

PROCEDURAL VARIATIONS IN GROUP CONTINGENCIES:
EFFECTS ON CHILDREN'S ACADEMIC AND
SOCIAL BEHAVIORS

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There has been little research on the effects of the many procedural variables in applied group contingencies. In the present study, an individualized contingency and three group contingencies with different "responder" criteria (e.g., reward based on the group average, reward based on the work of a designated, low-achieving student, or reward based on the work of a randomly selected student) were applied to the academic work of primary grade children in a learning disabilities classroom. Group social interaction during each contingency was measured systematically. Although there were large individual differences in students' academic and social responses to the different contingencies, some consistent effects were observed. Two of the four low-achieving target students did their best academic work during the group contingency which focused on their performance as a designated responder. This type of contingency also produced high levels of positive social interaction in three of four groups of children observed.

DESCRIPTORS: group contingencies, learning disabilities, social interactions, token economy, academic behavior

Group contingencies differ from other group operant strategies (e.g., multiple individual or "individualized" reinforcement) in that the behavior of one or more group members determines the consequences received by at least one *other* member of the group. This procedure creates an interdependent social situation that can facilitate behavior change in group situations (e.g., see Sulzbacher & Houser, 1968). Group contingencies are often very efficient, as all or some part of a group can be monitored and rewarded collectively. These procedures have been used to modify such far-ranging behaviors as academic achievement (e.g., Lovitt, Guppy, & Blattner, 1969), stealing (e.g., Marholin & Gray, 1976), energy consumption (Slavin, Wodarski,

& Blackburn, Note 1), problem drinking (e.g., Liebson, Cohen, & Faillace, 1972), social withdrawal (Walker & Hops, 1974) and racial integration in classrooms (e.g., Slavin, 1977).

There has been little research on the effects of procedural variables in group contingencies (for reviews of procedural differences, see Litow & Pumroy, 1975; Speltz, 1979). McReynolds, Gange, and Speltz (1981, Experiment II) compared two group contingencies with differing responder criteria (i.e., reward determined by the behavior of all group members or a single member monitored covertly by the experimenter) in an effort to reduce children's off-task behavior in work groups. Both contingencies produced a near absence of off-task behavior. Speltz, Moore, and McReynolds (1979) varied the designation of the recipients of consequences in contingencies applied to college classroom groups (i.e., reward given to all students or a variable subset of the group) and found significant group differences in the performance of an academic target behavior. Differences were also

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observed in the ways that groups responded socially to the contingencies (e.g., presence or absence of collaboration). Hamblin, Hathaway, and Wodarski (1971) examined three group contingencies which rewarded the group's average score on a worksheet task or the average score of variable subsets of responders (i.e., the average of the three highest or three lowest scoring students in the group). This procedural variable produced marked differences in children's academic performance and unprogrammed tutoring and helping efforts. Drabman, Spitalnik, and Spitalnik (1974) studied three types of group contingencies applied to children's appropriate classroom behavior. Group reward was determined by the behavior of the group's most disruptive child, least disruptive child, or a child selected randomly by the teacher. The different contingencies were equally effective in reducing disruptive behavior.

These few studies suggest that group contingencies which differ with respect to responder and recipient variables have different effects on target behaviors as well as the collateral social behaviors of group members (e.g., tutoring, collaboration). The effects of group contingencies on collateral social behavior are especially interesting but not well established as previous studies have assessed group interaction informally, most often providing anecdotal reports of interesting or unusual instances of social response (e.g., see Alexander, Corbett & Smigel, 1976; Packard, 1970; Schmidt & Ulrich, 1969; Wilson & Williams, 1973). What types of social behavior frequently develop during group or individualized contingencies and the extent to which group interaction is influenced by responder or recipient variables are not known.

In the present study, group contingencies with different responder criteria were examined in a relatively controlled social situation where videotaping of group interaction was undertaken unobtrusively. The contingencies were applied to the academic performance of low-achieving children as they worked in small groups. Two of the

most commonly applied group contingencies in classrooms were studied (reward based on the group average, reward based on the work of a low-achieving target student) and a third group contingency identified by Drabman *et al.* (1974) as preferred by teachers for its ease of classroom application (reward based on the work of a randomly selected student).

METHOD

Participants

Twelve pupils (four girls, eight boys), ranging in age from 7 to 10 yr, participated in the study. They were students in a learning disabilities class at the Experimental Education Unit, University of Washington, Seattle. All had been referred to this class by their school district for remediation of severe academic deficiencies. Students met criteria for the classification of "learning disabled" in the State of Washington including a significant deficit in at least one academic area, a significant sensory-motor deficit and a measured IQ in or very near the normal range.

The four lowest performing students in the class (as determined by a baseline assessment) served as target students during one of the group contingencies and were the focus of subsequent data analyses. The target students were females, ages 8 and 9. All had demonstrated on standardized tests a significant grade level delay in arithmetic computation.

Target Behavior

The target behavior rewarded in the various contingency conditions was the correct completion of arithmetic worksheet problems during 10-min work periods. Students were given a set of three worksheets for each work period, each containing 30 addition or subtraction problems. These problems were at the ability level of the student as determined by a standardized arithmetic test.

The possibility of students exchanging their worksheets with peers during group work peri-

ods was monitored by a research assistant who observed every work session. Worksheet exchanges were recorded immediately and corroborated by subsequent analyses of handwriting changes on worksheets. Students were given credit for the total number of problems they had done themselves, either on their own or someone else's worksheet. The reliability of identifying worksheet exchanges was determined by having an experimenter look over the worksheets and indicate (a) whether a worksheet set contained a handwriting change and (b) the number of the problem preceding a handwriting change.

Reinforcers

Students received one point for every problem completed correctly during the 10-min work periods in which the various contingency conditions were in effect. The points were exchangeable for a variety of privileges, activities, and games selected from an inventory given to students prior to the study. For example, if students had earned at least 150 points by the end of the week, they were allowed to go on a Friday afternoon field trip or leave school 10 min early. The "prices" of backup rewards did not vary during the study.

Behavioral Observation and Recording Procedures

All work periods were videotaped from behind a one-way observation mirror located about 6 feet in front of a work table. A pair of trained observers subsequently watched these videotapes and recorded their observations by using a 3-category, 7-sec observe, 7-sec record time sampling system. The observational categories provided information on the presence or absence of "positive," "negative," and "neutral" social interaction among students and the identity of participants in an interaction. The definitions for these categories (taken from Frankosky & Sulzer-Azaroff, 1978) are given in Table 1.

Using videotapes of pilot study groups, four observers were trained to a minimum percent

agreement of 85%. Two observers attended each of 14 observation sessions on a rotating schedule providing for continually changing pairs of observers. The observers worked privately, seated at opposite ends of a small viewing room. The first author attended all observation sessions to ensure independent work. The observers had no knowledge of each other's ratings. They were not informed as to the purpose

Table 1
Definitions for Behavior Observation Categories

Interacting with peer, neutral

The student is interacting with a peer or peers. The following *verbal* behaviors are coded in this category:

1. General discussion or nonnegative comment directed to a peer(s), (e.g., statements or questions such as "Look at this."; "What are you doing?").
2. Nondirected verbalizations intended apparently to evoke a verbal or nonverbal response from a peer(s) (e.g., "This is hard!"; "I'm done.").

Interacting with peer, positive

The following *verbal and/or nonverbal* behaviors are coded in this category:

1. Verbalizations or gestures of friendship, concern, congratulations, gratitude, or encouragement (e.g., compliments, cheering, handshaking, back patting).
2. Requests or offers for assistance or instruction, or gestures apparently for assistance.

Interacting with peer, negative

The following *verbal and/or nonverbal* behaviors are coded in this category:

1. Name calling or swearing at peer(s).
2. Laughing at a peer's mistakes.
3. Threats of physical aggression.
4. Physical aggression (e.g., hitting, slapping, biting, pushing, rough/forceful back slapping).
5. Obscene gestures, gestures of disgust or disapproval, gestures intended apparently to antagonize or frighten peer(s).
6. Behaviors which prevent or interfere with a peer(s)' work activities (e.g., taking a peer's worksheet or pencil).

An interaction is considered "directed toward a peer(s)" when: (a) another peer's name is used by the student or (b) the student's head is completely oriented toward a peer(s) or (c) the student is making physical contact with peer(s).

of the study or the nature of the different contingency procedures. Effective percent agreement (Hartmann, 1977) was calculated for each type of social interaction (e.g., positive, negative, neutral), using the total number of occurrences and nonoccurrences of each interaction recorded by observers over all 14 observation sessions.

Design and Treatment Conditions

Four reinforcement contingencies and two baseline conditions were examined. Following the serial presentation of the two baseline conditions, the four contingencies were presented in counterbalanced order. Students were assigned to one of four groups ($n = 3$), each group receiving the four contingencies in a different sequence as determined by the random selection of a Latin square (from Fisher & Yates, 1955). The experimental design is summarized in Table 2.

Baseline 1 (8 days). The Baseline 1 phase approximated the standard classroom worksheet period with no points or rewards for performance. Students remained in their own seats and were asked by their teacher to work quickly, solving as many problems as possible during a 10-min work period. Baseline 1 served as the basis for selecting the four target students.

Baseline 2 (4 days). This condition differed from baseline 1 in two ways. First, the students worked in four groups of three students each at

a small work table. Second, each group worked alone in a small experimental classroom situated across the hall from their regular classroom. Students worked in this experimental classroom during all the contingency conditions that followed.

Individualized contingency (6 days). In this condition each student in the group received one point for every problem solved correctly during the 10-min work period. Reinforcement in this condition was determined individually by evaluating each student's worksheet scores without regard to the performance of other group members.

All-member group contingency (6 days). In this condition students received points for the average number of correctly completed problems in the group during the work session. The total number of correct problems submitted by the group was computed and divided by the number of group members present with each member receiving an equal share of the points given.

Identified responder group contingency (6 days). Group reward in this condition was based on the number of correct problems completed during the work period by an identified target student. The target student was one of the four low-performing students identified during baseline 1. The number of correct problems submitted by the target student served as the basis

Table 2
Experimental Design

<i>Baseline 1</i> 8 days	<i>Group</i> <i>Assignment</i>	<i>Baseline 2</i> 4 days	<i>Period 1</i> 6 days	<i>Period 2</i> 6 days	<i>Period 3</i> 6 days	<i>Period 4</i> 6 days
Baseline 1 One group $n = 12$	Group I $n = 3$	Baseline 2	Individualized	All-Member	Unidentified Responder	Identified Responder
	Group II $n = 3$	Baseline 2	All-Member	Individualized	Identified Responder	Unidentified Responder
	Group III $n = 3$	Baseline 2	Unidentified Responder	Identified Responder	Individualized	All-Member
	Group IV $n = 3$	Baseline 2	Identified Responder	Individualized	All-Member	Unidentified Responder
Days 1-8		Days 9-12	Days 13-18	Days 19-24	Days 25-30	Days 31-36

for determining the number of reward points given to all group members. The identity of the target student was known to the group before the work period began. The same target student was the identified responder for the entire 6 days that this condition was in effect.

Unidentified responder group contingency (6 days). Group reward in this condition was determined by the performance of an "unidentified" group member. The unidentified responder was selected arbitrarily (by drawing a name out of a cup in front of the group) after the work period ended. The number of problems correctly solved during the work period by the student selected served as the basis for the reward of all group members.

Procedure

Students were assigned to one of the four experimental groups on the basis of baseline 1 performance as well as their peer preferences indicated on a paper-and-pencil sociogram given during baseline 1. Students were first ranked in order of their average daily worksheet performance during baseline 1. They were then assigned arbitrarily to one of four experimental groups with each student assigned in order of performance rank and each group assigned one student in turn. As a result of this matching procedure, each of the groups contained one of the four lowest baseline 1 performers (i.e., the target students) as well as one of the four highest baseline 1 performers. Without disturbing this group characteristic, a few students were shifted to other groups so that the average sociometric rating between all possible student pairs in each group indicated at least a "neutral" rating of likability.

During baseline 2 and all contingency conditions, groups were taken in turn from the regular classroom to the experimental classroom and seated at a small table for the 10-min work periods. The order in which groups were taken from the regular classroom was changed each

day. Before every work period a sign was posted which identified the reward condition in effect for the group that day: "No Points" for baseline 2, "Points for Own Work" for the individual contingency, "Points for —'s Work" for the identified responder group contingency and "Points for ?'s Work" for the unidentified responder group contingency.

Task instructions were presented to students before all work periods during baseline 2 and the contingencies by a teacher-experimenter who followed a prepared script. (Copies of the task instructions are available from the first author.) The instructions included examples of how each contingency "worked" and gave students permission to talk with one another about their worksheet problems and, if necessary, provide each other with help. Students were not told that they were to be observed and videotaped.

After the task instructions were presented and questions answered, the teacher-experimenter distributed the appropriate set of worksheets to each student and announced the beginning of the work period and left the room. The teacher-experimenter returned and announced the end of the period after exactly 10 min. After all worksheets were collected, the students were escorted back to the regular classroom and the next group was taken. This routine was followed until all four groups had participated in the work period for that day. Point slips exchangeable for rewards were given to students immediately before the following day's work period. No other feedback regarding worksheet performance was given to the students.

Following the work session on the final day of each contingency condition, students were given a questionnaire asking them to indicate which contingency was used in their group during the past few days and to rate the extent to which they liked this procedure on a 5-point Likert scale (a rating of "1" indicated complete dislike of the contingency, a rating of "3" indicated that it was "just okay" and a "5" indicated complete satisfaction). On the last day of the

study, students were informed of the videotape and observation procedures.

Worksheet Performance

RESULTS

To determine whether students could describe accurately the differing contingency procedures, their correct identifications of contingencies at the conclusion of each contingency condition were counted. Because 12 students were asked on four occasions to name the most recently applied contingency in their group, 48 opportunities for the correct identification of a contingency occurred. Of this total, there were 47 (98%) correct identifications.

Effective percent agreement for the detection of worksheets having one or more handwriting changes was 100% (55 of 336 worksheet sets contained a handwriting change). Among those worksheets containing a handwriting change, there was 98% agreement on the recording of problem numbers preceding a change.

Effective percent agreements for the occurrence and nonoccurrence, respectively, of each social interaction category were as follows: positive interaction, 88% and 99%; negative interaction, 80% and 99%; neutral interaction, 81% and 93%.

The dependent measure of worksheet performance was the total number of problems completed without error during each 10-min work period. Table 3 shows the mean daily worksheet scores and standard deviations of all students for baseline 1, baseline 2, and each contingency condition. As inspection of this table reveals, students tended to perform much better under the contingency conditions than during baseline. This effect was especially marked for target students (Students 3, 6, 9, and 12 in Groups 1, 2, 3, and 4, respectively). Figure 1 shows graphically the daily worksheet scores of the four target students. Three of the target students (Students 3, 6, and 9) consistently performed better during the contingencies than the baseline phases with no instance of overlap between their baseline and contingency scores. Students 6 and 12 performed best during the identified responder group contingency. Students 3 and 9 did their best work during the all-member group contingency with Student 9 also performing well during the identified responder procedure.

A one-way analysis of variance was calculated for the mean worksheet scores of all students ($n = 12$) during baseline 1, baseline 2, and all

Table 3
Means and Standard Deviations on Worksheet Scores for All Students
(Summed Across Days)

Students	Baseline 1		Baseline 2		Individualized		All-Member		Unidentified Responder		Identified Responder		
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	
Group 1 {	S1	47.2	23.9	72.2	8.3	91.6	11.7	84.7	9.2	95.8	10.1	104.1	14.8
	S2	38.1	6.4	41.2	3.9	41.2	5.1	45.0	3.4	47.6	8.4	24.8	14.3
	S3*	12.5	3.2	13.2	2.2	28.3	3.7	37.0	6.4	32.6	8.2	28.0	1.4
	S4	73.7	6.1	62.0	23.8	87.6	4.8	92.1	10.3	87.1	6.9	80.0	5.9
Group 2 {	S5	20.1	10.0	29.8	11.7	56.6	8.5	66.8	8.9	58.5	16.4	68.3	4.8
	S6*	14.6	7.3	16.8	6.8	41.5	3.6	37.5	5.1	39.7	6.1	47.8	5.6
Group 3 {	S7	47.1	6.4	30.2	6.5	72.1	5.3	75.3	6.2	64.0	16.0	57.3	14.3
	S8	33.1	8.4	32.7	2.5	42.3	3.3	45.2	1.9	38.8	3.3	32.8	5.0
	S9*	26.0	2.4	18.5	3.5	54.8	7.4	67.1	2.9	48.6	5.1	61.7	3.5
Group 4 {	S10	40.5	10.4	31.8	7.3	46.0	12.8	61.3	12.9	44.1	9.3	53.0	14.1
	S11	36.8	2.9	35.2	2.8	40.0	6.5	46.8	6.6	47.0	5.8	29.3	22.6
	S12*	16.2	4.5	12.2	2.6	17.0	9.7	28.7	17.6	38.9	8.2	49.3	20.7

*Target Students.

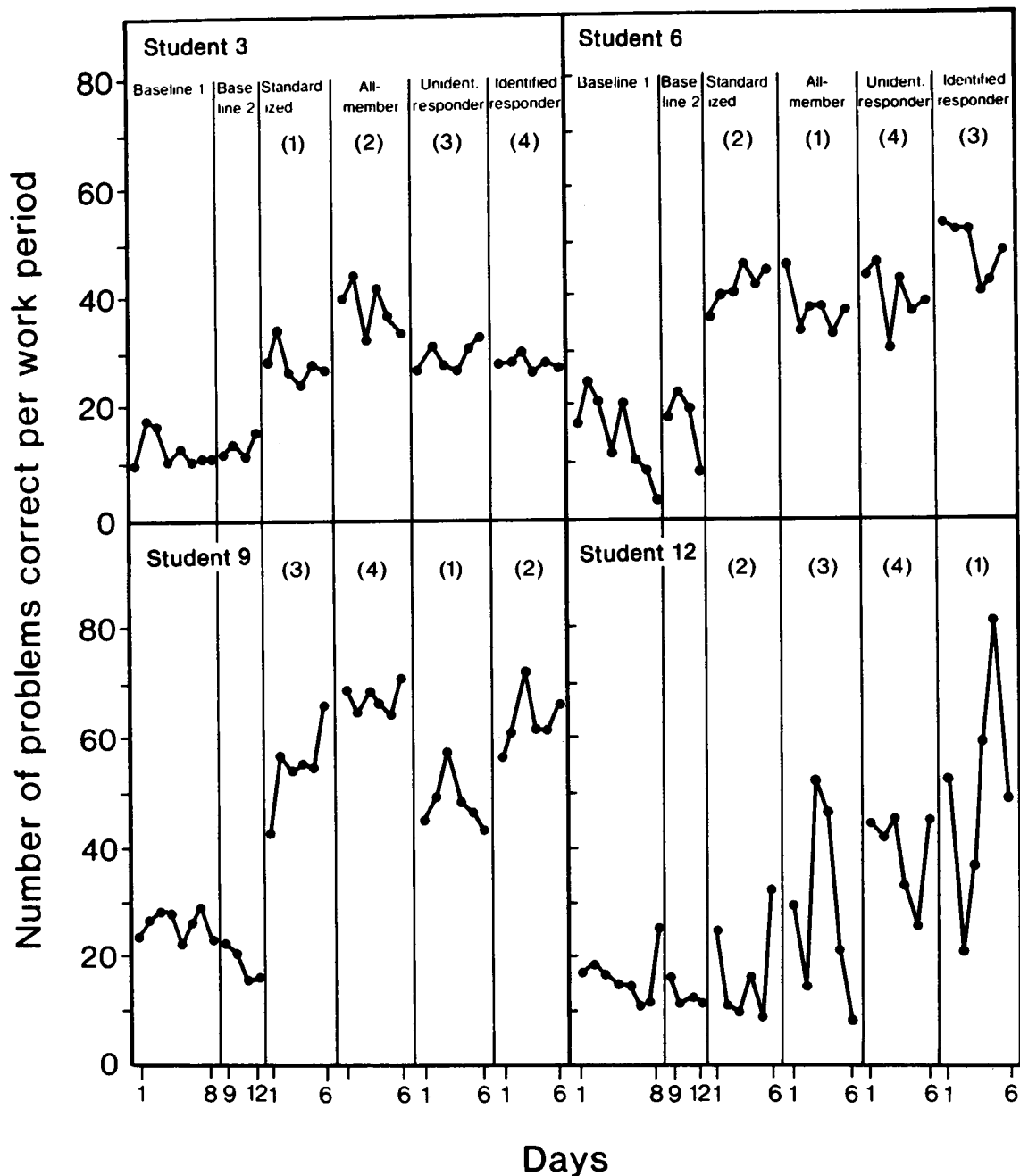


Fig. 1. Worksheet scores of target students for all baseline and contingency conditions. Numbers in parentheses indicate actual order of presentation.

contingencies combined during treatment periods 1-4. A significant main effect was found, $F(2, 22) = 24.5, p < .01$. Paired comparisons using dependent t tests indicated that worksheet performance was significantly higher during the

contingencies than during baseline 1, $t(11) = 5.14, p < .01$, and baseline 2, $t(11) = 5.79, p < 0.1$. Performance levels during baseline 1 and baseline 2 did not differ significantly, $t(11) = .77, p > .01$. A Latin square analysis

was used to evaluate the relative effects of the contingencies on the mean worksheet scores of all students. This analysis found no significant effects for contingencies, $F(3, 24) = 1.0, p > .01$, treatment period, $F(3, 24) = .6, p > .01$, or group, $F(3.8) = .5, p > .01$.

Social Interaction

Figure 2 shows the daily frequencies of social interaction in three categories (positive, negative, and neutral) for each of the four experimental groups. These frequencies represent the number of observation intervals per work session containing interaction of a given type. Two of the groups showed consistent increases in positive interaction during the identified responder group contingency. In Figure 3 are shown the daily percentages of total group interaction directed specifically at the target student in each group, divided into two categories: combined positive/neutral interaction and negative interaction.

The relative effects of contingencies on social interaction were evaluated statistically by Latin square analyses of variance. These were applied to the mean daily interaction frequencies of all students in each group. The effect of contingencies on frequencies of positive interaction was significant, $F(3, 24) = 7.6, p < .01$. The effect of treatment period was also significant, $F(3, 24) = 5.3, p < .01$, reflecting a steady increase in positive interaction over the course of the study (mean group frequencies of positive interaction were 2.7, 3.1, 5.7, and 15.4 for treatment periods 1-4, respectively). Groups did not differ significantly in their positive interaction, $F(3, 8) = 2.2, p > .01$. Dependent *t* tests indicated that average levels of positive interaction were significantly higher during the unidentified responder group contingency, $t(11) = 3.32, p < .01$, than baseline 2. In neither the individualized contingency nor the all-member group contingency did the level of positive interaction differ significantly from baseline ($p > .01$). All other analyses of interaction data resulted in nonsignificant statistical findings.

Student Ratings of Contingencies

The overall mean rating of the contingencies by the student group was 2.8 ($SD = 1.3$). Target students rated the identified responder group contingency highest ($M = 4.5, SD = 1.0$) and the individualized contingency lowest ($M = 2.2, SD = .9$). Target students gave intermediate ratings to the all-member group contingency ($M = 2.7, SD = 1.5$) and the unidentified responder group contingency ($M = 2.5, SD = .6$). Nontarget students rated the individualized contingency highest ($M = 3.5, SD = 1.8$) and the all-member group contingency lowest ($M = 2.0, SD = 1.4$). Mean ratings of 3.2 ($SD = 1.9$) and 3.0 ($SD = 1.8$) were given by nontarget students to the unidentified responder and identified responder group contingencies, respectively. A one-way analysis of variance in the ratings of all students found no significant main effect, $F(3, 11) = 1.3, p > .01$.

DISCUSSION

The different contingencies were equally effective in improving arithmetic worksheet performance. Only one of the twelve students (Student 2) failed to show discernible improvements over baseline and the group as a whole increased its performance by more than 66% during the reinforcement contingencies. Differences among the contingencies were most evident in social interaction with two of the procedures (identified and unidentified responder group contingencies) producing significantly more frequent positive social interaction than that observed during baseline. These findings are similar to those reported by Drabman *et al.* (1974) in which different group and individualized contingencies were equivalent in reducing inappropriate classroom behavior but produced different effects on children's sociometric ratings of disruptive target children.

All 12 students achieved their highest performance average during one of the group contin-

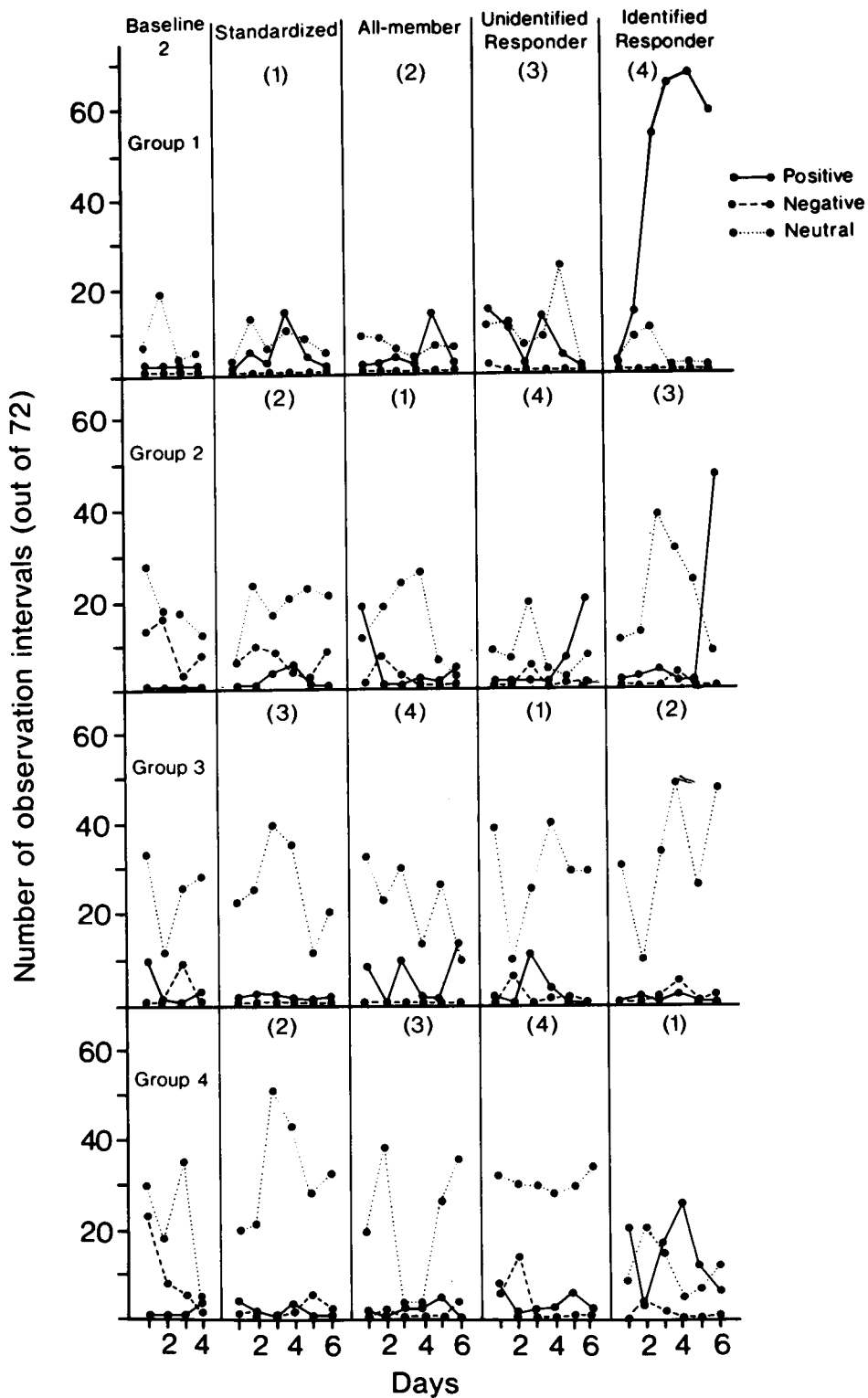


Fig. 2. Social interactions of each student group during baseline 2 and contingencies. Numbers in parentheses indicate actual order of presentation.

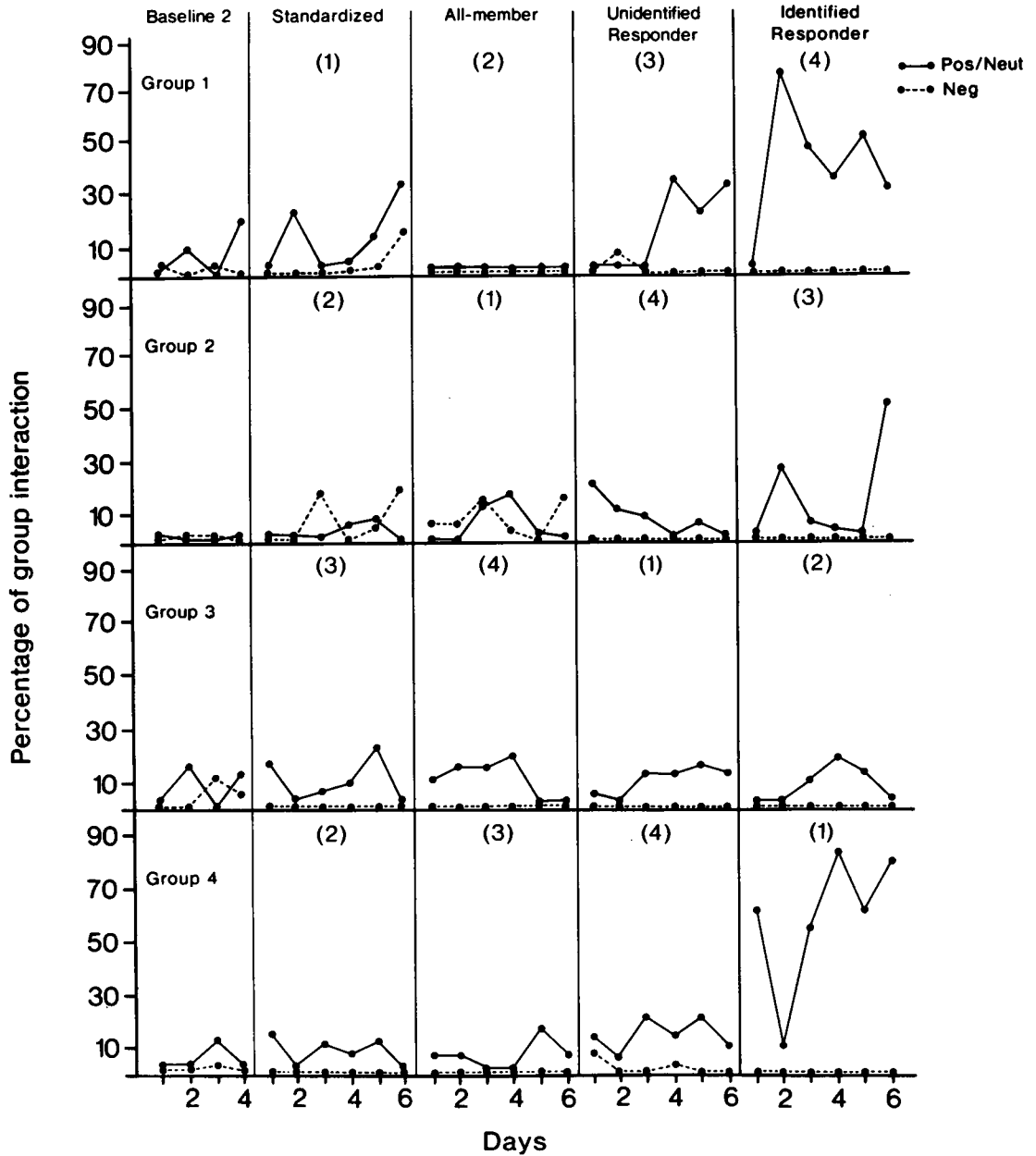


Fig. 3. Percentage of negative and positive/neutral social interaction in each group directed at a target student. Numbers in parentheses indicate actual order of presentation.

gencies—an important finding given the high “cost” to teachers of individualized operant procedures in the classroom. Among the more efficient group contingencies, there is much to recommend the use of the identified responder procedure when low-performing students are the

targets of intervention. Two of the three lowest performing students in the class during baseline (Students 6 and 12) achieved their highest average performance during the identified responder contingency. Another low-scoring target student (Student 9) also performed at a rela-

tively high level during this procedure. Target students rated the identified responder contingency highest in terms of acceptability and, in three of four student groups, this procedure produced higher levels of positive social interaction than the other contingencies.

Some investigators have noted the potential of group contingencies to encourage aversive forms of behavior control or influence among children (i.e., Gresham, 1981; Hayes, 1976; O'Leary & Drabman, 1971). The interaction data collected in the present study—under conditions in which children were apparently unaware of observation—do not support these concerns. Interactions coded "negative" (e.g., name calling, hitting, interfering with another's work) were generally quite low and did not differ significantly among the contingency conditions. Moreover, a very low percentage of group interaction was negative and directed specifically at target students. During the identified responder contingency, in which there would appear to be considerable social "pressure" on target students, not a single instance of negative behavior was directed at these children.

Peer helping behavior was allowed to occur without restriction to obtain some preliminary information on children's social strategies for earning collective reward. Observed helping behaviors were recorded by the experimenters each day in an anecdotal "log." The most frequently recorded helping behavior was a "task structuring" interaction in which students attempted to keep peers on task with repeated, problem-oriented prompts (e.g., "Do this one . . . ; Now do this one. . ."). The next most frequently recorded behavior was the exchanging of worksheets which, in most cases, allowed the most proficient worker in the group to finish another child's worksheet. Surprisingly, students exchanging their worksheets with a more skilled child were observed to work very hard on their helper's worksheet. Other forms of helping were recorded infrequently, including checking a peer's answers for accuracy, giving answers verbally to a peer,

and direct instruction or tutoring. In future research on group contingencies with children, the frequencies of these different peer helping behaviors should be measured systematically.

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