

THE INFLUENCE OF THE INSTRUCTOR'S WRITTEN COMMENTS UPON  
STUDENT TEST PERFORMANCE IN THE COLLEGE CLASSROOM

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The problem with which this investigation is concerned is that of determining the influence of instructors' written comments on the test performances of students in selected college subjects. The students were from one university and one junior college. The written comments were designed to be positive in nature and to encourage better future test performances by students. The comments were made in regard to the letter grades received by the students and were placed only on major (as defined by each instructor) objective tests.

Data were gathered from eighteen classes in each of three subject matter areas--biology, business administration, and psychology. Student enrollment in these fifty-four classes totaled 2,640.

The study has several purposes. The first is to determine whether those students who receive the instructors' written comments upon their test papers will perform significantly better on subsequent tests than will those students who do not receive such comments. The second is to determine the effects of two different types of comments on students'

test performances. The third is to determine whether comment effects will be cumulative after two successive applications. The fourth is to determine the relative effects of comments across subject matter areas and between schools.

A chi-square formula for ranked data and an analysis of variance design were used to determine whether significant differences existed among comment groups after a single application and after two successive applications of written comments. The analysis of variance was used to test for relative effects of comments across subject matter areas and between schools.

Significant differences were found between comment groups across the subject matter area of business administration after two successive applications of written comments. Further analysis revealed that the two groups which had received specified comments (certain specific comments designated in advance for all students receiving similar letter grades) had performed significantly better on the third major objective test than had a group which had received free comments (whatever comments the instructors felt were appropriate regarding the students' test performances) on only one test. One of these groups had received specified comments on only one test and the other group had received them on two successive tests. No other significant differences were found, although a trend toward better test performances was noted for those groups who received written comments.

In light of the restricted scope of the study, the following conclusions were drawn:

1. Written comments of the type utilized in this study do not significantly influence the test performances of college students so that they perform significantly better on subsequent tests than do college students who do not receive such comments.

2. There was no cumulation of comment effects after two successive applications.

3. The effects of written comments were not related to the school setting.

The following recommendations were suggested:

1. A study should be conducted to determine whether other types of written comments, such as critical comments or informative comments, would exert a significant influence on the test performances of college students.

2. A study should be made to determine whether the effects of specified comments would be cumulative over more than two successive applications.

3. A study should be conducted within the area of business administration in an effort to determine why students in this subject matter area showed relatively significant differences in their test performances after two successive applications of written comments.

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## CHAPTER I

### INTRODUCTION

Teachers at all levels of education have constantly sought new and better ways to reinforce the performance and learning of students. As Wallen and Travers (5, p. 495) have indicated, many common reinforcers are wholly or partially under the control of the teacher. Some common reinforcers which have been utilized by teachers include rewards, praise, encouragement, incentives, and verbal comments (1, 2, 3, 4, 7, 8, 9, 10, 12, 13).

Teachers have been particularly concerned with the effects of socially-derived (acquired or secondary) reinforcers (6, p. 40; 13, p. 225). As Perin (12, p. 51) has pointed out, secondary reinforcement plays a prominent role in most learning situations.

A secondary reinforcement sometimes used by teachers has been the writing of comments upon students' test papers. This practice has varied with individual instructors--some comment briefly, others copiously, and some not at all (11). Could the teachers who have placed written comments upon students' test papers have justified the expenditure of time and effort? Have these written comments actually had an effect upon student test performance? The answers to these

questions appeared most important because they were concerned with the learning of young people and one technique to encourage that learning.

Apparently, those teachers who made a practice of writing comments upon students' test papers believed that the comments would produce some positive result (11, p. 1). This belief has neither been supported nor refuted by research. Systematic investigation of the effects of written comments upon student test performance has been very limited. The studies which have been reported were concerned with the effects of written comments at the elementary, junior high, and senior high school levels (11, 14).

The present study, then, had both a general and a specific purpose. Generally, it was an attempt to fulfill the need for further research concerning written comments by investigating their use at the college level. More specifically, it was an attempt to investigate the effects of instructors' written comments upon the test performance of students in selected college subjects.

#### Statement of the Problem

The problem of this study was the investigation of the influence of instructors' written comments upon the test performance of students in selected college subjects.

The study also involved the following sub-problems:

(1) to determine whether there were any differences among

the second test performances of three of the comment groups after they had received comments on the first test; (2) to determine whether these differences, if any, would remain constant over a period of time, and whether comment effects would be cumulative in two additional groups; i.e., would comment effects continue to make a difference in two groups who received comments on two tests; (3) to determine whether there were differences in the relative effects of treatments across subject matter areas; and (4) to determine whether there were differences in the relative effects of treatments between groups from a university and those from a junior college.

#### Hypotheses

The basic hypothesis of this study was that there would be a significant difference between the subsequent test performances of those college students who received the written comments of the instructor upon their test papers and those who did not receive such comments. This difference was hypothesized to be in favor of those groups who received the written comments.

The following sub-hypotheses were also investigated:

1. After receiving written comments upon the first test, the Single Specified Comment Group would perform significantly better on the second test than would the No Comment Group.

2. After receiving written comments upon the first test, the Single Free Comment Group would perform significantly better on the second test than would the No Comment Group.

3. There would be no significant difference between the second test performances of the Single Specified Comment Group and the Single Free Comment Group after both groups had received written comments upon the first test.

4. After receiving written comments upon two tests, the Cumulative Free Comment Group would perform significantly better upon a third test than would the No Comment Group.

5. After receiving written comments upon two tests, the Cumulative Specified Comment Group would perform significantly better upon a third test than would the No Comment Group.

6. There would be no significant difference between the third test performances of the Cumulative Specified Comment Group and the Cumulative Free Comment Group after both groups had received written comments upon two tests.

7. There would be no significant differences in relative treatment effects across subject matter areas.

8. There would be no significant differences in relative treatment effects between the comment groups in the university setting and those in the junior college setting.

### Assumptions

The following assumptions were made in regard to this study: (1) any motivating factors which may be operating outside of the classroom were randomly distributed; (2) within each class, the students would have had an equal opportunity to achieve those learnings upon which they were tested; and (3) written comments placed on papers other than objective test papers by graders or instructors were randomly distributed.

### Definition of Terms

The No Comment Group was defined as that group of students who received no written comments upon their test papers regarding their grades or performance.

The Single Specified Comment Group was defined as that group of students who received certain uniform comments regarding their grades only upon their first test papers. These uniform comments were designated before hand for all students receiving similar letter grades.

The Cumulative Specified Comment Group was defined as that group of students who received certain uniform comments upon two test papers. These uniform comments were the same as those for the Single Specified Comment Group.

The Single Free Comment Group was defined as that group of students who received upon their test papers whatever comment the instructor felt was appropriate regarding the

particular student's test performance, provided that the comment was positive in nature and designed to encourage better student performance on future tests. The written comment was made in consideration of the letter grade received by the student.

The Cumulative Free Comment Group was defined as that group of students who received upon two test papers whatever comments the instructors felt were appropriate regarding the students' letter grades upon the tests. These comments were positive in nature and designed to elicit better student test performance on subsequent tests.

An objective-type test was defined as any kind of test, such as multiple-choice, true-false, matching, etc., so long as the score was quantitatively and objectively derived.

#### Limitations of the Study

This study was subject to the following limitations:

1. It was limited to selected students enrolled in the freshman classes at a state university and a junior college during the spring semester of 1968.
2. It was limited to the use of objective-type tests as measures of student performance, thus excluding the use of essay-type tests for purposes of the study.
3. It was limited to the use of major tests (as defined by each instructor) for the purpose of measuring student test performance, excluding other types of tests such as

daily tests, "pop" quizzes, or others not designated as "major" tests by the particular instructor involved.

4. It was confined to the subject matter areas of biology, business administration, and psychology.



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## CHAPTER II

### SIGNIFICANCE OF THE STUDY AND RELATED LITERATURE

The primary concern of teachers and instructors has always been the promotion, stimulation, and guidance of learning (49, p. 27; 77, p. 6). Since teaching first began, teachers have used various tools and mechanisms to stimulate, motivate, reinforce, and guide the learning of students. Therefore, a teacher should possess some knowledge about the nature of these tools and their application in a classroom setting (77, p. 6). The present study was an attempt to provide some knowledge about the use of one such tool in the college classroom.

#### Classroom Versus Laboratory Setting

An examination of research studies during the last century has revealed that there have been two distinct approaches to research on learning (87, p. 1; 18, pp. 1-4; 34, pp. 1-71; 39; 40). One approach was to study learning phenomena under simplified conditions in the laboratory; the other was to conduct research on learning in school and realistic settings where education was actually in progress (87, p. 1; 18, pp. 1-4).

Historically, educators have shown a lack of agreement regarding the merits of these two approaches to research on learning. This lack of agreement was evident as early as 1913. At that time, Kirby made the following statement regarding his study of the effect of practice upon children's schoolwork:

It was the intention that the study should be conducted under school conditions normal for children, teachers, and supervisor, in order to meet, as far as possible, a current criticism that results obtained from studies with small groups of persons under laboratory conditions are not applicable in school conditions; and also to establish greater confidence in the validity of the result of the study and insure the applicability of its results to actual schoolroom problems (39, p. 1).

At a later time but in a similar vein, Carr (7, p. 1) wrote: "We know much about learning, retention and recall for our usual laboratory conditions, but relatively little of these phenomena as they occur in actual life." In his introduction to certain studies in the psychology of learning, Knight was more specific:

Two of the studies utilize actual and important school subject matter, thereby shifting the subjects of the experiment from monkeys and chicks to seven- and sixteen-year-old humans; the materials from bananas and corn to the addition and subtraction of whole numbers and the mastery of plane geometry, and the background from cages and grey paper to schoolrooms and desks. Thus no one needs to draw upon his scientific courage or personal wish in thinking about the practical application of the results (40, p. 2).

Ross (63, p. 3) had asserted that the inherent differences between the laboratory situation and the classroom situation are so great as to make the laboratory experiment in itself an insufficient guide to educational practice. Thus Ross has indicated why some investigators might prefer the classroom approach. Other investigators (58, pp. 302-304; 15; 77, p. 11) have indicated a preference for the classroom approach because they felt that research conducted in the classroom setting was more valuable to classroom teachers than was research conducted in a laboratory.

Still other investigators have indicated that they feel that both these approaches to research on learning have proven their value (34, p. 2; 86, p. 1; 18, p. 3). Jones, for example, has stated

What we can learn of attention, for example, in the classroom differs fundamentally from what we can learn with the aid of tambours and kymographs in a darkened chamber. Both streams of evidence are useful in a psychological synthesis: the individual studies to give a detailed microscopy of the problem, the group studies to provide data aiding specifically in prediction and control in a social setting (34, p. 2).

Jones' viewpoint has been supported by Travers (87, p. 1) and Forlano (18, p. 3). In 1963, Travers wrote that more knowledge had been produced by laboratory studies of learning than by the study of learning in classroom settings, but he added that it was too early to tell which of these research positions would finally be adopted, and that it was entirely possible that both approaches held considerable merit (87,

p. 1). Forlano (18, pp. 2-3) has pointed out that the results of experiments under schoolroom conditions are just as valid and true as those obtained under laboratory conditions. It was his contention that if principles of learning were to be considered worthwhile, they must not only prove to be scientifically true, but they must also prove effective under school conditions (18, pp. 2-3).

The present study has served as one example of the classroom approach to research on learning. Except for the written comments themselves, the total classroom conditions were exactly what they would have been without the experiment. It was felt that this was one of the strengths of the study.

Regardless of the approach taken, research on learning has provided teachers and instructors with a great deal of knowledge which has actual or potential applicability in the classroom (77, pp. 4-17). The present study constituted an attempt to provide teachers and instructors with additional knowledge concerning the use of written comments under actual classroom conditions.

The written comments which were utilized in the present study embraced several different facets of learning. These facets included the law of effect, rewards, reinforcement, incentives, and motivation. Many writers in the field of learning have noted that all of these are closely related (20; 35; 36; 51; 70; 81; 74, p. 421).

### Studies of the Law of Effect

A learning principle which was embraced by these written comments was the law of effect (3, p. 3; 81, p. 244), sometimes called the empirical law of effect (32, pp. 66-67). It was originally proposed by Thorndike (81) as a result of his laboratory studies of animals and humans. Through the process of inductive reasoning, Thorndike formulated the original law of effect as follows:

Of several responses made to the same situation, those which are accomplished or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connections with that situation weakened, so that, when it recurs, they will be less likely to occur. The greater the satisfaction or discomfort, the greater the strengthening or weakening of the bond (81, p. 244).

Perhaps aware of the subjective nature of states of affairs such as satisfaction, Thorndike added the following classification: "By a satisfying state of affairs is meant one which the animal does nothing to avoid, often doing such things as attain and preserve it" (81, p. 245). This clarification referred to the first portion of the law of effect, which was also the portion with which this study was concerned. This study was concerned with the first portion of the law of effect because it was felt that some of the specified comments and free comments which were placed upon

test papers during the study were likely to produce "a satisfying state of affairs" in those individuals who received them. If this were indeed the case, then those individuals who experienced the satisfying condition as a result of receiving a written comment upon their first test paper would be expected to equal or better their performance on subsequent tests in order to preserve the satisfying condition.

#### Studies of Reward

Reward was another facet of learning with which the present study was concerned. It has been known for a long time that reward has a great influence upon learning (18, pp. 4-5). Some form of reward served as the satisfying after-effect in Thorndike's studies (82, p. 5), and this was also true of many studies by other investigators (4, 18, 62, 76, 90, 91).

Reward has generally been found to have a greater beneficial effect upon learning than has punishment. Thorndike (83) found this to be true in a series of experiments which he had designed as further tests of the law of effect. He and his staff also made a search of over one thousand biographies in order to find historical testimony concerning the efficacy of the law of effect (83, p. 140). It was found that the biographical data provided almost universal evidence



of the greater beneficial effect of reward than of punishment (27, p. 27; 83, pp. 135-141).

Thorndike's findings of the greater beneficial effect of reward than of punishment found a great deal of support in early animal studies. In their experiments with animals, Blodgett (4, pp. 113-134), Grindley (23, p. 4), Tolman and Honzik (86, p. 4), and Elliott (14, p. 4) found that the rate and amount of learning was greater under reward conditions than under non-reward conditions. The type of reward used in these experiments was usually food.

Thorndike's findings have also found a great deal of support in studies utilizing human subjects. Forlano (18), for example, conducted a study in which he utilized as subjects 1,294 pupils from grades four through eight of the public schools of New York City. The study was designed to determine whether learning with an immediate actual money reward or a promised money reward was more efficient than learning under the condition of no money reward. He found that learning which was accompanied by the promise of a monetary reward was more efficient than learning with no promise of a reward. Although this result was not always statistically significant, in practically all cases the means for the methods involving a promise of reward were greater than the means for the methods involving no reward. It was also found, in general, that learning accomplished under the condition of an actual money reward was more efficient than learning with no reward (18, p. 101).

In another study of the effects of reward upon human subjects, Forlano collaborated with Thorndike (84) to determine the differences in the strengthening of connections under different reward conditions. The subjects were boys ten to sixteen years old. The multiple-choice learning task consisted of the following: (1) the selection of one from five English meanings of Spanish words; (2) one from six parts of pictures; and (3) a number from one to six as a response to an English word. The subjects were rewarded for correct responses as follows: (a) by a mere announcement of "right," (b) by "right" plus a money bonus of one-tenth of a cent, (c) by "right" plus a bonus of two-tenths of a cent, (d) by "right" plus a bonus of four-tenths of a cent, (3) by "right" plus a bonus of eight-tenths of a cent. It was found that the increase of money reward up to four-tenths of a cent acts to increase the rate and amount of learning (84, pp. 401-411).

A study by Rock (62) lent support to the findings cited above. His subjects were fifty educated adults and seventy-five school children who were in the sixth, seventh, and eighth grades. The tasks involved in the experiment were code learning and ball tossing. He utilized the same reward groups as Thorndike and Forlano, with the exception of the group which was rewarded by "right" plus eight-tenths of a cent. He found that neither the addition of a money reward nor an increase in its amount produced a greater strengthening

of connections than that found for mere announcement of "right" by the experimenter.

Waits (90, pp. 1-56) conducted a study in which he found a gradual strengthening of rewarded connections. His study was concerned with whether rewards for correct responses were more effective for producing learning than punishment for wrong responses. His subjects were two groups of ten educated adults. The subjects were seated before an apparatus which contained a little window in which a drawing would appear. The subjects were instructed to associate the drawing with one of the letters on the typewriter keys and then strike that letter. For right answers, the subject's answer was followed by the ringing of a bell and he was told that he would receive one-tenth of a cent for each right answer. When the subject struck the wrong key, he received a slight electric shock and was told that he would lose one-tenth of a cent. The subjects were given five trials on each drawing. They were exposed to a total of twenty drawings. The following results were found: (a) without the interpolation of punishment, the strengthening effect of rewards was found to be 37 per cent for a single reward, 56 per cent for two rewards, 70 per cent for three rewards, and 75 per cent for four rewards; (b) rewarded responses which were preceded by punished responses produced rights as the first choice on the ensuing trial less frequently than those in which no punishment was administered; (c) rewarded responses preceded by a

larger number of punished responses resulted in the right response on the first choice at the ensuing trial less frequently than rewarded responses preceded by a smaller number of punished responses; (d) wrong responses were not eliminated through punishment. This study by Waits (90) provided further proof of the greater beneficial effect of reward than of punishment as found by Thorndike (82, 83).

Some evidence has been gathered which indicates that a previous reward experience may maintain its favorable influence in subsequent learning experiences. In a study of children under five years of age, Steigman and Stevenson (76, pp. 53-58) found that those children who had been more highly rewarded previously did better on subsequent problems where the rewards were dispensed equally. In a similar study, Longstreth (52, pp. 398-401) found that stimuli which had been previously paired with reward elicited reliably faster locomotor speeds in pre-school children than did stimuli which had not been previously paired with reward.

The majority of the research on reward has demonstrated that reward can have a beneficial effect upon learning. Both the rate and the amount of learning may be affected by reward (84). It has also been indicated that reward administered in a previous learning experience may maintain its influence so that it has a positive effect upon subsequent learning experiences (52, 76). This latter observation was especially significant for this study, since it was hypoth-

test papers of college students would have an effect upon the subsequent test performances of these students.

#### Studies of Reinforcement

Closely related to reward and the law of effect is an aspect of learning known as reinforcement. Indeed, Miller and Dollard (3, p. 34) have implied that reinforcement is just a more technical name for reward. Logan and Wagner (51, p. 27) have classified rewards as a subclass of reinforcers. In line with this classification was Kuethe (41, p. 51), who considered a reward as a positive type of reinforcement. In his treatment of reinforcement theory, Keller (37, p. 29) used the terms "reward" and "reinforcement" interchangeably. Symonds (79, p. 29) also used these terms interchangeably. Skinner (70, p. 29) has indicated that a close relationship exists between the law of effect and the concept of reinforcement. Miller (5, pp. 66-67) also recognized this relationship. Although all investigators have not always agreed upon the exact relationships which exist among the law of effect, reward, and reinforcement, the existence of a close relationship among these facets of learning has been noted.

Little unanimity has appeared among leading authorities in the field of learning with regard to a definition or conception of reinforcement (35, p. 114). The following definitions and conceptions of reinforcement have been offered:

(a) a reinforcing event increases the probability of recurrence of a response (27, p. 89; 69; 87); (b) reinforcement occurs by contiguity (69, 70); (c) reinforcement accompanies drive reduction (24, p. 67; 55); (d) reinforcement is related to dissonance reduction (45, p. 34); (e) reinforcement informs the organism (61, 85); (f) reinforcement is a reduction of fear or anxiety (24, pp. 44-48; 27, p. 413); (g) reinforcement is a reduction of need (27, p. 416). A definition which seemed particularly appropriate for purposes of study was that offered by Deese (11, p. 25): "A reinforcer is a stimulus event which, if it occurs in the proper temporal relation with a response, tends to maintain or to increase the strength of a response or a stimulus-response connection."

Reinforcers have been classified in various ways (24, p. 89; 36, pp. 3-6; 87, pp. 77-87). A distinction has been made between primary and secondary reinforcers (27, pp. 89-90; 37, p. 13; 87, p. 77). Primary reinforcers may be defined as those which are naturally reinforcing or which seem to have a kind of inborn capacity to strengthen behavior. Some examples of primary reinforcers which have been frequently cited in the literature are food, drink, and electric shock (37, p. 13). In this category, Travers (87, p. 77) has included any condition which operates to satisfy a basic physiological need. Secondary reinforcers have been defined as those which have acquired their reinforcing power,

possibly because they have been associated with primary reinforcers. Some examples of secondary reinforcers are the approval or disapproval of other persons (27, p. 95; 35, pp. 7-8), promises or threats, praise or blame (68). Primary reinforcers have been rarely utilized at the human level. They have been almost exclusively confined to animal studies and research (16, pp. 167-176; 27, pp. 88-90; 32, pp. 235-239; 37, p. 13; 63, p. 184; 65, pp. 161-173; 94, pp. 37-51). Secondary reinforcement has not played a prominent part in animal studies, but some evidence has accumulated to indicate that secondary reinforcement can have an important effect upon animal learning (16, 65, 94). Human responses are most often conditioned or strengthened by secondary reinforcers (37, 41, 74, 88).

In addition to being classified as primary or secondary, reinforcement has also been classified as positive or negative. Keller (37, pp. 7-13) has dichotomized reinforcement in this manner, and so has Travers (87, pp. 80-81). Hilgard (27, p. 89) utilized a combination of the above two classifications because he has referred to positive and negative primary reinforcers. Keller (37, p. 7) has defined positive reinforcers as all those stimuli that, when presented, act to strengthen the behavior that they follow. He defined negative reinforcers as those stimuli which strengthen responses through their removal. Hilgard (27, p. 89) defined positive reinforcers as those stimuli which strengthen the

probability of an operant response when they are added to a situation. He defined negative reinforcers as those stimuli which strengthen the probability of an operant response when they are removed from a situation.

The present study was concerned with the use of secondary positive reinforcement in the form of written comments applied to the test papers of college students. It was thought that these written comments, when added to the situation, would serve to maintain or strengthen the future test performance of these students.

Stephens (78, p. 111) has pointed out that the provision of an efficient schedule of reinforcement is an essential part of teaching. Traditionally, teachers have been concerned with providing appropriate amounts of reinforcement or sufficient schedules of reinforcement to bring about maximum learning on the part of students (78, pp. 108-120). Several investigators and writers in the field of learning have also been concerned with this problem. Jenkins and Stanley (33, pp. 193-234), in their review of the research studies on partial reinforcement prior to 1950, found that the following characteristic of performance under a partial reinforcement schedule emerged: "All other things equal, performance under a partial reinforcement schedule tends to be somewhat lower than that under a continuous reinforcement one as measured in terms of single responses." These authors were primarily concerned with the effects of partial



reinforcement on three aspects of learning behavior:

(1) acquisition, (2) maintenance of behavior or performance, and (3) resistance to extinction. The authors concluded that the following empirical generalizations may be drawn from the data: (a) a schedule of 100 per cent reinforcement builds up response strength somewhat more rapidly than does partial reinforcement; (b) while the behavior in post-acquisition performance is stable in the partial reinforcement situation, it is usually at a lower level than in the 100 per cent reinforcement situation (these differences are not always statistically significant, however, and they may not have great practical consequence); (c) large and significant differences in resistance to extinction favoring the partially reinforced groups were found in almost every experiment.

Lewis (48, pp. 1-28), in his review of the studies of partial reinforcement between 1950 and 1960, confirmed the above generalizations drawn by Jenkins and Stanley. Lewis reported the following: (1) most of the studies showed that, during acquisition of conditioned responses, the percentage of positive responses was an increasing function of percentage of reinforcement; (2) in extinction, however, the greatest resistance is shown by partially reinforced groups who experience between 20 per cent and 80 per cent reinforcement, with both high and low reinforced groups showing a low resistance to extinction.

These generalizations have indicated that 100 per cent reinforcement or continuous reinforcement may be more effective during the acquisition phase of the learning process, whereas partial reinforcement tends to make for greater resistance to extinction. This generalization concerning reinforcement during acquisition seems to be supported by the findings of Nipper (57, pp. 121-123). He examined empirically the effects precipitated by varying the schedules of reinforcement for a particular type of response. His subjects were 150 military males serving on a western military installation. The subjects were divided into three equal groups. Their task consisted of firing an M-2 carbine from a prone position at a target of standard design. Each man was to fire a total of thirty rounds of ammunition with five rounds being fired at each of six targets. The first group was to fire all thirty rounds without using the telescope to see the results of their firing. The second group was allowed to scope their shots after each ten rounds of firing. The third group scoped each shot immediately after it was fired. It was found that the continuously reinforced group received consistently higher scores. The group that was reinforced after each ten rounds also received consistently higher scores than did the nonreinforced group. The chi-square test of contingency was applied to determine if the immediate reinforcement of each shot actually was associated with improved shooting scores. The resulting value surpassed the .001 level of significance.

Another question which has concerned teachers is the amount of reinforcement that should be given (78, p. 118). In their discussion of the application of psychological learning theory to adult education, Lanyon and Schwartz (44, pp. 12-18) contended that the amount of reward was sufficient so long as it elicited the behavior again. They observed that if you gave the rat running a maze too large a piece of food as a reward, you would satiate his hunger so that he would soon be satisfied and stop running. For this reasons, the reward should be small or minimal so that the rat will continue his activity for a longer period of time.

Lanyon and Schwartz (44, p. 17) applied the results of this observation to the classroom situation. They felt that correct statements by students could be systematically rewarded by the instructor. According to these authors, the instructor should give small amounts of reinforcement at frequent intervals, rather than large amounts at infrequent intervals. These small amounts of reinforcement need be no more than a head-nod, or a smile, or some positive verbal comment. If given systematically and frequently, minimal reinforcement of this kind has a very powerful effect on learning (44, p. 17).

The use of small or minimal amounts of reinforcement has also been advocated by Travers (97) and Stephens (78). Travers (87, p. 97) has reported that the most usable reinforcements are small and frequent ones because they are easier

to administer and they are likely to prove just as effective as much larger reinforcements. In general, the results of studies which have been concerned with amounts of reinforcement have indicated that teachers should aim at a generous schedule of reinforcement (78, p. 118). In this regard, Stephens (78, p. 118) wrote, "In our day-by-day teaching, we should make much use of reinforcement, expediting any and all of its functions as circumstances permit."

In the Handbook of Research on Teaching, Wallen and Travers (20) have compiled a comprehensive set of learning principles which have strong implications for teachers and teaching. The following principle seemed to be particularly relevant to this study (20, pp. 494-495): "Behavior which represents the achievement or partial achievement of an educational objective should be reinforced."

#### Shaping

Reinforcement for partial achievement or for effort in the right direction has been called shaping or shaping up (77, p. 1; 78, p. 120). Skinner (71, pp. 94-99; 72) and Staats (75) have stressed the process of shaping up in their work. Ferster and Skinner (17) have demonstrated fairly conclusively the effects of shaping up on the learning of animals. Stephens (78, p. 120) has indicated that shaping up has been used to reinforce behavior in children--both before they enter school and afterward. Other writers have

also indicated that shaping up has value for the control of human behavior (41, 79, 87).

Traditionally, teachers have employed shaping up in those cases in which initial responses were in the right general direction (41, p. 54; 77, p. 342; 78, p. 120). As Symonds (62, p. 19) has pointed out, the majority of man's behavior is guided by cues or signals which indicate that he is or is not on his way toward his ultimate goal. Stephens (78, pp. 112-120) has related that the technique of shaping up might even be used in those cases in which students are learning factual or objective material. Although the teacher may have considered it morally unjustifiable or unfeasible to offer unconditional commendation in some cases, he could still have commended the general approach of the student. The teacher might have said, "That's close, but . . .," or "You're on the right track," or "Right so far. Anything to add?" or "True, but what about . . .?" Stephens (77, p. 342) has contended that the teacher strengthens the student's tendency to try or to make an effort by such commendation. It was thought that the written comments which were used in this study would strengthen the student's tendencies to make an effort in the direction of better test performance.

Skinner (71, pp. 94-99) believed that positive reinforcers could be a great help to the teacher in the classroom. He pointed out that there was a relative infrequency of reinforcement in much of school learning, and that the

wise and economic use of very slight reinforcements might be very effective in controlling classroom behavior (73, pp. 91-93). He has not said that the use of reinforcers would solve all the teacher's problems, but he has said (71, p. 95), ". . . a careful husbanding of small reinforcers and the nurturing of proper contingencies is a program well worth exploring."

#### Studies of Praise as Reinforcement

A form of positive secondary reinforcement which has been widely used is praise. Some writers have classified praise as a simple potential reinforcer (19, pp. 92-100; 80, pp. 357-363). Sorenson (74, p. 421) has reported that experiments on reinforcement have served to illustrate the single truth that praise and reward tend to improve learning and thus clearly constitute positive reinforcement. In his concluding remarks concerning experiments on reinforcement, Sorenson wrote (74, p. 421), "Finally, praise contributes more toward positive reinforcement when it is spontaneous and sincere, reflecting genuine concern on the part of the instructor."

The effects of praise upon student performance has been the subject of several studies. One of the earliest reported studies was that of Gilchrist (22). The purpose of Gilchrist's study was to determine the extent to which praise and reproof by a teacher may alter the test performance of students.

The fifty subjects were members of an educational psychology class at a well-known midwestern college. All the subjects were administered the Curtis English Test 4-B. The class was then divided into two groups without regard to how well the individual members of the class had performed on the test. One group was reprovved and the other group was praised. The group that was praised improved the group score by 79 per cent on the second test. The reprovved group made a lower group score on the second test than it had made on the first test. In Gilchrist's study, then, the effect of praise was a significant increase in test performance.

A similar study of the effects of praise was conducted by Gates and Rissland (21, pp. 21-26). They attempted to investigate the effects of an experimenter's comments on two very simple performances--two trials of the Motor Coordination (Three Hole) Test and two trials of the Color-Naming Test. The subjects were seventy-four naive college students who were individually administered the two tests. One-third of the group were praised and told that they had performed well and then were asked to repeat the test. One-third of the group were told that they had performed poorly and the examiner expressed sympathy and disappointment. The other third of the group received no comment. The investigators did not find any significant differences in performance among the three groups on the second trial. However, certain trends were noticeable. On the Coordination Test, the

encouraged group showed the greatest improvement, the discouraged group the next greatest improvement, and the control group the least improvement. On the Color-Naming Test, the discouraged group showed the greatest gain, the encouraged next, and the control group least. In general, it may be said that such differences as existed were in favor of encouragement or discouragement rather than mere repetition.

In 1923, Laird (42, pp. 366-379; 43, pp. 358-365) conducted two investigations which were concerned with students' reports of teachers' uses of different incentives in an effort to secure the students' cooperation and full measure of work. In both of the studies, Laird found that public commendation and public praise tended to result in an increased student work output.

One of the classic studies of the use of praise in the classrooms was conducted by Hurlock (29, pp. 145-159). The problem of her study was to determine whether children in the classroom who constantly received praise for their work showed more improvement from day to day than did children who were reprovved or who were completely ignored. The subjects were elementary students who were enrolled in a public school in a midwestern state. The group included forty-eight boys and sixty girls. The teacher praised or reprovved the children before the other members of the class. The greatest amount of average improvement at the end of a series of tests (over and above practice) was found in the group that



was praised for improvement in work and was urged and encouraged to do better on succeeding tests. The reproved group showed decidedly less improvement, the ignored group still less, and the control group none at all. Praise was decidedly more effective than reproof in the case of both boys and girls. In a previous study, Hurlock (31, pp. 5-78) had found that after one application of praise and reproof, the two, on the whole, were of equal value.

In 1927, Briggs (6, pp. 596-598) conducted a study which was designed to discover the relative effects of praise and censure on the test performance of junior high school students. Some classes received praise while others were severely reprimanded for their performances on teacher-developed tests. It was found that 87 per cent of the pupils in the praised groups made better scores on subsequent tests.

In 1931, Hurlock (30, pp. 261-290) was prompted to report that praise and encouragement had been found relatively more effective in producing improvement in test performance than had reproof and discouragement. She based her observation upon the previously cited studies.

Since 1931, several studies have been conducted which were concerned with the effects of praise and blame on the school performance of elementary school children. Forlano and Axelrod (19, pp. 92-100), for example, conducted an investigation which was designed to determine experimentally

the effects of repeated praise or blame on the performance of children who were classified as extroverts or introverts on the basis of their responses to a psychological questionnaire. They found that blame was more effective than either praise or control in producing an increment in performance on both successive trials of a number cancellation test. Praise showed some influence on the third trials, but not significantly so. The introverts responded more readily to blame after one application. After two applications, however, the extroverts produced the larger gain in performance. In general, it may be said that praise did not exercise any differentiating effect.

Thompson and Hunnicutt (80, pp. 257-266) were also interested in the effects of extended applications of praise or blame on the work achievement of elementary school pupils. They also used a number cancellation test as a criterion measure. Six alternate tests were constructed so that the students could be tested six times. The teacher administered praise or blame after each testing session. An analysis of variance revealed that the blamed, praised, and control groups all made significant gains (at the 1 per cent level of confidence) on tests two, three, four, five, and six. It was also found that all five of the mean gains obtained by the control group were significantly smaller than those obtained by either the praised or blamed group. Repeated applications of praise increased the work output of

introverts who were blamed or extroverts who were praised. Repeated applications of blame increased the work output of extroverts until it was significantly higher than that of extroverts who were praised or introverts who were blamed. No significant differences were found between the mean cancellation scores of extroverts who were blamed or of introverts who were praised.

Silberman (68, pp. 199-206) investigated the effects of praise and reproof on the learning of reading in the elementary school. He utilized forty classes in which he observed the behavior of teachers and counted the number of times in which statements were made which fell into one of the following categories: (1) supportive statements ("right," "good," "fine work"), (2) problem-structuring statements ("Your difficulty is . . ."), (3) neutral statements, (4) directive statements ("Pass the pages forward," "Read this"), and (5) reproofing statements ("You're all wrong," "Won't you ever learn?"). It was found that the number of teacher behaviors in each category had little relation to pupil growth in reading.

The effect of praise on the personal adjustment and test performance of elementary school children has been investigated by Dollins, Angelino, and Mech (13, pp. 446-450). The subjects were seventy-five pupils selected from twelve schools in central Oklahoma. The pupils were selected on the basis of having scored at or below the thirtieth

percentile on the California Test of Personality, Elementary Form AA, which measures personal adjustment. The pupils were divided into three equal groups. The pupils in Group A were praised on two of every three school days for a period of thirty days. Group B was praised on one of every three school days so that they received praise on ten of the thirty days. Group C was the control group and received no praise. The children were given a series of arithmetic problems in addition and subtraction for three minutes a day for each school day during the study. Form BB of the California Test of Personality was given at the end of three weeks, and Form AA was given at the end of the study. Changes in personality inventory scores indicated that praise from the teacher had some influence on the psychometric adjustment of the pupils in the experimental groups. No significant difference was noted in work output in arithmetic for three groups. This study, then, indicated that praise did not exercise a differentiating effect upon the test performance of these elementary pupils.

Sechrest (67, pp. 197-201), however, found that positive verbal reinforcement (praise) had a differentiating effect upon the speed with which children worked jigsaw puzzles. The subjects were two groups with fifteen pairs of children in each group. The experimental task was the completion of a pair of wooden jigsaw puzzles. Each child of a pair was given one of the two puzzles to work. Following completion

by both children of their puzzles, they then exchanged puzzles so that all the subjects worked the same two puzzles, but in differing orders. In the interval between the two puzzles, the children received either positive verbal reinforcement or negative verbal reinforcement. It was found that positive verbal reinforcement facilitated and negative verbal reinforcement hindered performance (speed of putting together the second puzzle).

Hill (28, pp. 723-737) also found that positive verbal reinforcement (supportive comments) had a facilitative effect upon the performance of some elementary school children. His subjects were 128 seven-year-olds of each sex from three elementary schools in Robbinsdale, Minnesota. The subjects were divided separately by sex into high and low levels of anxiety on the basis of the median TASC (Test Anxiety Scale for Children) score for each sex. The subjects were divided equally into four experimental groups according to the type of pre-training (success or failure) they had received. The pre-training involved putting together a puzzle under a time limitation. The social reinforcement involved the experimenter making a supportive statement about each subject's performance on a marble-sorting task. The following supporting statements were used: "Very good," "That's very good," "Fine," "That's fine," "You're playing well," "You're doing well." The subjects received each of the six supportive statements twice. It

was found that performance was higher under social reinforcement and lower under non-reinforcement for low-anxious subjects after success and high-anxious subjects after failure, but similar under the two reinforcement conditions and at an intermediate level for low-anxious subjects after failure and high-anxious subjects after success.

Schmidt (66) investigated the effects of praise and blame upon the test performance of students at three educational levels--junior high school, high school, and college. He found that neither praise nor blame could be singled out as being more effective in producing a significant difference in performance over five administrations of a code substitution test. These findings contrasted with those of Tyler (89, pp. 166-172), who found that a significantly larger number of praised college students were able to solve light-flashing patterns and also arrived at their answers significantly faster than did a discouraged group and an inconsistently treated group.

Wood (96, pp. 657-664) was also interested in the effects of praise and blame upon the performance of college students. He studied the effect of approbation (praise) and reproof (blame) on the mastery of nonsense syllables by college students. He found that approbation and reproof did not have a differentiating effect upon the learning of nonsense syllables by these students.

Anderson, White, and Wash (1, pp. 169-173) tested the hypothesis that praised college students would perform better than reproved college students on a locally designed achievement test covering the content material in a university level course. Four days after the administration of the achievement test, the subjects were given sham scores that were written on a piece of paper and handed to them in class. The professor then made prepared remarks emphasizing his pleasure with the high scores and his embarrassment for the low scores. Immediately after the professor's remarks, the achievement test was again administered. It was found that those with whom the professor had expressed pleasure (praise) performed significantly better on the second administration of the achievement test than did those who had been reproved.

The foregoing studies have indicated that the effect of praise on student performance has not always been consistent. The majority of these studies (1, 6, 21, 22, 28, 29, 42, 43, 67, 80, 89), however, have indicated that praise has been more effective than either blame or nothing at all. Other studies (21, 31, 80) have indicated that both praise and blame may be effective in bringing about an increment in performance. Still other studies (13, 19, 66, 68) have shown that praise did not exercise any differentiating effect upon the performance of students.

In 1964, Kennedy and Willcutt (38, pp. 323-332) reviewed thirty-five articles spanning fifty years of research on the effects of praise and blame on the performance of school children. They concluded that praise generally acts as a facilitator to performance, whereas blame generally has a decremental effect on the performance of children. Their findings have been supported by Mouly (50, pp. 282-285), who also reported that early studies showed praise to be superior to reproof. However, as Mouly hastened to point out, the findings have not always shown complete agreement.

Mouly (56, p. 285) has reported that teachers, in common with people in general, believe in praise to a greater extent than reproof, but in actual practice this is reversed. Mouly has contended that achievement without praise is relatively unsatisfying. If overdone, reproof loses its effectiveness and may even be harmful to a student's mental health, whereas praise tends to be cumulative in its effects.

#### Approval and Attention

Teachers have been particularly concerned with the effects of socially-derived reinforcers because it is a widely held belief that teacher approval has a powerful effect in pupil behavior modification (20, p. 225). Both adult (teacher) approval and attention have been mentioned as important secondary or socially-derived reinforcers (37, p. 29; 49, p. 256).



According to Stevenson (50, pp. 97-124), adult approval has constituted one of the most commonly used means of effecting behavioral change in children. The response of parents and other significant adults form the referent which the child uses in determining whether his behavior is satisfactory or commendable. The social aspects of adult approval constitute the most common source of reinforcement for most children, since adult approval is more frequently expressed by a smile, a nod, or a verbal comment, than by the presentation of some tangible reinforcement. Approval-seeking behavior has not been confined to children, however. As Keller (37, p. 29) has pointed out, approval is a secondary reinforcer which figures prominently in most of the social contacts of human beings. Regarding the approval-seeking behavior of people, Keller wrote, ". . . there are few of us who do not seem to be rewarded by the 'good will' of others at one time or another." Skinner (73, p. 74) was more specific. He cited the good will and affection of the teacher as a possible secondary reinforcer in the learning process. Keller (37, p. 29) also cited attention as an important secondary reinforcer. From birth until death, the attention paid to us by others exerts a tremendous influence in human affairs. This attention serves as a stimulus compound which may be the strengthener of a wide range of activities. It was conceivable that the written comments which were employed in this study constituted a form of attention

and, in some cases, approval on the part of the instructor regarding the test performance of students. As Lindgren (49, p. 256) has indicated, the placing of written comments upon test papers constitutes a kind of positive attention that teachers have used to reinforce the behavior of students.

#### Motivation

In addition to the reinforcement of learning, teachers have constantly sought ways to bring motivation on the part of students to continue intellectual activity. Several writers in the field of learning have reported that a close relationship exists between reinforcement and motivation (20, p. 488; 35, pp. 66-67; 51; 69, p. 39). Indeed, Sorenson (74, p. 421) has contended that motivation and reinforcement are inseparable in the long continuation of learning experiences. In this regard, he has written, "Feelings which positively or negatively reinforce one piece of learning serve to motivate the learner when a similar situation arises."

Motivation has long been recognized as an important variable in the learning process. As Hilgard (27, p. 469) has pointed out, "Everybody agrees that motivation affects performance . . . ." A motivated learner acquires learning material more readily than a learner who is not motivated (27, p. 486). The influence of special motivation upon the acquisition of skills had been recognized as early as 1929,

when McGeoch (54, p. 464) noted, "The accelerating influence exercised upon improvement by the introduction of special motivating conditions of diverse kinds seems established . . . ."

Motivation must necessarily take into account the needs, interests, and attitudes of the individual and the relation of these to the situation (25, p. 291). Motives have been said to include drives, needs, urges, impulses, sets, pre-dispositions, values, purposes, etc. (26, p. 38). Early in life, children learn a need for approval or recognition from parents who reward or praise them for approved conduct and who punish them or withhold good things from them for conduct which does not meet with the parents' approval. For this reason, it becomes important for the child to learn how to gain the approval of his parents. In order to gain parental approval, it often becomes essential that the child gain the approval of playmates, teachers, and others. Thus the need for teacher approval becomes a strong motive for learning in school (26, pp. 36-41). Thelen and Tyler (26, p. 305) have reported that the need for approval is so pervasive that it operates in every social situation including the classroom. Travers, Reid, and Wagensen (88, p. 225) have reported that it is a widely held belief that teacher approval has a powerful effect in pupil behavior modification. As Hilgard and Russell (26, pp. 36-41) have related, the approval of the teacher is a strong motive for the student. In this regard, Sorenson (74, p. 408) wrote, "In learning, as elsewhere,

motivation is fundamentally dependent on an individual's needs and drives." In general, these needs and drives produce a willingness to learn and also act to focus this willingness.

The motives of students are central factors in learning which teachers have attempted to understand and capitalize upon. Secondary or social motives, such as the need for approval, seem to be the more important ones for the teacher (26, p. 36). Other secondary or social motives with which teachers have been concerned include exploration, activity, curiosity, mastery (achievement), and stimulation (2, pp. 480-481; 64, p. 223).

Motives have been classified as extrinsic or intrinsic (64, p. 223). In everyday learning situations, both extrinsic and intrinsic motivation are frequently involved. Intrinsic motivation has been defined as that which comes from within the organism and brings about a particular act or accounts for what one does (9, p. 9; 25, p. 291). Motivation becomes extrinsic when the incentive or goal is artificially introduced into the situation and was not an original function of the material to be learned or of the learner's attitude toward it (25, p. 296).

In his theory of motivation, McClelland (53) recognized the roles of both extrinsic and intrinsic motivation in learning. According to McClelland, the learner's level of motivation is determined partly by the cues provided by the

environment and partly by the learner's internal capacity to respond to those cues. To Wallen and Travers (20, p. 496), this theory implied that teachers might be able to supply cues which would arouse activity in students. In this regard, Wallen and Travers wrote, "If the function of the teacher is to raise the level of arousal of the pupil to an optimum level, then he must be able to introduce into the environment those stimuli which have arousal value . . . ." Congruently, the following learning principle seemed relevant (20, p. 495): "The introduction of cues which arouse motivation toward the achievement of an educational objective will increase the effectiveness with which that objective is achieved." In other words, the teacher or instructor may be able to manipulate some independent variables which are related to the learning process. By manipulating one or more independent variables, the teacher or instructor may be able to exercise some control over the efficiency with which the learning process takes place (20, p. 487). In this study, the written comments of the instructor constituted such an independent variable.

#### Incentives: Extrinsic Motivation

Traditionally, teachers have been primarily concerned with extrinsic motivation in the form of incentives which can be manipulated by the teacher in a direct manner not possible with motives (10, pp. 134-145; 26, p. 39; 64, p. 223;

92, pp. 413-416; 93, pp. 320-326). An extrinsic type of motivation may involve the use of an incentive which helps the student to increase or maintain his efficiency, or which emphasizes the desired or correct response or behavior (9, p. 13). An incentive is outside of a person, or extrinsic to him. It may be a tangible reward for particular accomplishment, or it may be an intangible honor. It should cause the student to focus his energies on the task at hand, and it should help him to keep a clear image of the study goal and his real need to learn (74, p. 418). Davis and Ballard (10, pp. 134-145) have defined incentives from the standpoint of the function of the school as follows:

"Artificial devices introduced into methods of teaching for the purpose of stimulating pupil activity." Similar definitions have been offered by Leuba (46, pp. 107-114; 47, p. 430), Ryans (25, p. 294), Chase (9, p. 10), and Mouly (56, p. 279).

Some examples of incentives (extrinsic motivation) which have been used by teachers in the classroom are honor rolls, gold stars, report cards (64, p. 223), rewards and punishments, material rewards, praise and blame (25, p. 309), encouragement and discouragement (5, pp. 305-362; 10, pp. 134-145), and written comments (58; 92, pp. 413-416). According to Leuba (47, p. 433), some of the most commonly used elementary incentives are words, expressions, or attitudes of praise, approval, or encouragement. He contended that those

motivating incentives served to facilitate any activity in progress, and that they could be used as a spur to more intense and persistent effort (46, p. 107; 47, p. 434).

#### Encouragement as an Incentive

The use of encouragement as an incentive has received a great deal of attention in the writing of Dinkmeyer and Dreikurs (12). One of the methods of encouragement advocated by these authors was the recognition of a job well done; and the giving of recognition for effort (12, p. 50). Another means of encouragement which they cited as being used by teachers was the solid communication of the attitude of faith in the ability of the student to do the work. They related (12, p. 70), "Any influence on attitudes is crucial because it so closely relates to the motivational set of the individual." The student's attitude predisposes him to act in a certain manner. Dinkmeyer and Dreikurs (12, p. 124) felt that the widespread use of encouragement was a goal toward which all teachers should strive. The present study was concerned with the use of written comments which were designed to be encouraging of better test performance on the part of college students.

A study by Book and Norvell (5) has illustrated the efficacy of the use of encouragement as advocated by Dinkmeyer and Dreikurs. The subjects were 124 juniors and seniors at Indiana University. There were forty-eight men and seventy-six women in the group. The subjects were tested on four

simple learning tests involving widely divergent types of acquisition, as follows: (1) making the small letter "a" as rapidly and accurately as possible, (2) learning to locate and cross out certain letters in a uniform list of disconnected Spanish words, (3) a case of learning in which a set of psycho-physical habits must be formed and fixed, (4) learning to mentally multiply one two-place number by another. The subjects were given seventy-five practice periods on the first learning task and forty-five practices each on the other three. The subjects were divided into an experimental (stimulus) group and a control group. The stimulus group were urged (encouraged) to do their best at the beginning of each practice period. The following results were accumulated: (1) it was found that the stimulus (encouraged) group made more improvement with a given amount of practice than did the control group; (2) the stimulus group, which had been making rapid and continuous improvement, ceased suddenly to show much gain when the incentive was removed; (3) when made to feel that further improvement was possible, the control group which had been making little or no progress in practice began suddenly to improve and continued to gain more rapidly and consistently when definitely interested in the improvement as such; (4) the same group of individuals not only ceased to gain in their scores but also became more careless about their work when not interested in their improvement as such. When they were again subjected to the incentive



condition, both groups began at once to increase their output and accuracy.

In addition to verbal encouragement, teachers have used social recognition as an incentive. This was amply recognized in the work of Sorenson (74). He felt that the feeling of personal worth gained from social recognition was about as fundamental an incentive as the prize itself. He contended that achievement could be increased if the incentives served to stimulate good morale. Sorenson (74, p. 419) wrote, "Most basically, incentives are usually potent in terms of their bearing on feelings of personal worth." Incentives which make a person feel that he is appreciated, wanted, or respected will serve to direct his efforts toward the maintenance and enhancement of that status. About school incentives, Sorenson (74, p. 430) concluded, "Generally, incentives in school cause students to direct their energy toward worthy goals and achieve much more than they would without incentives."

The value of social recognition as an incentive was also recognized by Ruch (64), Chapman and Feder (8), and Leuba (92). Ruch (64, p. 223) cited the case of the Boy Scout who eagerly learned the Morse Code because he wanted to enjoy secret communications with his friends, but he also wanted to advance his scouting rank and win the (social) recognition that accompanies this accomplishment. Analogously, Ruch cited the case of the scientist who conducts research

to advance his knowledge in a particular field, but he also achieves recognition and advancement. Chapman and Feder (8, pp. 469-474) conducted a study in which social recognition in the form of gold stars were awarded to students who had scored in the upper 50 per cent of their class on certain tests or who were in the upper 50 per cent of the class with regard to the amount of gross improvement they had made. Certain other incentives were also employed. It was found that the experimental (incentive) group made a significant improvement over the control group on an additional test and a substitution test.

The written comments which were utilized in the present study constituted a form of reinforcement as well as a form of motivation (incentive). They were designed to be positive in nature and to encourage students in the direction of improved test performance. It has been shown that both reinforcement and motivation have proven effective in producing an increment in student test performance (1, 5, 8, 28, 38, 56, 67, 80).

#### Previous Studies of Written Comments

Studies dealing with the effects of written comments upon student test performance have been few in number. The studies in evidence have reported findings which appear contradictory. Wallen (92, pp. 413-416), for example, found no significant difference in the performance of elementary

pupils who received written comments from teachers on their test papers and those who did not receive such comments. Page (59), however, was primarily concerned with the effects of teachers' written comments upon the test performance of junior and senior high school students. He found that the students who received written free comments and written specified comments from teachers upon their test papers performed significantly better on a subsequent test than did students who did not receive such comments. However, he did not find a significant difference between the test performance of the groups who received specified comments and the groups who received free comments.

The present study was designed to fulfill the need for further investigation of the effects of written comments on student test performance. It differed from previously cited studies in several ways. First of all, this study was conducted at the college level, whereas previous studies had been conducted at the elementary, junior high, and senior high school levels. Second, this study was designed to measure the students' performance on one criterion test after the students had received comments on two previous tests. Third, this study was designed to measure any differences which might occur across subject matter areas. Finally, this study was designed to measure any differences which might occur between university students and junior college students.

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## CHAPTER III

### METHODS AND PROCEDURES

#### Procedures for Collecting Data

There were eighteen classes in each of three subject matter areas from which data were gathered for this investigation. The subject-matter areas were biology, business administration, and psychology. The classes were selected from among those of the thirty-five instructors who agreed to participate in the experiment. Sixty-two class sections with a total enrollment of 2,925 students participated in the experiment. These students were enrolled in one university and one junior college. Due to the necessity for equal numbers of observations within each cell of the analysis of variance design, fifty-four of the sixty-two class sections were utilized in the final analysis. These fifty-four classes were selected on the basis of their having retained more students over the period of the three test administrations. The student population sample totaled 2,640 in the fifty-four classes which were selected.

The deans and department chairmen of the particular colleges and departments involved in the study were contacted prior to the beginning of the spring semester, 1968. They consented to the participation of their particular departments

in the study and suggested that each instructor involved in teaching freshman classes be contacted for the purpose of securing the instructor's consent regarding the participation of his classes. Each instructor was contacted, and it was found that they were all willing participants. Each instructor was informed that further information regarding the study would be forthcoming prior to the opening of the spring semester, 1968.

Each instructor who had agreed to participate in the study was delivered a packet containing a detailed explanation (see Appendix A) of the purpose of the experiment and an overview of the procedures to be followed. A procedure for securing further information was outlined in Appendix A for those instructors who felt a need for more information or who had questions regarding some aspect of the study.

The procedure explained in the packet consisted of the following steps: (Step One) The instructor gave the first objective test naturally occurring in accordance with his conduct of the class. The test covered the classwork just completed. No restrictions were imposed upon this test, so long as the instructor derived the grades quantitatively and objectively. (Step Two) The instructor then collected the tests in his usual way and scored and graded them. A letter grade and a numerical score were placed on each test. Having scored and graded the tests, the instructor was requested to write the students' names, numerical scores, and

letter grades on a reporting sheet (see Appendix B), following the ranked order of the test papers. Each instructor then delivered his reporting sheets to the investigator.

(Step Three) The students were then divided into groups of five in accordance with the descending order of their test scores. Thus each group of five students had received comparable test scores. A die was used to randomly assign each student within a group to one of the five experimental groups--the No Comment Group, the Single Specified Comment Group, the Cumulative Specified Comment Group, the Single Free Comment Group, and the Cumulative Free Comment Group. The random assignment was carried out by assigning a die number to each of the experimental groups, with the exception of the ace (die number one). (Step Four) The reporting sheets containing the results of the random assignment were returned to the instructor or grader, who then placed the written comments upon the appropriate test papers.

The two Specified Comment Groups (Single and Cumulative) received a numerical score, a letter grade, and certain specified comments designated in advance for all students of a given letter grade achievement, as follows:

- A "An excellent paper! Keep it up."
- B "Well done. Keep working at it."
- C "There's room for improvement here."
- D "Let's bring this up!"
- F "Try to do better next time."

The Single Specified Comment Group received a specified comment only upon the first major objective test given in each class, whereas the Cumulative Specified Comment Group received a specified comment upon the first major objective test and also upon the second major objective test given within each class. The No Comment Group received a numerical score and a letter grade, but no written comment upon either the first or the second major objective test. The two Free Comment Groups received a numerical score, a letter grade, and whatever comment the instructor or grader felt was appropriate for the particular student and test concerned, so long as the written comment was positive in nature and designed to encourage the student to improve his performance upon subsequent tests. The Single Free Comment Group received a numerical score, a letter grade, and a free comment only upon the first major objective test given by the instructor in each class, while the Cumulative Free Comment Group received a numerical score, a letter grade, and a free comment upon both the first and the second major objective test given within each class. (Step Five) For the second major objective test, the instructors were requested to make certain that written comments were placed only upon the test papers of those students who had been assigned to the Cumulative Specified Comment Group and the Cumulative Free Comment Group. The instructors were also requested to prepare a reporting sheet showing the ranked order of the students'



test papers on the second major objective test and the third major objective test. The scores from the second major objective test which each instructor administered were used as a criterion test for investigating the effects of a single written comment. The scores from the third major objective test which each instructor administered were used as a criterion test for investigating the cumulative effects of written comments.

#### Procedures for Treating Data

For the No Comment Group, the Single Specified Comment Group, and the Single Free Comment Group, comment effects were computed from the scores achieved on the second major objective test given within each class. Since the testing instruments naturally differed sharply from each other in subject matter, length, difficulty, and every other testing variable, they obviously presented some rather unusual problems with regard to statistical treatment. These difficulties disappeared, however, when the tests were regarded primarily as ranking instruments. In other words, the numerical scores which the students had achieved were used as a means of ranking the students from highest to lowest within each class. In the case of tied scores, the instructors utilized the alphabetical last names of the students.

The use of ranks and levels of matched sets of subjects allowed for the use of the two-way analysis of variance by

ranks. The formula for such a test was given by Friedman (1, p. 677) as follows:

$$\chi_r^2 = \frac{12}{Nk(k+1)} \sum_{j=1}^k (R_j)^2 - 3N(k+1)$$

where N = number of levels

k = number of columns

R<sub>j</sub> = sum of ranks in jth column

$\sum_{j=1}^k$  directs one to sum the squares of the sums of ranks over all k conditions.

For the Friedman test, the data were cast in a two-way table having N levels and k columns. The levels represented the matched sets of subjects, and the columns represented the various conditions, as shown in Table I.

TABLE I  
ILLUSTRATION OF SECOND-TEST RAW SCORES WITHIN A  
SINGLE CLASSROOM

Levels	Conditions				
	N	SS	SF	CS	CF
1	49	46	48	45	47
2	40	44	42	41	43
3	37	36	39	35	38
...	..	..	..	..	..
...	..	..	..	..	..
6	22	24	20	23	21

The data of the test were ranks. The scores in each level were ranked separately. This meant that the ranks in any level ranged from 1 to  $k$ , with  $k$  representative of the treatment conditions being studied. To perform the Friedman test on these data, the scores were ranked in each level. For example, a class of thirty students formed six levels on the basis of their scores from the first test. Each level consisted of five students, with each student receiving a different treatment. The lowest score in each level was given a rank of one, the next lowest score in each level the rank of two, the third lowest score in each level the rank of three, etc., as shown in Table II.

TABLE II  
ILLUSTRATION OF SECOND-TEST LEVEL RANKS WITHIN A  
SINGLE CLASSROOM

Levels	Conditions				
	N	SS	SF	CS	CF
1	5	2	4	1	3
2	1	5	3	2	4
3	3	2	5	1	4
...	..	..	..	..	..
...	..	..	..	..	..
6	3	5	1	4	2
Sum of Ranks	20	27	22	25	23

If the null hypothesis (that all the samples--columns--came from the same population) was in fact true, then the sum of ranks in each column was a matter of chance, and thus one would have expected the ranks of 1, 2, 3, 4, and 5, to have appeared in all columns with about equal frequency. This would have indicated that for any one group it was a matter of chance under which condition the highest score occurred and under which condition the lowest score occurred, which would have been the case if the conditions really had not differed.

The Friedman test determined whether the rank totals ( $R_j$ ) differed significantly. To make this test, it was necessary to compute the value of the statistic which Friedman denoted as  $\chi_r^2$ . This statistic was cited previously.

Page (2, p. 40), in collaboration with two colleagues, tried to relate Friedman's formula to the classic chi-square for frequency tables:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

where O is the observed frequency, and

E is the expected frequency.

Page was seeking a conversion factor which would convert the classic chi-square to a two-way analysis of variance by ranks. Page and his colleagues brought forth a simplified conversion factor. This factor was  $6/k$ , where k was simply the number of ranks (2, pp. 40-42). Page's new formula was expressed as follows:

$$\chi_r^2 = \frac{6}{k} \sum \frac{(O-E)^2}{E}$$

Page and his colleagues felt that this new formula could be more desirably expressed for computational purposes. Using mathematical substitution within this new formula, they derived the following formula:

$$\chi_r^2 = \frac{6 \sum (O-E)^2}{\sum O}$$

The above formula was the one which was employed for testing the main treatment effects in the present study.

The test for main treatment effects was accomplished by treating treatment groups within classes as intact groups. The ranks of sums for each treatment group in all fifty-four classes were added to get a total for the observed frequencies. The expected frequencies were derived by taking the mean of the ranks of sums and multiplying by the total number of classes. Since the mean of the ranks of sums was the same value within each class, the expected frequencies for each treatment group were also of equal value. By inserting the values for the observed frequencies and the expected frequencies into the foregoing formula, the main effect for treatments was determined.

In order to make comparisons among treatment groups and to test the relative effectiveness of the treatments across subject matter areas and between schools, the F test was employed. It was possible to use this statistic by treating the mean ranks within treatments within classes as parametric

scores. The mean rank by treatment within each class was found by dividing the number of levels into the sum of ranks. These mean ranks were inserted into the appropriate cells of the design shown in Figure 1.

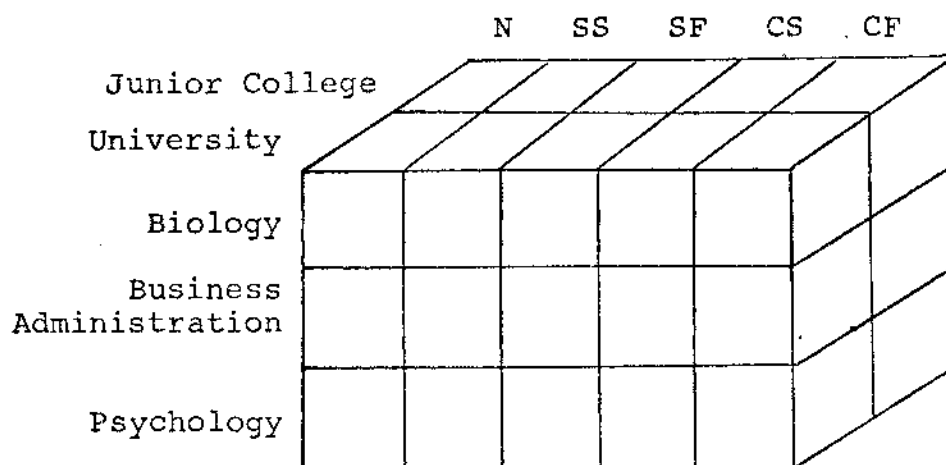


Fig. 1--The analysis of variance design

Each mean rank was treated as a score. There were nine scores included within each cell.

In actuality, two separate analyses were performed. One was performed after the second major objective test in order to test for single comment effects. The other was performed after the third major objective test in order to test for cumulative effects of written comments.

The above design was described by Winer (3, pp. 337-338) as a three-factor experiment with repeated measures on only one of the three factors. Thus a two by three by five analysis of variance design was employed to test for main treatment effects and also to test the null hypothesis that

the relative effectiveness of treatments was not related to subject matter area or to school (that is, that treatments did not interact with school or subject matter area).

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## CHAPTER IV

### ANALYSES, RESULTS, AND DISCUSSION

#### Analyses

The analysis which was employed in the present study was divided into two parts. The first part dealt with the application of written comments upon the first major objective test papers of college students and the effects of these comments on the students' performances on a second major objective test. The second part dealt with the cumulative effects of written comments after students had received these comments upon both the first major objective test and the second major objective test.

Data were gathered from eighteen classes in each of three subject matter areas for purposes of this investigation. The three subject matter areas included biology, business administration, and psychology. Since the tests which were administered to the students in these classes would naturally differ from each other in terms of length, difficulty, content, etc., it was necessary to use the ranks of scores in order to perform the statistical analysis. The ranks of scores were summed for each treatment group within each class. These sums of ranks were then divided by the number of levels (matched sub-groups of five students each).

The result was a mean rank within treatment within class. In order to perform the statistical analysis, these mean ranks were treated as individual scores. Therefore, there were fifty-four individual scores within each treatment group.

There were 2,925 college students from sixty-two classes who participated in the present study. Since it was necessary to have equal numbers of classes from each subject matter area, fifty-four of these sixty-two classes were utilized in the final analysis. These fifty-four classes were selected on the basis of their having retained more students over the period of the three test administrations. The student population sample from these fifty-four classes totaled 2,640.

All hypotheses were tested by employing a chi-square formula for ranked data, and by comparing mean ranks within treatments within classes through an application of the analysis of variance design. The .05 level of significance was used to test all hypotheses.

The basic hypothesis of the present study was that there would be a significant difference between the subsequent test performances of those college students who received the written comments upon their test papers and those who did not receive such comments. It was hypothesized that this difference would be in favor of those groups who received the written comments. Several sub-hypotheses concerning the

effect of type of comment, cumulation of comment effects, and relative effects of treatments across subject matter areas and between schools were also investigated.

### Results

The chi-square formula for ranked data was employed to test for the main treatment effects in accordance with the basic hypothesis of the present study. This formula was employed on two sets of data. The first set of data was obtained from the second major objective test taken by the students, and the second set of data was obtained from the third major objective test taken by the students. The data from the two tests and the resulting chi-square values are shown in Table III.

TABLE III  
RESULTS OF CHI-SQUARE TEST FOR RANKED DATA

	Sum of the Ranks					df	$\chi_r^2$
	N	SS	SF	CS	CF		
Test 2	157.5	169.5	163	167	153	4	1.36
Test 3	159.5	168	159.5	160.5	162.5	4	.38

The treatment groups consisted of a No Comment Group (N), a Single Specified Comment Group (SS), a Single Free Comment Group (SF), a Cumulative Specified Comment Group (CS), and a Cumulative Free Comment Group (CF). At the time that the

first set of data was obtained, the Cumulative Specified Comment Group and the Cumulative Free Comment Group were like the Single Specified Comment Group and the Single Free Comment Group in that they had only received written comments upon one test.

The chi-square values shown in Table III were not significant, since the .05 level of significance required a chi-square value of 9.49 (2, p. 249). These findings were substantiated by the results of the analysis of variance which was performed to test for main treatment effects as well as the relative effectiveness of treatments across subject matter areas and between schools. Therefore, the basic hypothesis of the present study was not supported. However, a trend in the direction of better test performances on the part of those students who received written comments may be noted on Test 2 as shown in Table IV. Table IV reveals that this trend was also present on Test 3 for the Specified Comment Groups (SS and CS).

TABLE IV

TOTALS OF MEAN RANKS WITHIN TREATMENTS WITHIN CLASSES ON TEST 2 AND TEST 3

	Treatment Groups				
	N	SS	SF	CS	CF
Test 2	157.63	168.37	161.94	162.50	159.62
Test 3	162.69	165.79	155.32	165.16	161.07

Table IV shows the totals of the mean ranks for the various treatment groups in all classes based upon the students' second major objective test performances and the students' third major objective test performances. Thus it shows the effects of a single application of written comments and also the effects of two successive applications of written comments.

Since the present study was concerned with the effects of a single application of written comments as well as the cumulative effects of two applications of written comments, two separate analyses of variance were performed. The first analysis was concerned with the effects of written comments on the students' second major objective test performances after they had received written comments upon the first major objective test. The second analysis was concerned with the cumulative effects of written comments on the students' third major objective test performances after they had received written comments upon two previous major objective tests. The results of these analyses are found in Tables V and VI.

Table V shows the results of the analysis of variance which was performed using data from the second major objective test. No calculation of sums of squares between classes was required because the mean for any class was  $(k+1)/2$ , or in the present study just 3.00.

Since the F-ratio for main treatment effects (.90) shown in Table V (C Treatments) was not significant, no

TABLE V  
SUMMARY OF ANALYSIS OF VARIANCE: TEST 2

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between Classes	. . .	53	. .		
A Schools					
B Subject Matter					
AB					
Subj. w. groups error (between)					
Within Classes	96.10	216			
C Treatments	1.57	4	.39	.90	NS
AC	3.42	4	.85	1.95	NS
BC	3.59	8	.45	1.02	NS
ABC	3.47	8	.43	.99	NS
C X Subj. w. groups error (within)	84.06	192	.44		

further comparisons were justified and the first two sub-hypotheses were not confirmed. Thus, neither the Single Free Comment Group nor the Single Specified Comment Group performed significantly better on the second major objective test than did the No Comment Group.

It was stated in the third sub-hypothesis that there would be no significant differences in the second major objective test performances of the Single Specified Comment Group and the Single Free Comment Group after both groups had received written comments upon the first test. In a sense, this hypothesis was confirmed. The chi-square value (1.36) shown in Table III for Test 2 data was not significant. The F-ratio (.90) shown in Table V for main treatment effects

(C Treatments) was also not significant. Therefore, there was no significant difference in the second major objective test performances of these two comment groups. Of course, neither were these groups different from the No Comment Group.

The fourth, fifth, and sixth sub-hypotheses dealt with the cumulative effects of written comments. The students' performance scores from the third major objective test were used to determine the cumulative effects of the written comments. In two sub-groups, students who had previously received written comments upon the first and second major objective tests administered in their classrooms were compared with a group which had received no comments and two groups who had received comments on only one test. The results of the analysis of variance performed on the data gathered from the third major objective test are presented in Table VI. Here again, no calculation of sums of squares between classes was required because the mean for each class was the same.

It was hypothesized in the fourth sub-hypothesis that, after receiving written comments upon the first two major objective tests, the Cumulative Free Comment Group would perform significantly better upon a third major objective test than would the No Comment Group. The chi-square value shown in Table III for Test 3 data did not support this hypothesis. The critical value for chi-square needed to

TABLE VI  
SUMMARY OF ANALYSIS OF VARIANCE: TEST 3

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between Classes	. . .	53	. . .		
A Schools					
B Subject Matter					
AB					
Subj. w. groups error (between)					
Within Classes	144.36	216			
C Treatments	1.48	4	.37	.58	NS
AC	1.14	4	.29	.45	NS
BC	12.45	8	1.56	2.46	.05
ABC	8.21	8	1.03	1.62	NS
C X Subj. w. groups error (within)	121.08	192	.63		

obtain significance was 9.49. Therefore, the critical value of .38 shown in Table III for Test 3 data was not significant. This finding was also supported by the results of the test for main treatment effects shown in Table VI (C Treatments). The F-ratio of .58 was not significant, which means that there was no significant variation among the five treatment means.

It was stated in the fifth sub-hypothesis that the Cumulative Specified Comment Group would perform significantly better on the third major objective test than would the No Comment Group after the former had received written comments upon the first two major objective tests. This hypothesis was not supported. The chi-square value (.38)



for ranked data shown in Table III for Test 3 data was not significant, and neither was the F-ratio for main treatment effects (.58) shown in Table VI.

It was hypothesized in the sixth sub-hypothesis that there would be no significant differences in the third major objective test performances of the Cumulative Specified Comment Group and the Cumulative Free Comment Group after both groups had received written comments upon the first and second major objective tests. This hypothesis was confirmed by the results of the chi-square test for ranked data as revealed in Table III for Test 3 data and by the analysis of variance results shown in Table VI. The critical value for chi-square (.38) shown in Table III was not significant, and the F-ratio (.58) for main treatment effects shown in Table VI was not significant. Since these values failed to reach significance, none of the means could be considered to be significantly different from any other.

It was stated in the seventh sub-hypothesis that there would be no significant differences in relative treatment effects across subject matter areas. The analysis of variance performed on data from the second major objective test is shown in Table V. This analysis of variance test revealed a non-significant F-ratio of 1.02 for treatment by subject matter interaction. Thus the seventh sub-hypothesis was supported by data gathered from the second major

objective test after the students had received written comments on the first major objective test.

The seventh sub-hypothesis was not supported by the analysis of variance which was performed on Test 3 data. This analysis of variance revealed an F-ratio of 2.46, which was shown to be statistically significant beyond the .05 level (2, pp. 646-647). Hence the data from Test 3 indicated a statistically significant difference in the relative effects of treatments across subject matter areas. The null hypothesis was rejected. Thus the seventh sub-hypothesis was not supported by the results of the analysis performed on Test 3 data.

Since significant differences for the relative effects of treatments across subject matter areas were found for Test 3 data, further comparisons were justified. Using the Newman-Keuls method (2, pp. 309-310), further analyses were performed. It was found that significant differences existed between the mean ranks of treatment groups in the subject matter area of business administration. More specifically, it was found that the Single Specified Comment Group and the Cumulative Specified Comment Group performed significantly better on the third major objective test than did the Single Free Comment Group. The mean rank totals for the various treatment groups are shown in Table VII.

Table VII shows the mean rank totals for treatment groups across the subject matter areas of business

TABLE VII

MEAN RANK TOTALS FOR TREATMENT GROUPS ACROSS SUBJECT MATTER AREAS ON TEST 3

Subject Matter Area	Treatment Groups				
	N	SS	SF	CS	CF
Business Administration	53.31	58.88	44.29	60.94	52.59
Biology	54.62	51.76	54.89	56.95	51.78
Psychology	54.76	55.15	56.14	47.27	56.70

administration, biology, and psychology. No significant differences were found between the mean ranks of treatment groups in the subject matter areas of biology and psychology on the third major objective test.

It was hypothesized in the eighth sub-hypothesis that there would be no significant differences in relative treatment effects between the treatment groups in the university setting and those in the junior college setting. Two separate analyses of variance were performed.

The first analysis of variance utilized students' performance scores from the second major objective test after the students had received written comments on the first major objective test. As indicated in Table V (AC), the results showed no significant treatment by school interaction effects. Thus results were consistent for the university setting and the junior college setting. The eighth sub-hypothesis was confirmed for data from the second major objective test.

The second analysis of variance was concerned with the cumulative effects of written comments. This analysis utilized the mean ranks of students' performance scores from the third major objective test after students had received written comments upon the first two major objective tests. The results of the analysis of variance are reported in Table VI. No significant treatment by school interaction was found for these data. Therefore, the eighth sub-hypothesis was supported.

#### Discussion

In a previous study of the effects of teachers' written comments on the test performances of junior and senior high school students, Page (1) found that students who received written comments from teachers upon their test papers performed significantly better on a subsequent test than did students who did not receive such comments. Therefore, it was hypothesized in the present study that those college students who received written comments upon their test papers would perform significantly better on subsequent tests than would those college students who did not receive written comments upon their test papers. This hypothesis was not confirmed. Therefore, these findings do not support those of Page. The discrepancy between these findings and those of Page may be partially attributable to the fact that junior and senior high school students generally get to know their

teachers better and therefore may take more notice of written comments applied to their test papers.

Theoretically, it was thought that the written comments would provide positive reinforcement and would serve to strengthen the future test performances of those college students who received them. \*Apparently, the written comments which were employed in the present study were not sufficiently reinforcing to produce the predicted results.

Page (1) also found that there was no significant difference between the second test performances (in terms of mean ranks) of the groups who received specified comments and the groups who received free comments upon their first test papers. In light of this finding, it was hypothesized that there would be no significant differences between the test performances of those groups who received specified comments and those groups who received free comments. This hypothesis was supported by the data which were obtained after a single application of written comments and also by the data which were obtained after two successive applications of written comments. Although they were not significantly different from each other in terms of the mean ranks of their test performances, these comment groups were also not significantly different from the group which did not receive written comments. Therefore, it may be concluded that neither specified comments nor free comments exerted a significant influence on the test performances of those

college students who received them. These results might be partially explained by the fact that the two types of comments were similar in many respects and were designed to accomplish the same results, even though they differed somewhat in content and wording.

It was also found that the test performances of two cumulative comment groups were not significantly different from the test performances of a no comment group and two groups who had received comments on only one test. These findings indicated that two successive applications of the types of comments utilized in the present study did not significantly influence the subsequent test performances of those college students who received them. In other words, the written comments did not produce the cumulative effects which had been predicted, thus indicating that there was no build-up of comment effects over two successive applications.

In terms of the mean ranks of their test performances on the second major objective test, comment groups within the subject matter areas of biology, business administration, and psychology did not differ significantly from each other after one application of written comments. These results indicated that there was no significant interaction between treatments and subject matter. Thus the effects of written comments were not dependent upon the particular subject matter areas concerned.

The analysis of variance performed on the data from the third major objective test showed that there were statistically significant differences in relative treatment effects across one or more subject matter areas. Using the Newman-Keuls method (3, pp. 309-310), further analyses were performed. It was found that significant differences existed between the mean ranks of treatment groups in the subject matter area of business administration. More specifically, the Newman-Keuls test revealed that the Single Specified Comment Group and the Cumulative Specified Comment Group had performed significantly better (in terms of the mean ranks of their test performances) on the third major objective test than had the Single Free Comment Group. An examination of Table VII reveals that the mean rank total for the Single Free Comment Group was considerably lower than the mean rank totals for the Single Specified Comment Group and the Cumulative Specified Comment Group. It is possible that such differences occurred by chance. Any other rationale for such differences was not readily apparent.

No significant differences in relative treatment effects were found between treatment groups in the university setting and those in the junior college setting. The results showed no significant treatment by school interaction effects for the mean ranks data from the second major objective test or the mean ranks data from the third major objective test. In other words, neither a single application of written comments

nor two successive applications of written comments significantly influenced the test performances of one treatment group relative to any other treatment group within either the university setting or the junior college setting. These results may be interpreted to indicate that the effects of written comments on the test performances of college students are not dependent upon the particular school setting in which the comments are applied.



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## CHAPTER V

### SUMMARY, FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This chapter is divided into five sections. The first section presents a summary of the problem and the procedures employed. The second section presents the findings. The third section presents the conclusions which were reached as a result of the present study. The fourth section gives some of the implications for further research. The final section is concerned with the presentation of recommendations.

#### Summary

The primary purpose of the present study was the investigation of the influence of instructors' written comments on the test performances of students in selected college subjects. The three subject matter areas included biology, business administration, and psychology. Eighteen classes in each subject matter area were utilized to gather the data. One-half of the classes in each subject matter area consisted of university students, and the other half consisted of junior college students. The number of students who were included in the final analysis totaled 2,640.

The classes were selected from among those of the instructors who agreed to participate in the experiment. A total of thirty-five instructors agreed to participate. The number of classes taught by these instructors was sixty-two. Of these, fifty-four were utilized in the final analyses.

The study included those students who were enrolled in the freshman classes at a leading southwestern university and a large junior college during the spring semester of 1968. The total enrollment in the sixty-two freshman classes was 2,925.

After the students had taken the first major objective test administered by the instructors within their respective classrooms, they were divided into levels within each class in accordance with the descending order of their test scores. Within each level, the students were randomly assigned to one of the five treatment groups. The treatment groups consisted of a No Comment Group, a Single Specified Comment Group, a Single Free Comment Group, a Cumulative Specified Comment Group, and a Cumulative Free Comment Group.

The No Comment Group received a numerical score and a letter grade on their test papers, but they did not receive a written comment. The two specified comment groups (Single and Cumulative) received a numerical score, a letter grade, and certain uniform comments designated in advance for all students of a given letter grade achievement. The Single Specified Comment Group received written comments only upon

the first major objective test, whereas the Cumulative Specified Comment Group received written comments upon both the first and the second major objective tests. The two free comment groups (Single and Cumulative) received upon their test papers whatever comments the instructors felt were appropriate regarding the students' letter grades upon the tests, provided that the comments were positive in nature and designed to encourage better future test performances on the part of the students who received them. The Single Free Comment Group received free comments only upon the first major objective test, while the Cumulative Free Comment Group received free comments upon both the first and the second major objective tests.

A chi-square formula for ranked data and an analysis of variance design were employed to test the basic hypothesis and several sub-hypotheses. Levels of significance were determined for all chi-square values and F-ratios.

### Findings

The basic hypothesis of the present study was that there would be significant differences between the test performances of those groups who received written comments and those who did not; i.e., that the groups who received written comments would perform significantly better upon a subsequent test or tests than would the group which had not received written comments. The chi-square test for main

treatment effects revealed no significant differences among treatment groups after a single application of written comments and no significant differences among treatment groups after two successive applications of written comments. These findings were supported by the analyses of variance. Therefore, the basic hypothesis of the present study was not supported. However, a trend in the direction of better test performances on the part of those groups who received comments was observable on the second major objective test. This trend was also evident for the specified comment groups on the third major objective test, but it was not evident for the free comment groups.

It was hypothesized in the first sub-hypothesis that the Single Specified Comment Group, after receiving written comments upon the first major objective test, would perform significantly better on the second test than would the No Comment Group (the group that did not receive written comments). This hypothesis was not confirmed.

It was stated in the second sub-hypothesis that the Single Free Comment Group would perform significantly better on the second major objective test than would the No Comment Group. The Single Free Comment Group had previously received a written free comment upon the first major objective test while the No Comment Group had not received a written comment. The results of the chi-square test and the analysis of variance failed to support this hypothesis.

The third sub-hypothesis was that there would be no significant differences between the second major test performances of the Single Specified Comment Group and the Single Free Comment Group after both groups had received written comments upon the first major objective test. This hypothesis was confirmed. No significant differences were found between the second major objective test performances of these two groups. However, neither were they significantly different from the No Comment Group.

The fourth sub-hypothesis was that the Cumulative Free Comment Group, after receiving written comments upon the first two major objective tests, would perform significantly better than the No Comment Group on a third major objective test. It was found that these two groups did not differ significantly in their performances on the third major objective test. Therefore, the fourth sub-hypothesis was not confirmed.

The fifth sub-hypothesis was that the Cumulative Specified Comment Group would perform significantly better on a third major objective test than would the No Comment Group after the former had received written comments upon the first and second major objective tests. Statistical analysis revealed that there was no significant difference between the third major objective test performances of these two groups. Thus the fifth sub-hypothesis was not supported. However, it was revealed in Table IV that there was a trend in the

direction of better test performances on the part of students in the Cumulative Specified Comment Group.

The sixth sub-hypothesis was that there would be no significant differences between the third major objective test performances of the Cumulative Specified Comment Group and the Cumulative Free Comment Group after both groups had received written comments on the first two major objective tests. This hypothesis was confirmed. The analysis of variance also revealed that these two groups were not significantly different from the No Comment Group in terms of the mean ranks of their test performances on the third major objective test. However, Table IV reveals that there was a trend in the direction of better test performances on the part of students in the Cumulative Specified Comment Group.

The seventh sub-hypothesis was that there would be no significant differences in relative treatment effects across subject matter areas. In order to test this hypothesis, it was necessary to perform two separate analyses of variance. The first analysis was concerned with differences in relative treatment effects across subject matter areas on the second major objective test, whereas the second analysis was concerned with differences in relative treatment effects across subject matter areas on the third major objective test.

The analysis of variance performed on the data from the second major objective test revealed a non-significant F-ratio of 1.02 (see Table V) for treatment by subject matter

interaction. This meant that no significant differences existed in relative treatment effects across subject matter areas on the second major objective test. Thus, the seventh sub-hypothesis was supported on the second major objective test.

The analysis of variance which was performed on the data from the third major objective test revealed an F-ratio which was statistically significant beyond the .05 level. This meant that significant differences in relative treatment effects existed across one or more subject matter areas. Further analysis revealed that these significant differences existed across the subject matter area of business administration. More specifically, it was found that both the Single Specified Comment Group and the Cumulative Specified Comment Group had performed significantly better on the third major objective test than had the Single Free Comment Group. Thus, the seventh sub-hypothesis was not supported by the data from the third major objective test.

The eighth sub-hypothesis was that there would be no significant differences in relative treatment effects between the comment groups in the university setting and those in the junior college setting. Here again, two separate analyses of variance were performed. One analysis was concerned with data from the second major objective test and the other was concerned with data from the third major objective test.



The analysis of variance performed on data from the second major objective test showed no significant treatment by school interaction effects. Since results were consistent for the university setting and the junior college setting, the eighth sub-hypothesis was confirmed for these data.

The results of the analysis of variance which was performed on the data from the third major objective test revealed no significant treatment by school interaction effects. Thus, results were consistent for the university setting and the junior college setting. Therefore, the eighth sub-hypothesis was confirmed for these data.

#### Conclusions

Since the present study was rather restricted in terms of population sample, subject matter areas, and schools, any conclusions which may be drawn should be confined to the scope of the present study. Any conclusion which may be drawn as a result of the present study are necessarily limited in applicability and should not be generalized to whole populations or larger settings.

In light of the above restrictions, the following conclusions were drawn as a result of the present study:

1. Written comments of the type utilized in the present study do not significantly influence the test performances of college students so that they perform significantly better upon subsequent tests than do college students who do not receive such comments.

2. Cumulation of comment effects are not evident after two successive applications of written comments. Therefore, there was no build-up of comment effects.

3. The effects of written comments are not dependent upon the particular school setting in which the comments are administered.

### Implications

The results of the present study indicated that more research is needed regarding the efficacy of placing written comments upon the test papers of college students in an effort to encourage better future test performances on the part of these students. Although no significant differences were found for main treatment effects, a trend in the direction of better test performances was noted for those students who received written comments.

Since significant differences were found between treatment groups within the subject matter area of business administration after two applications of written comments, it was indicated that more research is needed regarding the influence of written comments on the test performances of students within this subject matter area. These results also indicated that a more extensive investigation of the effects of written comments over more than two applications may be in order.

Since the particular types of written comments utilized in the present study did not exert a significant influence on the test performances of these college students, there is an indication that more research is needed to determine the influence that might be exerted by other types of comments. Other types of comments which might be investigated are critical comments and informative comments.

#### Recommendations

The results of the present investigation indicated a need for further research in the areas suggested below.

1. A study should be conducted to determine whether other types of written comments, such as critical comments or informative comments, would exert a significant influence on the test performances of college students.

2. A study should be made to determine whether the effects of specified comments would be cumulative over more than two successive applications.

3. A study should be conducted within the area of business administration in an effort to determine why students in this subject matter area showed relatively significant differences in their test performances after two successive applications of written comments.

## APPENDIX A

### INFORMATION CONCERNING THE STUDY

#### A Personal Note:

Following our conversation concerning my study of the effects of written comments upon student test performance, I am providing you with this packet which contains some further information about the study. It also contains some materials you will need for participating in the study. Before proceeding further, I want you to know that I sincerely appreciate your help in this effort to advance our knowledge of one technique of motivating students to achieve better test performance. You may be interested to know that you are one of approximately forty professors and instructors who have graciously volunteered to aid in this research.

NOTE: Please read the information and instructions in this packet and feel free to call me if you have a question about anything. My Denton phone number is 387-2061. I may be contacted there on any week night from 6 p.m. until 10 p.m. At Tarrant County Junior College, my telephone is Extension 200, 201, or 202, and I may be contacted there from 8 a.m. until 5 p.m. Monday through Friday.

#### PURPOSE OF THE STUDY

The purpose of this study will be the investigation of the influence of instructors' written comments upon the test performance of students in selected college subjects. The

subject matter areas involved will be biology, business administration, and psychology.

The practice of writing comments upon test papers seems to vary widely among professors and instructors. Some will comment briefly, others copiously, and some not at all. Is it a waste of time and effort for instructors to place written comments upon test papers? Do these written comments actually have a significant influence upon students' subsequent test performance? The present study constitutes an attempt to provide some answers to these questions.

#### Procedures for Collecting the Data:

As an instructor participating in the study, you will be placing written comments upon a maximum of two sets of test (major tests only) papers. We are trying to find out whether these written comments will have a positive effect upon the future test performance of those students who receive them.

One of the most unusual and desirable features of this study is that it leaves your usual classroom procedures almost entirely unchanged. You will give your first major test in accordance with your teaching of the class, collect the papers, score and grade them, just as you would without participation in the study. After scoring and grading the papers, you are requested to place them in rank order from highest to lowest according to their numerical scores (in

the case of tie scores, use the students' alphabetical last names) and then write the students' names in this rank order onto the Reporting Sheet. You are asked to retain the test papers and give the Reporting Sheet to the investigator. The investigator will then randomly assign each of the test papers to one of the five treatment groups--the No Comment (N) group, the Single Specified Comment (SS) group, the Cumulative Specified Comment (CS) group, the Single Free Comment (SF) group, the Cumulative Free Comment (CF) group. The investigator will then return the Reporting Sheet to you so that you (or your grader) may write the comments upon the appropriate test papers (you can learn the group to which the student belongs by looking in Column E on the Reporting Sheet).

The No Comment (N) group will get only a numerical score and a letter grade upon their test papers (this you will have already done). The Single Specified Comment (SS) group and the Cumulative Specified Comment (CS) group will receive a numerical score, a letter grade, and certain specified comments designated in advance for all students of a given letter grade achievement (see page entitled Specified Comments). The Single Free Comment (SF) group and the Cumulative Free Comment (CF) group will receive a numerical score, a letter grade, and whatever comment you feel is appropriate for the particular student and test concerned. You are asked to write the specified comments and

free comments upon the appropriate test papers and also copy the free comments verbatim onto the Reporting Sheet in Column F before you hand the test papers back to the student. Please keep the Reporting Sheet for the investigator.

For the second major test, only the students in the CS and CF groups will receive written comments upon their test papers. This means that you will have to write comments upon only half as many test papers as you did on the first test. In writing these comments, you should follow the same steps as you did for the first major test.

For the third major test, all you have to do is write the students' names on the Reporting sheet in rank order from highest to lowest (according to their numerical scores) and also write their numerical scores (in Column C) and letter grades (in Column D). The investigator will then collect this Reporting Sheet from you and the experiment will be concluded.

#### What Kinds of Comments:

There will be two kinds of comments--specified comments and free comments. The specified comments have been designated beforehand by the investigator and so will be furnished to the professor or instructor of each class (see Specified Comments). There is a different specified comment for each letter grade. The professor or instructor needs only

to place these comments upon the appropriate test papers. The free comments will be whatever comments the instructor feels are appropriate for the particular students and tests concerned, so long as they are of a positive nature and designed to encourage the students to improve their performances upon a subsequent test or tests.



## SPECIFIED COMMENTS

Please administer the following Specified Comments according to the letter grade which the student has received, as follows:

FOR GRADE OF:	COMMENT
A	An excellent paper! Keep it up.
B	Well done. Keep working at it.
C	There's room for improvement here.
D	Let's bring this up.
F	Try to do better next time.

NOTE: These comments should be administered only on the papers of those students who have been designated as belonging to the SS group or the CS group in Column E of the Reporting Sheet.

## SOME SUGGESTIONS ABOUT FREE COMMENTS

1. Be natural when making these Free Comments. Take up the two stacks of Free Comment papers (Single Free (SF) and Cumulative Free (CF) Comment papers) and go through them in any fashion you want, only finding something positive to write on each.

2. Write your comment, first, directly on the test paper. This way you can ignore the fact that the comment will appear on the Reporting Sheet. This way you will write a more ordinary, usual comment.

3. Write anything that occurs to you in the circumstances and that you think will be encouraging to the student. Here are some freedoms you have regarding the comment itself:

- a. Address the student by name or not, just as occurs to you.
- b. Make your comment general or specific, whichever you wish.
- c. Make your comment friendly or formal.
- d. Make it long or short--whatever seems desirable to you.

NOTE: After you have received the Reporting Sheet back from the investigator, remember to write your Free Comments only upon the test papers of those students who have been designated as belonging in the SF or CF treatment groups (see Column E) on the Reporting Sheet. Make sure you copy the Free Comments onto the Reporting Sheet (in Column F) before you return the test papers to the students.

## WHAT YOU ARE ASKED TO DO

Your contribution to this educational experiment may be broken down into definite steps, some of which are a part of your normal routine in teaching. These steps should be followed in each freshman class that you teach, provided that the class is involved in the study. The steps and the approximate time needed to complete each step (i.e., time beyond the usual time) may be summarized as follows:

THE STEPS	APPROXIMATE TIME NEEDED BEYOND USUAL TIME
Step One:	Give your first major test, collect test papers, score and grade them. (Normal routine). 0 minutes
Step Two:	Prepare a Reporting Sheet. List the students' names in each class according to the ranked order of the test papers, from highest to lowest. Also report each student's numerical score and letter grade. 10 minutes
Step Three:	Give the Reporting Sheet to the investigator. (Do not give the test papers back to the students until the investigator has determined which papers will receive the comments and you have written the comments upon the appropriate papers. (See Step Four). 5 minutes
Step Four:	Write the comments upon the appropriate test papers. Specified Comments go upon the papers of students who have SS or CS placed in Column E opposite their names. Free Comments are to be placed upon the papers of students who have SF or CF placed in Column E

	opposite their names. The Free Comments which you place upon the papers of these students should be copied <u>verbatim</u> upon the Reporting Sheet in Column F.	20 minutes
Step Five:	Give the test papers back to the students (Normal routine).	0 minutes
Step Six:	For the second major test, repeat Steps One through Five, but this time you will place comments only upon the test papers of students who were designated as belonging in the CS and CF groups following the first major test. (In the case that a student is absent for the second or third major test, write Absent in the F column of the Reporting Sheet).	30 minutes
Step Seven:	For the third major test, repeat Steps One and Two.	10 minutes
Step Eight:	Return the Reporting Sheets for the third major test to the investigator.	<u>5 minutes</u>
	Estimated Total Time	80 minutes

## SUGGESTIONS CONCERNING PRECAUTIONS

1. Please do not say anything to your class or to any individual in your class which might negate the effectiveness of the positive comments.

2. It is very important that the students remain naive about the experiment. If the comments should come under discussion, you will have the job of walking the line between giving the experiment away (which would ruin it) or temporarily endangering your classroom atmosphere.

FOR EXAMPLE, a student might chance to ask:

"Why did he get an 'Excellent' written on his paper and I didn't, even though I got a higher score than he did?" It would obviously spoil the experimental effect to answer: "There's absolutely no difference between the papers that have the comments and those that don't." Instead it might be handled by such comment as: "When I was recording the grades, I just felt like urging some of you to keep it up, or to do better, that was all." This way the encouragement is left as being slightly selective--it still has meaning--but you would have avoided the "unfair" reaction. It is very doubtful whether the matter will come up, since students get comments more or less like this, in one class or another, all the time.





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