 percent during baseline to 6 percent during the first positive and negative contract, to 1 percent during the positive only contract which followed. The percentage of days above criterion increased to 33 percent on the second positive and negative contract, and increased again to 40 percent on the following positive only contract. With a return to baseline, Mary was never above criterion, but she increased to being above criterion 23 percent of the days during the next positive and negative

contract. She increased again to being above criterion 35 percent of the time and 100 percent of the time on the negative only and baseline conditions, respectively.

Figure 9 shows the daily percentages of arithmetic completion for Doug. Doug demonstrated some variability in completion rates across conditions. During baseline, Doug averaged 60 percent completion. This increased to 98 percent during a positive only contract, dropped to 87 percent during a positive and negative contract, and increased again to 100 percent during a subsequent administration of a positive only contract. Doug's completion rates remained high at 99, 100, 92, and 100 percent, respectively, in the remaining baseline, positive and negative contract, negative only contract, and baseline conditions.

Figure 10 shows the daily percentages of arithmetic accuracy for Doug. Doug's average accuracy level during the initial baseline was 65 percent. This increased to 87 percent during the positive only contract, decreased to 71 percent in the following positive and negative contract, but again increased to 84 percent when he returned to the positive only contract. A return to baseline proved to have no effect on Doug's accuracy level as it again averaged 84 percent and stayed at 84 percent for the remaining positive and negative contract, the negative only contract, and the baseline conditions.

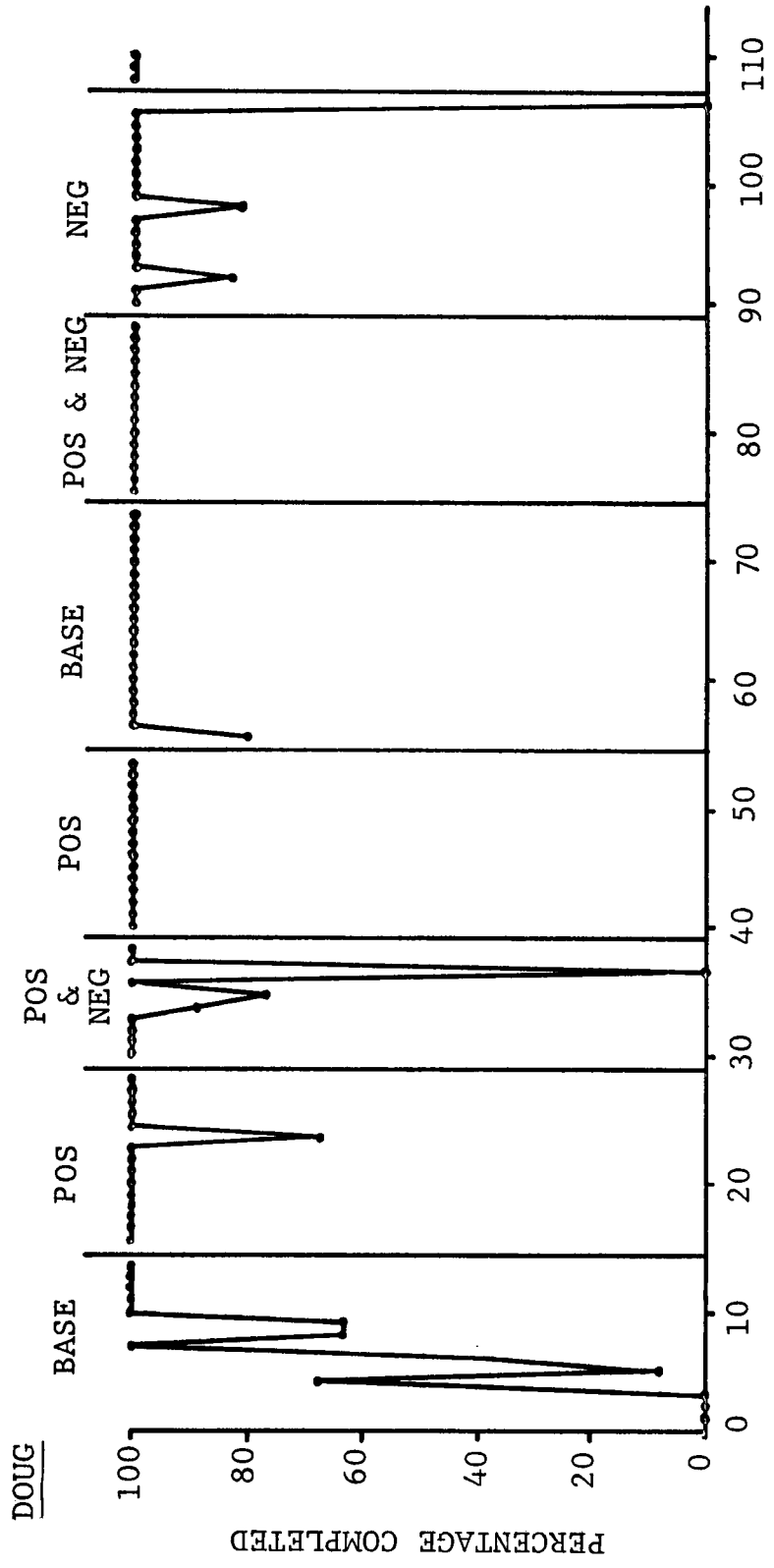

Figure 9. The Daily Percentage of Arithmetic Problems Completed Across Experimental Conditions for Doug.

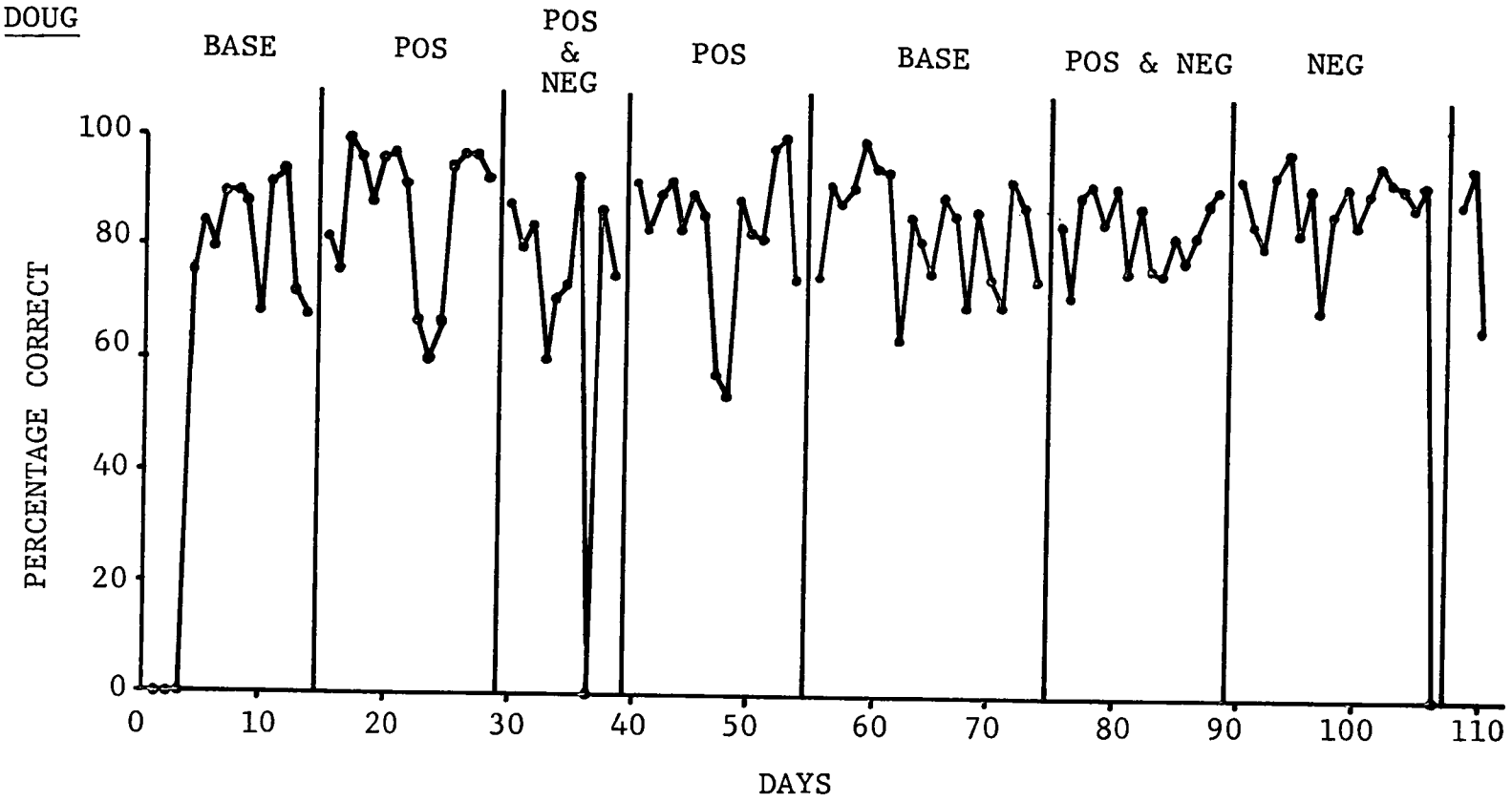

Figure 10. The Daily Percentage of Arithmetic Problems Correct of Those Completed Across Experimental Conditions for Doug.

Figure 11 shows the mean percentage correct and the mean percentage complete combined across experimental conditions for Doug. The mean percentages correct for Doug were as follows: 77 percent across 37 days of baseline, 85 percent across 30 days of positive only contract, 79 percent over 25 days of the positive and negative contract, and 84 percent across 18 days of the negative only contract. Doug's mean percentages completed were as follows: 84 percent across 37 days of baseline, 99 percent across 30 days of the positive only contract, 95 percent across 25 days of the positive and negative contract, and 92 percent across the 18 days of the negative only contract.

The range of Doug's scores during the initial baseline was 0 to 100 percent completion and 0 to 94 percent accuracy. The range decreased to 67 to 100 percent completion and 60 to 100 percent accuracy during the positive only contract, but returned to 0 to 100 percent completion and 0 to 93 percent accuracy in the positive and negative contract. The range of scores once again decreased with a second positive only contract as there was no range in the completion rates and a range of 54 to 100 percent in accuracy levels. A return to baseline had negligible effects on Doug's range of scores over the preceding positive only contract condition, as he completed from 80 to 100 percent of his assignments with 64 to 100 percent accuracy levels. The range of Doug's scores during the final contract

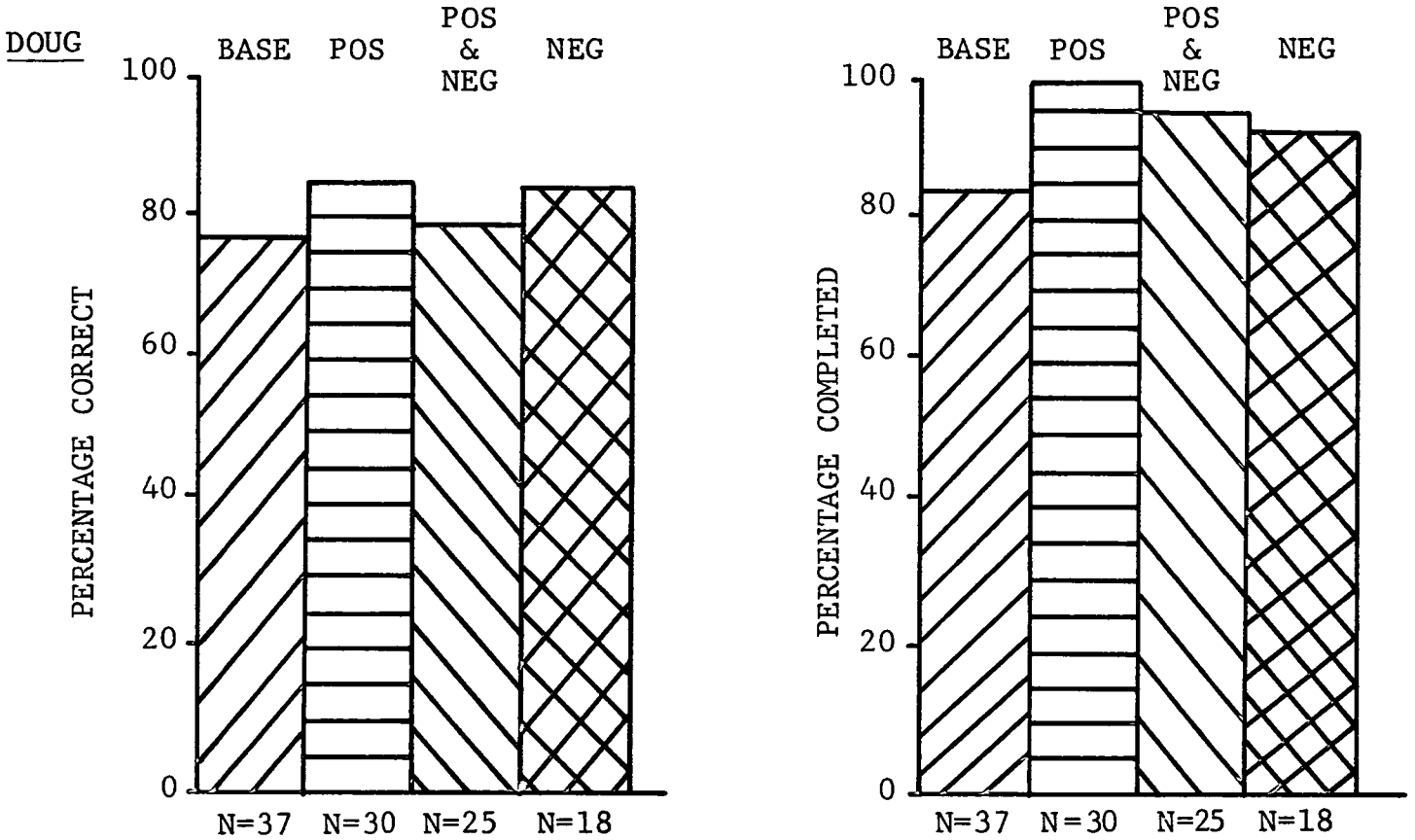

Figure 11. The Mean Percentage of Arithmetic Problems Completed and Correct Combined Across Experimental Conditions for Doug. The N's represent the total number of days in each condition.

conditions were 72 to 92 percent accuracy with no range in completion on the positive and negative contract, and 0 to 100 percent completion and 0 to 98 percent accuracy in the negative only contract condition. The range of Doug's scores during the final baseline condition was from 67 to 96 percent accuracy with no range in completion rates.

Table 1 (page 17) shows that Doug was above criterion only 21 percent of the time during baseline. This figure jumped to 60 percent when the positive only contract was introduced, but fell below original baseline proportions to 1 percent when a positive and negative contract was instituted. The second positive only contract saw an increase in Doug's performance over the positive and negative contract results in that he was above criterion 40 percent of the days. A return to baseline brought about little change over the preceding positive only contract as he remained above criterion 35 percent of the time. With the final positive and negative contract, Doug was above criterion 27 percent of the days, and 50 percent of the days on the negative only contract. Doug was above criterion only 33 percent of the days on the final baseline condition.

IV. DISCUSSION

The results obtained for John and Kathy suggest that a positive component is sufficient in contingency contracts designed to improve academic performance. The results obtained for Mary and Doug are not comparable to those obtained for John and Kathy. There were unexpected variables which occurred during the course of study with Doug and Mary which made any interpretation of their results difficult, if not impossible. The results obtained for John and Kathy will be discussed first, followed by a discussion of those obtained for Mary and Doug.

The results obtained with John and Kathy replicated the results of other studies using only positive contingencies (Bardill, 1972; Bristol & Sloane, 1974; Kabler, 1977; Pines, 1977) and those using positive and negative contingencies (Ardoff & Weaver, 1975; Litzenberger & Trusty, 1977; Siggers, 1977; White-Blackburn, Semb, & Semb, 1977) in contracts designed to increase test performance and to modify on-task and disruptive classroom behaviors. Positive contingencies have also been sufficient in contracts used with children to modify school phobia (Cretekos, 1977) and obesity (Dinoff et al., 1972).

Since it is usually recommended that one of the major elements of a contract be sanctions for failure to meet the terms of the contract (Stuart, 1971), the

implication is that a contract with positive contingencies alone might not be strong enough to maintain a high rate of performance. It is expected that the positive and negative contract would yield the most powerful results, because, although a punishment is present for inappropriate behavior, there is a specified alternative behavior which, if demonstrated, will be rewarded (Phillips, Phillips, Fixen, & Wolf, 1973; Walker, Mattson, & Buckley, 1971). However, for John and Kathy, sanctions built into the contracts were not necessary for maintaining either high levels of completion or accuracy. Since a contract with only positive contingencies did not appear to be less effective with either a third or a sixth grade student, it may be more desirable when dealing with classroom-related behaviors to use contracts with only positive contingencies as they contain the simplest procedures and take less teacher time to monitor.

It is important to note here that Kathy's average accuracy of 86 percent in the positive and negative contract condition was somewhat misleading. On the first administration of the positive and negative contract, Kathy was above criterion 90 percent of the time. During the second administration of the positive and negative contract, however, Kathy was sent home for a period of two and a half weeks due to head lice. During her absence from school, her classmates had been introduced to new math skills, specifically the multiplication process. When

Kathy finally returned to school, she had to learn skills that the remainder of her class had already acquired. There were six days of low performance until, according to her teacher, Kathy began to understand multiplication. From this point on, Kathy remained above criterion.

The implication that a negative component is not necessary in contracts does not support Mann's (1972) finding in a study of weight loss with an adult. However, the individual contribution of the negative consequences was not directly assessed in Mann's design, as it was in the present study. In Mann's design, the following sequence of contracts was used: Positive and Negative Contract, Positive Only Contract, Positive and Negative Contract. On the basis of the results obtained using that sequence, Mann made the inference that a positive consequence alone was not sufficient and that a negative component was necessary for contingency contracting to be effective. Mann was, however, dealing with a different behavior with respect to weight loss, where the contingencies were focused on a decrease in a behavior. In the present study, the contingencies were focused on an increase in a behavior. The results of the present study do not negate Mann's findings. They do, however, emphasize the fact that the relative effectiveness of the different components in a contingency contract may depend on the particular target behavior of concern.

Unlike any research available in the literature, the present study included use of a contingency contract which only contained a punishing consequence for failure to meet the contracts' terms. It was expected that the negative only contracts in the present study should have resulted in avoidance learning. That is, if the students obtained 100 percent completion and 90 percent accuracy, a punishment would have been avoided. Technically, the students were operating under a Sidman avoidance schedule (Sidman, 1953) because, although they were aware of the required avoidance behavior, they had no "warning" until their papers were graded that a punishment would be forthcoming. Although avoidance conditioning has been extremely effective in animal studies, this phenomenon did not occur with John and Kathy. Their mean performance on the negative only contracts was below the original mean baseline performance.

Since there was no replication of the negative consequences, one explanation for the results obtained is that the negative consequences had no function with respect to the target behavior. In other words, the students were simply returned to baseline conditions. The negative consequences did not function as a contingent aversive stimulus. Although it would have been scientifically advantageous to have replicated the results of the negative only contract for both John and Kathy, it seemed ethically questionable

to return John and Kathy to a situation which held potentially failing grades for them. Kathy and John's teachers had commented that they would like to change the contracts for their students from the negative only contract to a different contract condition. According to her teacher, Kathy seemed to be anxious about her daily math performance throughout the negative only contract condition. During math class, Kathy would repeatedly ask the teacher if she was going to miss half of her recess that day. In addition, Kathy continued to ask if she could sweep the floor (her positive consequence during the other contract conditions) if she obtained the 90 percent. When Kathy had to miss her recess time as a result of low accuracy levels, she would constantly ask the teacher if the 15 minutes without recess were over. Since recess time was the only time during the day that the two third grade classrooms were able to socialize, Kathy was unable to play with her many friends in the other third grade classroom if she did not obtain the criterion performance. Kathy's teacher stated that, therefore, missing half of her recess appeared to be highly aversive to Kathy. According to her teacher, Kathy behaved similarly on the positive and negative contracts when she failed to obtain criterion performance. John also indicated that his punishing consequence, double homework, was aversive to him. According to his teacher, John would repeatedly ask her while she was grading his paper if he had made the

90 percent accuracy level. When John did not obtain criterion performance, he would begin complaining to his teacher about having to do the double homework. This tendency to complain about the double homework was also present in the positive and negative condition when John failed to obtain criterion performance.

The use of contingency contracts was not successful in significantly improving the completion or accuracy levels for Doug or Mary. The condition means might indicate that Doug improved in completion rates over the initial baseline; however, Doug's completion rate had stabilized at 100 percent over the last five days of the first baseline condition.

In viewing their data, it could be argued that a functional positive contingency was not available for Doug or Mary in the school environment. Although the positive and negative consequences for three students remained the same throughout the study, the negative consequence for Mary was changed in the second administration of the positive and negative contract condition. It appeared that this change seemed to have an effect in her performance. But in the subsequent positive and negative contract, the effect was not replicated; therefore, it is difficult to determine if the change in the negative consequence was functional. Since Mary and Doug's data were also influenced by inconsistent teacher follow through, it is impossible to

determine whether the chosen contingencies may have been sufficient had the teacher been consistent. Mary and Doug had the same teacher. From conversations with her, it was evident that throughout the study, she was not providing Mary and Doug with immediate feedback regarding their daily math performance. In spite of repeated reminders from the researcher on the importance of immediate feedback and delivery of consequences, she would often not grade Mary and Doug's papers until sometime the following day. Thus, not only was there a delay in feedback to Mary and Doug, there was usually more than a day's delay in the delivery of the consequences. Basic operant learning principles point out the need for consequences to be experienced in close proximity to the behavior in order for the consequences to have maximum effect. Given teacher inconsistency in following through with the contract specifications, it is most difficult to compare the effectiveness of the various contracts for Doug and Mary. It is true that Doug and Mary show increased accuracy rates in the negative only contract condition, but since their performance remained high during the following baseline condition, it is impossible to determine whether improvements were made in response to the negative only contract or in response to some extraneous variables. In contrast, John and Kathy had two different teachers. Their teachers informed them of their performance within an hour after they had turned

their papers in. John and Kathy were also able to experience their rewards the same day as the day their work was turned in. Thus, with two different, but consistent, teachers, the effects of contracting were seen. The results of two students who had the same, but inconsistent, teacher yielded no effects of contracting. The teacher's performance with Mary and Doug points out the need for researchers to pay close attention to the performance of both parties involved in contracting.

Each of the students was asked which contract condition he or she preferred. Kathy and Mary preferred the contract which contained only the positive component while John and Doug preferred the contract with both positive and negative contingencies. Although the students may have preferred one contract over another, they functioned as well on the positive as on the positive and negative contracts. The teachers were not unanimous in their preference of contract conditions. The teachers for Doug, Mary, and Kathy all preferred the contract which contained only the positive component, while John's teacher preferred the contract which contained both the positive and negative components.

While the present study demonstrated that a positive component was sufficient and that a negative component was not necessary in contracts dealing with improvement of academic performance in elementary students, there was not sufficient evidence to rule out the necessity of sanctions

in contracts dealing with other behaviors. Future research may show a need to include a negative component in a contract is highly dependent on the target behavior or characteristics of the subjects.

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APPENDIXES

APPENDIX A

POSITIVE AND NEGATIVE CONTRACT

October 31, 1979

I, _____, agree to complete my arithmetic assignment daily in the classroom and to have at least 90 percent of the problems correct.

I understand that if I meet the terms of this contract each day, Ms._____ agrees to allow me to do one of the following activities in school: 15 minutes free time at the end of the day to listen to tapes, draw, or read.

If I fail to meet the contract terms, I understand that I will have to miss half of my recess time the following day or double my math homework to be turned in the following day for each day that I do not obtain 100 percent completion and 90 percent accuracy on my math class work.

I understand that this contract will last at least two weeks, starting today, and is subject to change.

_____ _____

Student's Signature Teacher's Signature

APPENDIX B

POSITIVE ONLY CONTRACT

February 4, 1980

I, _____, agree to finish my arithmetic assignment every day in the classroom and to have at least 90 percent of the problems correct.

I understand that if I meet the terms of the contract every day, Ms. _____ agrees to allow me to do one of the following activities in school: 15 minutes free time at the end of the day to sweep the floor or to be the leader to the bus.

I understand that this contract will last at least two weeks, starting today, and is subject to change.

_____ _____

Student's Signature Teacher's Signature

APPENDIX C

NEGATIVE ONLY CONTRACT

December 6, 1979

I, _____, agree to complete my arithmetic assignment daily in the classroom and to have at least 90 percent of the problems correct.

I understand that if I fail to meet the contract terms, I will have to miss half of my recess the following day, or double my math homework to be turned in the following day for each day that I do not obtain 100 percent completion and 90 percent accuracy on my math assignment.

I understand that this contract will last at least two weeks, starting today, and is subject to change.

_____ _____

Student's Signature Teacher's Signature

VITA

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