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ABSTRACT

Third grade subjects were classified as impulsive or reflective on the basis of the Matching Familiar Figures (MFF) test. In Experiment I, subjects were given either convergent thinking tasks, brainstorming tasks, or a control task. In Experiment II, half of the subjects received difficult tasks intended to induce failure while the other half received success tasks, with feedback or no feedback appropriate to each subject's task, provided. Response latencies on the MFF post tests were increased by convergent training to a lesser extent by the failure tasks. The data suggest that the convergent thought process may be potentially useful in modifying impulsive thinking. (Author)

TRAINING IN BRAINSTORMING AND CONVERGENT THINKING AND THE CONCEPTUAL TEMPO OF IMPULSIVE AND REFLECTIVE CHILDREN

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Third grade subjects were classified as impulsive or reflective on the basis of the Matching Familiar Figures (MFF) test. In Experiment I, subjects were given either convergent thinking tasks, brainstorming tasks, or a control task. In Experiment II, half of the subjects received difficult tasks intended to induce failure while the other half received success tasks, with feedback or no feedback appropriate to each subject's task, provided. Response latencies on the MFF post tests were increased by convergent training and to a lesser extent by the failure tasks. The data suggest that the convergent thought process may be potentially useful in modifying impulsive thinking.

TRAINING IN BRAINSTORMING AND CONVERGENT THINKING AND THE CONCEPTUAL TEMPO OF IMPULSIVE AND REFLECTIVE CHILDREN

There has been extensive interest among both educators and psychologists concerning the problems of children with fast conceptual tempos. Much of this interest has centered on the dimension of the impulsive vs. the reflective child, or the tendency toward fast or slow decision times on tasks with a high degree of response uncertainty (Kagan, Rosman, Day, Albert, & Phillips, 1964). Some children impulsively report the first hypothesis or answer that occurs to them, leading subsequently to numerous errors. Other children are reflective. They refrain from hasty solutions by delaying their initial responses. This strategy results in an increased likelihood of being correct.

There have been numerous efforts made at reducing impulsivity and increasing impulsivity. The thrust of one type of modification effort has been to use modeling techniques. Thus, by exposing impulsive children to reflective models (either teachers or students) the conceptual tempo of such children should slow down. Research based on modeling techniques (Kagan, Pearson, & Welch, 1966; Yando & Kagan, 1968; Coup & Brown, 1970) has been generally ineffective in modifying both response latencies and error scores, with the exception of Denney (1972). One problem that researchers find in using modeling techniques is that while it is not difficult to increase the latency between presentation of a stimulus item or question and the child's response, it is quite difficult to reduce the number of errors which a child makes on various post-modeling tasks (Debus, 1970; Ridberg, Parke, & Hetherington, 1971).

Various reinforcement strategies have been no more successful in modifying impulsivity. While the manipulation of reinforcement contingencies and task incentives has been partially successful in modifying conceptual tempo, it was more difficult for impulsives to become reflective than to train reflectives to become even more reflective (Briggs & Weinberg, 1973). The use of token rewards (Finney, 1970) and various combinations of verbal and nonverbal rewards and punishment (Hemry, 1973) were ineffective in altering conceptual tempo.

Various training procedures have focused on modifying impulsivity by improving a child's scanning strategies (Nelson, 1968; Stein, 1970). These procedures have been generally effective in increasing the number of observing

responses and in reducing errors on subsequent measures of conceptual tempo such as the Matching Familiar Figures (MFF) test (Kagan, 1965). The relative success of such training procedures raised the possibility that in order for a child to become reflective, he must engage in cognitive activity which encourages attending to or searching for significant dimensions of concepts and ideas. In many respects, Guilford's (1959, 1967) theoretical models of the structure of intelligence relate to the attending or searching strategies necessary for reflective thinking. Of particular significance are his constructs of convergent and divergent thinking. The convergent thinking process with its emphasis on correctness and careful analysis of one's responses, appeared to be linked to the reflective disposition. Divergent thinking, and more specifically, the process of brainstorming, appeared to be linked to the impulsive disposition. Brainstorming is a type of thinking process in which there is "suspended judgement" and the "reduction of evaluative operations" (Osborn, 1962). Brainstorming encourages quantity of ideas, rather than quality of ideas and thus appeared to be linked to impulsive response pattern.

Convergent thinking and brainstorming are further linked to the reflective and impulsive conceptual tempos, respectively, by the research of Wallach and Kogan (1965). They argue that reflective children show a great deal of cognitive cautiousness. Such children are unwilling to risk error by deviating from conventional modes of response, and have a high personal investment in academic achievement. It was reasoned by the present investigator, that training in convergent thinking would help to develop these characteristics in impulsive individuals and would strengthen them in reflective individuals. Brainstorming tasks should lead to increases in characteristics common to impulsive learners. It was hypothesized that training in convergent thinking would result in changes to a more reflective conceptual style, whereas training in brainstorming would result in changes to a more impulsive conceptual style.

In addition to the cognitive processes associated with the impulsive-reflective dimension, there are significant motivational variables. Several studies have shown that "being wrong" fails to elicit as much apprehension for impulsives as it does for reflectives (Ward, 1968; Messer & Kagan, 1969). It has been suggested that the concern about experiencing failure may be an antecedent of the reflective conceptual tempo. Messer (1970) found that following induced failure tasks, MFF time scores increased and error scores decreased. The present investigation attempted to explore the motivational effects of success and failure further, by looking at the effect of feedback following these experiences.

In particular, the concern was whether or not concern for making errors is the same when it is intrinsic to the task or subjectively imposed as it is when externally imposed. Under subjective feedback the learner receives only internal cues regarding the quality of his performance, if, indeed, he receives any cues at all. Under external feedback the learner becomes aware of the quality of his performance by an outside source. Research on knowledge of results tends to support the notion that external feedback leads to better performance (Page, 1958; Zigler & Kanzer, 1962).

Thus, a secondary concern of the present study was to test the hypothesis that exposure to a failure task followed by verbal extrinsic feedback of the failure, would lead to maximal levels of reflectivity on subsequent measures of conceptual tempo. On the other hand, exposure to a success task followed by verbal extrinsic feedback of the success would lead to maximal levels of impulsivity on subsequent measures of conceptual tempo. It was predicted that the experience of failure and success tasks followed by no feedback (subjective) would lead to intermediary levels of reflectivity and impulsivity respectively.

METHOD

This study consisted of two experiments: Experiment I was concerned with the effects of convergent vs. brainstorming training upon impulsive and reflective learners; Experiment II was concerned with the effects of failure and success experiences in interaction with different modes of feedback upon impulsives and reflectives.

In order to select impulsive and reflective children for the study, the Matching Familiar Figures (MFF) test was administered to 423 third grade children from five public elementary schools in Springfield, Massachusetts. Of the 423 children, a total of 97 impulsives and reflectives were selected to take part in Experiment I and II. All subjects who participated in the experiments were seen individually in an experimentation room provided by each school. All tasks were administered on an after-school basis, with each subject participating in one session lasting approximately one hour.

Experiment I

Two sets of training tasks were developed for Experiment I, the convergent training set was designed to elicit qualitatively correct responses; the brainstorming training tasks elicited many responses without concern for the quality of the responses.

A series of eight tasks were used to provide convergent training. In the missing letters game, the subject was instructed to complete the last two letters of a nine letter series. The comic strip game consisted of a set of four comic strip sequences. The frames of each sequence were shuffled, and it was the subject's task to rearrange them so as to tell a story or joke. In the word guessing game, the subject had to supply the appropriate word on the basis of its definition and first letter. In the opposites game, the subject had to provide the correct opposite of a given word on the basis of a first letter clue. The name game consisted of 10 sets of four word groups. The subject's task was to supply the class a category name for the four words in each set. The make a story game required the subject to chronologically order sets of three sentences in order to form an appropriate temporal story. The money game required the subject to give the experimenter various amounts of money, usir ed chips (equivalent to five cents) and blue chips (e alent to three cents). In the words alike game the subject was given 10 word pairs and asked to orally describe how the words in each pair were similar in terms of letters or letter positions.

A series of ten different tasks were used to provide training in brainstorming. In the making unusual designs game the subject was given approximately 80 pieces of colored felt and told to make a variety of designs, shapes, and pictures. In the drawing game, the subject was told to draw pictures from sets of parallel lines. The alternate uses game required the subject to name as many different uses as a cardboard box as possible. The examples game required the subject to name as many things as possible that could be made out of wood. In the funny situations game, the subject was asked to speculate how things would be different if people no longer needed sleep. The name a product game required the subject to give as many different names to a new invention that he could think of. In the plot titles game the subject was to read a five sentence story and was then asked to make up as many titles for the story as possible. The crazy cake game required the subject to suggest things that he would put in the recipe of a cake to make it "funny and crazy." In the auto accessories game the subject had to suggest new gadgets that could be put in a car to make it more fun to drive. In the rescue problem the subject had to suggest possible things a man trapped on an island could do to rescue himself.

Each control group subject was given a neutral task, one that was intended to be devoid of both convergent and brainstorming characteristics. The task consisted of a Tinker Toy Set, with which subjects were individually allowed to construct objects or shapes of their choice.

Following each subject's experimental task, he was given an MFF post test and two supplementary performance measures, a variation of the Porteus Maze (Porteus, 1950) and an anagrams tasks. The performance measures were inserted to determine if changes in conceptual tempo brought about by training, generalized to tasks more intuitively related to actual school learning processes.

Experiment II

Two tasks were developed to induce feelings of success or failure. They were both modifications of the water-jar problems developed by Luchins (1942).

The success tasks consisted of a game called milk measuring, in which the subject was given 15 problems which required him to obtain a specified number of quarts of milk from a hypothetical milk tank. He was told that the only measures available were one-, three-, and five-quart pails. Any one of many possible solutions to the problem was acceptable. Subjects in the success task, after a practice item, were allowed to proceed to solve the 15 test problems. Upon the completion of the task, the subject was given one of two kinds of feedback. Half of the subjects were given no feedback. They were simply told "Let's do something else now." The other half of the subjects were given success feedback. In this condition the experimenter provided verbal feedback by stating "You did very well. You did much better than the other kids in your class."

The failure task, also a milk measuring game, contained only four soluble and six insoluble problems and there was a strong likelihood that the subject would experience subjective feelings of failure. Subjects receiving the failure task were told there were several possible solutions to each problem. Thus, an incorrect solution to a problem would suggest, perhaps, that the subject had not carefully exhausted all possible solutions. Following this task, the subject was given one of two kinds of feedback. Half of the subjects were given no feedback in exactly the same way as described previously in the success task. In the failure feedback condition the experimenter provided verbal feedback by looking over the subject's answer sheet and then stating "You know, you didn't do as well as other kids in your class. Let's do something else now."

As in Experiment I, the same MFF post test and performance measures were administered in Experiment II, following each subject's success or failure task.

RESULTS

For each subject, post-experimental interviews were conducted in order to determine the extent to which subjects correctly perceived their respective experimental treatments, and to assess their feelings regarding their performance. The results of these interviews confirm that the subjects did perceive their tasks correctly and in Experiment II, feelings of success or failure were induced under the feedback conditions.

Experiment I

Concerning the effect of convergent vs. brainstorming training, there was a significant interaction of Type of Training x Pre-Post MFF time scores, indicating that the effect of training did alter the subjects' response latencies, $F(2,84) = 8.53$, $p < .05$.

Insert Table 1 about here

Differences between the post- and pretest time scores for each of the three training groups were as follows: convergent ($\bar{d}$ = +31.36 seconds), brainstorming ($\bar{d}$ = -63.93 seconds), and control ($\bar{d}$ = +84.18 seconds). The two tailed t statistic was employed to test for differences between the pre- and post-experimental time scores for each treatment group at the impulsive and reflective levels. This analysis yielded $t(84) = 3.34$, $p < .05$ for the difference between the pre- and post test scores of the brainstorming reflective group. Though not significant, the convergent impulsive group did increase their MFF time scores by an average of 84.93 seconds. The analysis of error scores did not reveal any significant treatment effects. Reductions in errors among impulsives were attributed entirely to regression effects. Analyses of the performance transfer measures revealed no significant main effects or interactions for time and error scores on the maze and anagram tasks.

Experiment II

The analysis of Experiment II was divided into two parts. The first part was concerned with the effect of the success, failure, and control tasks collapsed over the two types of feedback, while the second part was concerned with the effect of type of feedback following either the success or failure tasks.[1]

[1]The analysis of the effects of success and failure in Experiment II used the control group data from Experiment I.

Table 1

Mean Pre- and Post-Experimental MFF Scores

Treatment Group	Time		Errors	
	Pre	Post	Pre	Post
Experiment I				
Effects of Training				
Convergent Impulsive	282.78	367.71	8.00	6.71
Convergent Reflective	532.21	510.00	3.71	3.36
Brainstorming Impulsive	257.71	281.36	8.07	6.78
Brainstorming Reflective	573.00	421.50	4.00	4.57
Control Impulsive	280.76	328.88	8.24	6.18
Control Reflective	503.82	624.06	3.82	3.94
Experiment II				
Effects of Success-Failure				
Success Impulsive	298.88	303.46	8.04	5.54
Success Reflective	581.31	429.08	3.92	3.85
Failure Impulsive	292.77	373.85	8.23	5.69
Failure Reflective	575.92	544.62	4.31	3.77
Control Impulsive	280.76	328.88	8.24	6.18
Control Reflective	503.82	624.06	3.82	3.94
Effects of Feedback				
Success Feedback Impulsive	286.00	265.54	8.31	5.77
Success Feedback Reflective	570.00	422.38	4.31	4.62
Success No Feedback Impulsive	311.77	341.38	7.77	5.31
Success No Feedback Reflective	592.62	435.77	3.54	3.08
Failure Feedback Impulsive	286.54	346.69	8.54	5.85
Failure Feedback Reflective	577.00	578.31	4.38	3.54
Failure No Feedback Impulsive	299.00	401.00	7.92	5.54
Failure No Feedback Reflective	574.85	510.92	4.23	4.00

The analysis of the MFF time scores revealed a significant Levels of Success x Pre-Post interaction, $F(2, 132) = 9.77$, $p < .05$. The two tailed t statistic was employed to test for differences between the pre- and post test time scores of the success, failure, and control groups. The success reflective group decreased their time scores significantly ($\bar{d} = -153.23$ seconds, t (132) = 4.08, $p < .05$; and the failure impulsive group increased their time scores significantly ($\bar{d} = +81.08$ seconds), t (132) = 2.17, $p < .05$. The analysis of the MFF error scores revealed no significant treatment differences.

Analyses on the effects of feedback vs. no feedback in Experiment II were not significant. It is worthy of note, however, that the failure feedback impulsive group increased its average MFF time by 60.15 seconds. Also, the success feedback impulsive group was the only impulsive group which decreased in time score ($\bar{d} = -2.46$ seconds), although not significantly.

The only significant performance measure difference in Experiment II was a significant levels of success main effect on the anagram time scores, $F(1, 96) = 3.97$, $p < .05$. The failure group anagram test times were greater than those of the success group ($\bar{d} = 72.48$ seconds).

DISCUSSION

It is implied from Experiment I, that response latency, as measured by total time on the MFF, can be increased by means of convergent training. The phenomenon of learning set may be as appropriate an explanation as any of the kind of processes employed by the learners in this setting (Harlow, 1949). Thus, the "set" to slowly examine the response possibilities in the search for the one correct answer in each of the eight convergent tasks was probably adopted as a successful strategy in searching for the one identical figure from among the six variants in each MFF test item. That there were no differences between the convergent and brainstorming training groups on total MFF post test errors was disappointing. Perhaps one reason for this was the fact that error score reliability (.46) was much lower than time score reliability (.71) as computed for the control groups.

The results of Experiment II reveal that induced failure can have the effect of lengthening the period of initial response delay. In a school setting it might be fruitful for a teacher to structure an impulsive learner's materials and activities so that the learner experiences errors or mistakes or perhaps is given incomplete information to perform some task. Perhaps if the teacher corrects the work of the impulsive child thoroughly, the same objective can be realized.

That type of feedback was not a crucial variable in affecting MFF scores may be related to level of aspiration. For example, Ausubel and Schiff (1955) found that intrasession failure reduced subsequent levels of aspiration. Perhaps the ineffectiveness of the feedback factor can also be attributed to the indirect nature of the experimenter's positive and negative comments: that is, the verbal feedback was directly provided for the subjects' good (success task) or bad (failure task) performance, but was not directly provided for his MFF pretest performance.

Future research with the convergent training procedure may be most productive if done on an individualized basis. Depending on the extent of the impulsive disposition, daily, weekly, or monthly training sessions with convergent thinking tasks might lead the learner to become more concerned about the quality of his responses. Also, in considering individual differences, it may be worthwhile to examine the parent-child and sibling-child relationships of reflective vs. impulsive children to see if there are differences in the levels of convergent processes in the home environment.

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