PROCEDURES TO INCREASE SOME
ASPECTS OF CREATIVITY

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Instructions, reinforcement (team points), and practice were applied to four behaviorally defined creative behaviors of eight fourth- and fifth-grade students. All four aspects (number of different responses, fluency; number of verb forms, flexibility; number of words per response, elaboration; and statistical infrequency of response forms, originality) were demonstrated to be under experimental control. The procedures also raised students' scores on Torrance's tests of creativity. Application of the experimental procedures may well be practical for classroom teachers.

DESCRIPTORS: creativity, writing, classroom management, unusual uses game, students

The enhancement of creativity has long been of concern to educators, although attempts to modify behaviorally specified components of creativity have been relatively recent. Maltzman, Bogartz, and Bregar (1958) demonstrated that pairing instructions to be verbally novel with contingent reinforcement of verbal novelty among college-age students significantly increased levels of verbal novelty. Maltzman, Simon, Raskin, and Licht (1960) replicated that study, varying reinforcement under five conditions, with similar findings. Reese and Parnes (1971) demonstrated the efficacy of increasing creativity test scores through the use of programmed materials designed to facilitate problem solving.

Using more precise behavioral specifications of components of creativity, Goetz and Baer (1972, 1973) demonstrated the possibility of increasing the diversity of blockbuilding in preschool children by reinforcing individual production of new blockbuilding forms. Goetz and Salmonson (1972) demonstrated that the number of painting forms used by children could

also be increased through the use of descriptive reinforcement. Maloney and Hopkins (1973) showed that reinforcement of certain aspects of students' writing, operationally defined as creative, increased subjective impressions of the levels of creativity evidenced in the students' writing.

All authors mentioned above, however, noted that a complete definition of creativity may be impossible, due to the nature of the term "creative". For the past 20 yr, a number of researchers have studied creativity, using widely accepted but nonbehavioral criteria, *e.g.*, Parnes, 1967; Parnes, 1971; Torrance, 1966; Torrance, 1971). Torrance (1966) described four components of creativity that serve as the basis for much of the current literature dealing with creativity, *viz.*, (1.) fluency, the production of large numbers of ideas; (2.) flexibility, the production of a large variety of ideas; (3.) elaboration, the development, embellishment, or filling out of an idea, and (4.) originality, the use of ideas that are not obvious or banal, or are statistically infrequent.

The present study defined these components of creative behavior operationally, and attempted to modify these response forms in lists of uses written by fourth- and fifth-grade students, and to relate these operationally defined

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variables to scores on the Torrance *Thinking Creatively With Words Test*.

METHOD

Subjects and Setting

Eight fourth- and fifth-grade students attending a voluntary, nonremedial 12-week summer-school program participated. Subjects were three female fourth graders aged 9 yr two months, 9 yr six months, and 9 yr eight months; two male fourth graders aged 9 yr eight months and 9 yr 11 months; two female fifth graders aged 10 yr one month and 10 yr four months; and one male fifth grader aged 10 yr two months. Subjects' intelligence quotients on the Lorge-Thondike Intelligence Tests ranged from 102 to 116. All students occupied the same activity room at the same time. The students' activities were under the direction of a fifth-grade teacher who was assisted by an aide, the experimenter.

General Procedures

At the beginning of the third class hour each day, a noun, randomly selected without replacement from a pool of 40 nouns, was printed on the blackboard by the experimenter. Students were instructed to list all possible uses they could think of for the object listed on the board. At the end of 10 min, the students passed their papers to the experimenter, and returned to a "free-reading" period.

The experimenter then left the room and had the responses scored, a procedure that took between 25 and 30 min. The experimenter then re-entered the room and, during baseline, returned the original sheets to the students with "good" written on the top of the sheet, followed by a pronouncement to the group that "you are doing very well". During experimental conditions, nothing was written on the papers and points were assigned each paper as described below.

All words were names of inanimate objects found within the classroom and which also appeared within the reading material used by the

students (e.g., box, can, brick, pencil, pot, book). Since all eight children received the same randomly selected stimulus noun each day, no further special techniques were employed to ensure that the nouns were comparable across conditions.

Response Measures

The responses were scored on the four defined variables by two scorers, both graduate students in educational psychology, who were not informed about the purposes of the experiment nor the experimental conditions involved. The variables and definitions of the variables are listed below.

Number of different responses (fluency). Number of different responses is defined as any response given by a student that was not identical to a previous response given by that student on any of his or her preceding lists.

Number of verb forms (flexibility). Number of verb forms is defined as the total of all different forms of responses (uses), i.e., if five responses are in the same form (e.g., throwing, pitching, or flinging), they were counted as one response verb form. If two responses were of one form (containing), the next two of another form (hitting), and next four as still another form (throwing), these responses would be scored as three verb forms. To facilitate scoring, a list of 100 verbs was provided the raters for matching the responses to the verbs. The total number of verbs matched with responses constituted the verb form score. Synonymous verbs, such as hit, strike, and smack, were listed together and any of the synonymous responses that appeared were lumped together and classed as one verb form.

Number of words per response (elaboration). Number of words per response is defined as the total number of words used in the list divided by the number of responses on the list.

Statistical infrequency of verb forms (originality). Statistical infrequency of response is defined as the number of verb forms per list that had not appeared in previous lists of each indi-

vidual. To facilitate scoring, an alphabetized list of previously used verb forms was updated daily by the experimenter for each student.

Reliability

Different kinds of reliability checks were made throughout the study. Student on-task time was checked daily by the experimenter and the scorers. The mean of the absolute value of time disagreements was 3.1 sec for the entire study.

Reliability measures on the four variables were computed daily by both scorers on each paper with the Pearson product moment correlation coefficient. The mean for number of different responses was 0.83, 0.76 for number of verb forms, 0.97 for number of words per response, and 0.89 for statistical infrequency. The same scorers were used throughout the study and neither was informed of the purpose of the experiment.

Experimental Conditions

Baseline. On Days 1 to 5, general procedures as described above were in effect.

The unusual uses game. The unusual uses game, a rough approximation of the good writing game (Maloney and Hopkins, 1973) and the good behavior game (Barrish, Saunders, and Wolf, 1969), was introduced on Day 6 and played throughout the remainder of the study. The game was played during the free reading period, an hour in which the students were allowed to read any of the available materials in the classroom. It was explained to the students, using Torrance's (1966) directions as a guide, that many common items had unusual or uncommon uses that often did not occur to people. Further, it was explained that there are at least four kinds of unusual uses: the number of uses (responses), the number of different kinds of uses (verb forms), the number of words used to describe or explain each use (words per response), and the "originality" of each response (statistical infrequency). At the end of Hour 2, approximately 35 min was spent discussing the

four aspects of unusual uses until the experimenter was convinced that each student understood and could explain each response form.

The rules of the game allowed the students one point for each desired response. The class was divided into two equal teams, using their baseline performance as the criterion.

During the game conditions, each team member was awarded points based on the conditions in effect. The team with the greater number of points won and gained their recess 10 min early; each member also received a carton of milk and a few cookies. Both teams could win if the lower score met or exceeded 80% of the higher score.

The discussion of the game and the components of unusual uses occurred only on Day 6 during the last half of the period preceding the usual game period. At the beginning of each day thereafter, the experimenter wrote on the board the names of the variables that could gain points and circled the one in operation on each specific day. The experimenter then announced the contingency for the day and repeated that part of the definition concerning the daily variable given on Day 6. This general procedure for the game was followed from Days 7 to 25.

Number of different responses. For Days 6 to 10, one point was awarded for every different response. No points were given for repeated responses.

Number of verb forms. For Days 11 to 15, one point was awarded for every different verb form. No points were given for repeated verb forms.

Number of words per response. For Days 16 to 20, points were awarded equivalent to the mean number of words used per response, rounded to the next higher number.

Statistical infrequency. For Days 21 to 25, one point was awarded for each "original" response, *i.e.*, each verb form that had not previously appeared.

Torrance Tests, *Thinking Creatively With Words* (Form b) (Torrance, 1966), were administered by the experimenter to all eight students during the first 2 hr of Day 1 and readministered

during the first 2 hr on Day 26. Standard directions were given with an arbitrary time limit of 10 min set for each subtest. All tests were scored by the two regular scorers, using the scoring directions provided by the handbook (Torrance, 1966). Scoring reliability was checked for each child's test on the three response measures with the Pearson product moment correlation. The means were 0.74 for fluency, 0.69 for flexibility and 0.77 for elaboration.

RESULTS AND DISCUSSION

Figure 1 presents the results. During the first experimental period, when the number of different responses gained points, the mean number of responses increased over the baseline period. During the second experimental period, when the number of different verb forms earned points, that dependent measure increased. During the third experimental period, when the

GROUP MEAN RESPONSES

Fig. 1. Mean number of different responses, mean number of different verb forms, mean number of words per response, and mean number of statistically infrequent verbs for the students during the five conditions. The mean number of different verb forms was not calculated for Day 25, due to the loss of the verb reference list that day.

number of words per response earned points, that measure increased markedly. During the final period, when statistical infrequency gained points, the mean level of statistical infrequency increased slightly.

Matched pairs *t* tests were computed over the individual pre- and post-Torrance Test results, as were Pearson product moment correlations. The mean score for verbal fluency on the Torrance Tests was 56 on the pretest and 64 on the posttest. The *t* test yielded a statistically significant difference ($t = 4.3$, $df = 7$, $p < 0.01$) while the test-retest correlation ($r = 0.26$) was far below that of 0.82 that Torrance (1974) reported for test-retest reliability on this measure. The mean score for flexibility was 41.5 on the pretest and 52.1 on the posttest. The *t* test demonstrated statistically significant differences ($t = 5.8$, $df = 7$, $p < 0.01$), while the computed test-retest correlation ($r = 0.27$) was below that provided by Torrance for test-retest reliability ($r = 0.78$). The mean score for elaboration was 53 on the pretest and 59 on the posttest. A *t* test yielded no statistically significant difference, while the computed correlation ($r = 0.29$) was still below that cited for retest reliability by Torrance ($r = 0.83$). It appears that the experimental treatment influenced the post measure on the Torrance tests considerably.

Individual Results

All eight students' results were similar to the mean results presented earlier. That is, the individual results, first, demonstrated an increase in the number of different responses from baseline conditions during Days 6 to 10; second, showed an increase in the number of different verb forms during Days 11 to 15; third, showed an increase in the number of words per response during Days 16 to 20; and last, demonstrated an increase in the number of statistically infrequent verbs during Days 21 to 25. Student absences during the study ranged from zero to two per day, with a mean number of daily students absences of 0.6.

Responses

During baseline conditions, many of the responses seemed obvious. For example, in responding to a box, the majority of responses stressed the use of a box to hold things, *e.g.*, "hold books in" or "hold leaves in". Few "obscure" uses such as "use as a sled" appeared. During the first condition, when points were obtained for the number of different uses, the number increased, but the kinds of uses remained obvious (*e.g.*, in responding to tin cans, subjects listed "hold pencils in", "hold water in", "hold dirt in", "hold marbles in", and so on); few obscure uses appeared.

During the second condition, when points were awarded for the number of different kinds of uses, some interesting uses were described by the students (*e.g.*, "using a pot as a circle drawing guide", "using pots as wheels", "shooting pots out of cannons", "smash pots and use the pieces to make a sidewalk", and "cut into and make roof shingles").

During Condition 3, when the number of words per response gained points, the responses became much longer, such as "getting lots of pieces of chalk and putting them under a pyramid and using them for wheels, putting those that roll out behind back in front".

During Condition 4, when originality of uses gained points, some very obscure uses appeared, such as "tie a brick to each foot to make legs stronger", "put the blackboard erasers in my shirt to make my shoulders look bigger". The most common uses for all the nouns were throwing, holding, building.

Conclusions

It proved possible to modify operationally defined equivalents of Torrance's four components of creative behavior. Whether the changes in the four components are unique to the behavior change procedures used cannot be determined from this study. It also seems that exposure to the procedures increased students' scores on a standardized creativity test, although

whether the procedures, the practice, or both were responsible for the change was impossible to determine. Further, the effects of instructions, reinforcement, practice, or some combination thereof cannot be specified from the present study. Procedures that combine instruction, reinforcement, and practice, however, seem to be useful and powerful in experimentally changing behavior.

The results generally agree with the findings of Maltzman *et al.* (1958), Maltzman *et al.* (1960), Reese and Parnes (1971), Goetz and Baer (1972, 1973), Goetz and Salmonson (1972), and Maloney and Hopkins (1973). The modification of operationally defined components of creativity as demonstrated in these studies was confirmed by the present results. The present study, however, provided a broader series of responses defined as creative and developed these directly from nonoperant research in the area of creativity.

Since defined equivalents of Torrance's four major components of creativity were successfully modified with a corresponding increase in subjects' scores on a standardized measure of creativity, it would seem reasonable that the present procedures could be adopted for classroom use by teachers and used to increase levels of creativity in other student activities, such as story writing, problem solving, and other activities in which fluency, flexibility, elaboration, and originality can be identified. Maloney and Hopkins (1973) demonstrated the efficacy of enhancing levels of creativity by reinforcing creative responses during classroom activities. The present study directly supports these findings. For those willing to do so, it is possible to apply operant techniques to a wide variety of classroom settings and obtain similar results.

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