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A PROGRAMMED APPROACH TO THE APPLICATION OF EDUCATIONAL PSYCHOLOGY: THE TEACHER VIEWED AS AN INDUCTIVE THEORIST

by

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INTRODUCTION

In the educational world of today, there is probably much less room than in any previous era for teaching which is based on tradition and stereotyping rather than the realities of behavior.

> When society moved from century to century substantially unchanged, there was some practical sense to the idea of education as transmission. You can "prepare for life" if the life will be there after the period of preparation is over. Whether education should ever be of this kind is another question, since such education is one way of ensuring social and cultural stagnation. However, in a static, stratified society "preparation for life" on the traditional model is a practicable if not desirable educational ideal. But in modern American society, the adults are not preserving the status quo. American social and cultural conditions are constantly changing. "With the advent of democracy and modern industrial conditions," Dewey wrote in 1897, "it is impossible to foretell definitely just what civilization will be twenty years from now. Hence, it is impossible to prepare the child for any precise set of conditions." When adult society is undergoing rapid reconstruction, traditional education becomes a deliberate miseducation of the young, a program of unfitting them for life. In a changing society, "to prepare the child for future life means to give him command of himself, it means so to train him that he will have full and ready use of all his capacities," . . . The controlling idea both of Dewey's educational and social philosophy (which are inherently related) can be stated as having for its end, making the spiritual values of science an integral part of our culture life. When science is interpreted in broad terms of human values, it is what Dewey calls "freed intelligence" (Ratner, 1940, pp. x-xiii).

The quotation above is just as applicable to the training of teachers as it is to teaching students. It is no longer desirable to cling to the "traditionalist" model which views teaching as an art best acquired by a period of apprenticeship with an experienced teacher. To be sure one can always profit from the experiences of one's mentor, but what is needed most in modern education is not the

maintenance of time-honored tradition. Instead education needs teachers who are trained to formulate innovative ideas or hypotheses about the control of student behavior. Teachers need training not in techniques per se but rather in the application of behavioral technology to specific problems in specific classroom situations. Such training should be geared to teaching the teacher to utilize rather than merely assimilate new psychological information as it is presented.

A Model of Learning to Teach

The model which is offered here as an alternative to the "traditionalist" approach described above is that proposed by McDonald (1965, pp. 44-47). This view of the teacher is derived from the concept of "planning" as formulated by Miller, Galanter, and Pribram (1960). Miller et al. define a plan as "any hierarchical process in the organism that can control the order in which a sequence of operations is to be performed." McDonald views teaching as a planning process. He describes teaching plans as "structures for teacher decisions about desired behavior changes in students and ways of implementing such changes" (McDonald, 1965, p. 48). Such decision-making plans evolve as the teacher makes selections among alternatives, considers the consequences of selecting a particular consequence, and considers the probability that a given consequence will occur. Estimates of the probability of any given consequence may be objective (as is the case when correlational studies are undertaken to determine a student's chances of success

in college given his high school grade point) or may be subjective in the sense that they are based entirely on the experience of the individual teacher.

Teaching in McDonald's view is a process analogous to what the scientist does when he develops a theory; that is, the teacher must develop plans for dealing with classroom problems which are in effect hypotheses about ways to modify student behavior. Such hypotheses are in most cases tested by the teacher's experience with the classes he teaches and generally fall in the realm of subjective rather than objective probabilities. Such hypotheses could, of course, be tested by experimental manipulations or correlational studies and in the cases in which the teacher chooses to adopt an empirical strategy, the probabilities become objective. In either case the teacher is behaving in a way which is analogous to scientific behavior in that he is trying to develop a teaching plan, which is in essence a hypothesis derived from his theory of teaching. In this way teaching plans become an important source of feedback and determine the development of the teacher's own highly individual theory of the nature of teaching.

The ideas expressed in the preceding paragraph are quite similar to the theory of the counseling interaction suggested by Lewis (1965). According to Lewis, the neophyte counselor is initially forced to choose between a variety of theories of personality but has very little information available as to the sort of interaction with a client in which he will function best. As the

counselor has the opportunity to interact with a variety of clients, he begins to make observations about what seems to work and what does not and hence gradually evolves a theory of counseling which is unique. (This must be so since individual counselors bring rather different resources to the same client; hence different variables are operating.)

If Lewis's theory is rephrased in McDonald's terminology, the neophyte counselor would be viewed as a scientist with a series of choices to make as to how to behave with clients. These decisions could be based on objective probabilities as in the case in which research evidence is available or subjective probabilities as in the case in which the counselor must rely on his own personal experiences or those of his colleagues. What the counselor will have when he is finished is a plan for counseling which is a hypothesis, and the counselor's theory of counseling will evolve as such hypotheses are tested.

The "planner" model of teaching like any other model is not assumed to be an exact replica of the system it attempts to explain. It is instead an abstraction which tends to focus on certain selected aspects of teaching and to emphasize their importance while ignoring others. The aspects of teaching which this model emphasizes are the modificability of teaching behavior, the influence which a teacher's theories about human behavior and learning can exert upon his behavior as a teacher, and the distinction between the acquisition of psychological knowledge,

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and its utilization (McDonald, 1965, p. 61). Models can best be evaluated in terms of their utility. Thus the planner model of teaching may be considered a good scientific model to the extent that it generates new hypotheses about teaching or suggests new criteria for the evaluation of teachers and teacher training programs.

If teachers are viewed as planners or theorists, then teacher training should provide as much opportunity as is possible for the teacher to develop his theory of teaching, to formulate plans based on the theory, and to receive feedback about the items he has generated. The plea for a greater emphasis on the acquisition of this kind of ability parallels Guilford's statement that what is needed in modern education is "a better balance of training in the divergent thinking area as compared with training in convergent thinking and in critical thinking or evaluation (Guilford, 1962, p.478)".

A second antecedent of some of the salient characteristics of the model is apparent in Bruner's discussion of discovery learning:

> Now to the hypothesis. It is my hunch that it is only through the exercise of problem solving and the effort of discovery that one learns the working heuristic of discovery, and the more one has practice, the more likely is one to generalize what one has learned into a style of problem solving or inquiry that serves for any kind of task one may encounter--or almost any kind of task. I think the matter is self-evident, but what is unclear is what kinds of training and teaching produce the best effects. How do we teach a child to, say, cut his losses but at the same time be persis-

> tent in trying out an idea; to risk forming an early hunch without at the same time formulating one so early and with so little evidence as to be stuck with it waiting for appropriate evidence to materialize; to pose good testable guesses that are neither too brittle nor too sinuously incorrigible; etc., etc. Practice in inquiry, in trying to figure out things for oneself is indeed what is needed, but in what form? Of only one thing I am convinced. I have never seen anybody improve in the art and technique of inquiry by any means other than engaging in inquiry (Bruner, 1966, pp. 618-619).

All of these statements imply that if it is truly desirable that students in courses in educational psychology learn how to think divergently, i. e., develop their own ideas and theories about teaching then it is extremely important that they be given practice in doing so. The next point to be considered then is the degree to which existing approaches to teaching educational psychology provide appropriate opportunities for practice in applying psychological knowledge and encouraging the student to generate new ideas and theories about behavior.

In a recent unpublished manuscript, Brown and Gliessman (1968) have discussed two such strategies. One view is that psychology should be generalized deductively to the classroom; the second, that the variables in the classroom should first be studied intensively, followed by the application of such psychological knowledge as may be relevant.

> The first view suggests that psychology has developed certain theoretical viewpoints, principles, concepts, research findings, etc., which have implications

> for various aspects of teaching. The strategy of the educational psychologist becomes one of screening this content in terms of its relevance to teaching. The textbooks produced by those of this orientation tend to be organized around such traditional psychological categories as Conditioning of Learning, Retention and Transfer, Motivation, Measurement and Statistics, Personality Development, Concept Formation, etc. Usually included, with respect to the principles and concepts, are sections devoted to "Implications for Teaching" (Brown & Gliessman, 1968, p. 1).

The reasoning process required of the teacher in this first view is clearly deductive. The teacher is to use the psychological principle as a generalization which will suggest a solution to any of a class of educational problems. Such a deductive application assumes that the body of psychological research which deals with such topics as learning, motivation, and personality can be immediately generalized to classroom situations. The validity of this assumption is, of course, highly questionable. Furthermore, those who would question it most are the very researchers who have supplied the basic data from which the deductive practitioner would seek to generalize. Hilgard (1966, p. 573) suggests that it is both impossible and undesirable to move from basic science research directly to the classroom without going through a number of intervening steps. Beginning with basic studies which are not directly relevant to the classroom, such as studies on conditioning, a program of research might proceed to studies which utilize relevant subjects and topics, such as human verbal learning; proceed thence to school relevant topics (e. g., mathematics); from there, to a laboratory

classroom, such as is employed in programmed learning studies; and finally, to a tryout of some learning principle in a normal classroom.

The reason that such a complicated program of research is needed is that different variables come into play as a program proceeds from basic to applied research. This does not necessarily imply that the effects demonstrated in the laboratory setting do not occur in the classroom as well, but it does raise a question as to whether a given principle of learning explains as much of the total variance in the classroom as it does in the laboratory.

Hilgard's statements suggest the possibility of strong interactions between the learning variables which have been demonstrated in laboratory settings and situational variables specific to the classroom. If such interactions are strong and no attempt is made to control for them, classroom projects which the teacher sets up may fail, not because the learning principle is incapable of generalization but rather because the teacher has shown no sensitivity in setting up the situation in a manner which will insure success. Only after all of these factors have been carefully studied would it be scientifically and economically feasible to proceed to the stage of advocacy and adoption of a psychological principle into textbooks and teacher-training programs. Suffice it to say that few psychological principles are directly applicable to the classroom without careful consideration of

relevant situational variables[1].

The second view of educational psychology is very nearly the opposite of the first.

> The starting point is not the parent discipline of psychology, but teaching, or the teaching-learning process, or perhaps the school generally. Here the educational psychologist screens the classroom and the school for educational problems or issues and attempts to develop classes of problems or issues, or develop dimensions of processes. Having done this, he returns to the discipline of educational psychology for what-

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[1]As an example of the sort of application which is being discussed, the old argument about the relative merits of massed vs. distributed practice will be temporarily revived. These studies have sometimes been interpreted as evidence that students should not cram for examinations. A somewhat more adequate interpretation of these same data would say that the relative merits of massed and distributive practice depend on the kind of task which is being learned; thus the instructor should point out this additional finding to his students to avoid an application of results which is inappropriate. I would argue, however, that even this somewhat more detailed interpretation is not enough. The teacher who is dealing with students who are trying to learn to study effectively may encounter other variables which interact with distribution of practice. Thus it is possible that the way in which learning is to be assessed, the goals of the learner, as well as, other variables which were purposely controlled out of the picture in laboratory investigations may interact with distribution of practice in the classroom. To the extent that such interactions are strong, it becomes increasingly indefensible to advise students "not to cram for examinations" without knowing a good deal about the situation in which the student is learning. In this situation the teacher could probably learn more from studying the manner in which the psychologists who did the work on distributed practice thought through the problem than from learning the results of their studies per se. In the deductive or blind application sort of approach to the instruction of educational psychology, there tends to be little communication to the student of the psychological way of thinking about problems.

> ever may be relevant in the way of theory, principles, and research findings which may be of help in dealing with these problems. Texts written from this point of view tend to be organized around such topics as Pupil Characteristics and School Learning, Classroom Interaction and Learning, the Construction of Learning Situations, Teacher-made Tests, Providing for Individual Differences, etc." (Brown & Gliessman, 1968, p. 1).

The Brown-Gliessman approach to educational psychology has several advantages which distinguish it from the rival position. It suggests that the kind of thinking which students should be encouraged to practice is that of reasoning from the relevant aspects of a real teaching situation to the psychological principles, research, etc. which may be relevant. Since this is more analogous to the situation the teacher must face when he actually begins to teach, it seems reasonable to expect a greater amount of transfer from the educational psychology course to the classroom. Also because the student gets more practice in considering the multiplicity of situational variables inherent in classroom learning, there is less danger of his attempting to apply psychological principles in a meaningless, stereotyped way.

The obvious danger is that the kind of course proposed by Brown and Gliessman might produce planning behavior which is based almost exclusively on the subjective probabilities associated with the student's own (and perhaps biased) sampling of observations of behavior[2].

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[2]The "danger" involved probably varies a good deal depending on the nature of the problem being solved. In areas in which the

A course in educational psychology should offer more than sensitivity training or introduction to objective procedures of observation. Some guarantee must be provided that the student will also learn to find, interpret, and apply psychological data to a problem.

A comparison of the deductive approach to applying psychology and the alternative approach outlined by Brown and Gliessman leads to the conclusion that neither is entirely satisfactory. A purely deductive approach is indefensible until research is conducted in situations which are more analogous to that of the classroom. Applications based on careful observations of classroom behavior by a teacher may be of great value in situations in which the value system of the teacher is not directly involved. To the extent that the teacher's value system is involved, it is imperative that teacher observations be considered in the light

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(Footnote continued) value system of the teacher is less directly involved, it seems quite probable that a skillful observer might have as much or perhaps even more to contribute than does the psychological researcher. One such area is that of concept formation. The observations of classroom behavior to be found in Wertheimer's Productive Thinking and in Holt's Why Children Fail, while based primarily on observations and rather simple "experiments," are probably worth as much consideration as some of the more controlled work in the same area.

In areas of greater social significance (such as racism and cultural deprivation), it seems unlikely that even a highly trained observer could avoid contaminating the observations he makes by introjecting his own value system. In such areas teacher-problem-solving behavior which is based primarily on personal observations is likely to result in solutions to problems which fail to consider the total reality of the situation and hence are unlikely to be successful. The advantage of psychological research over opinion and speculation is not that the researcher's judgments are unbiased but rather that there are many checks and balances in good research technique to help him become aware of bias. his biases.

of more objective observations such as those found in psychological data.

The teacher like the applied psychologist seems to be plagued by the problem of developing a theory out of a superabundance of apparently unrelated empirical facts. (Here we assume that facts can be supported by either objective or subjective probabilities.) MacKinney (1967) has discussed a concept which might provide a valuable heuristic for the teacher-theorist. This concept is based on the Baconian notion of inductive theory. MacKinney feels that the emphasis on empirical rather than formal theoretical studies in industrial psychology has led to a situation in which a sound theoretical structure can best be established on the basis of generalizations which relate existing empirical facts.

> In overview the process is first to summarize a set of empirical observations none of which previously have been related to the others in any clear or formal way, and second to hypothesize the generalization which relates these to each other. The generalization must be one with which the empirical events appear to be consistent (note this does not preclude other generalizations). Subsequently, this generalization may be used to predict the outcome of future empirical observation (MacKinney, 1967, p. 58).

Extending MacKinney's concept to the situation in which the teacher is trying to develop and test his plans or hypotheses and hence to develop his theory of teaching, it would appear that what the teacher does or should do is to make a series of observations of classroom data which are available and finally

to review relevant psychological concepts and studies and to hypothesize a generalization which relates these observations and data. These hypothesized generalizations would then have to be tested by subsequent teacher experiences (in which case support for the hypothesis would be based on subjective probability) or by empirical data (which would yield an objective probability).

The advantage that the concept of inductive theory offers over the approach advocated by Brown and Gliessman is the clarification it offers concerning the relationship of psychological data to the observations the teacher makes in the classroom. An ideal inductive theory of classroom teaching and learning would be based on empirical data obtained in the classroom. Such research would take into account all the important variables which are involved in classroom learning. Since such an array of empirical evidence is not available, we must be satisfied for the present with applications based on laboratory studies, our subjective perceptions of the variables operating in a classroom setting, and whatever empirical findings are available on real classroom settings.

From the standpoint of an inductive theory, all three kinds of evidence are worthy of consideration; and all three must be taken into account. Psychology may suggest to the teacher that it is potentially fruitful to manipulate certain variables in order to gain control over a given class of student behaviors.

The teacher's job is to study the situation carefully to see what situational variables might be acting which could produce strong interactions. Such interactions may exert a negative influence on the behavior of interest in which case they should be controlled out of the picture. In other cases they might tend to enhance the desired effect in which case the experimenter would want to maximize interaction. This sort of analysis should lead the teacher to a generalization which can then be tested in the classroom either subjectively or objectively and would serve as the basis for the teacher's theory of teaching. To the extent to which hypothesis testing of this sort yields objective probabilities and can be shown to replicate over different teachers and classrooms, it might even provide a means of expanding our understanding of psychology in general (MacKinney, 1967).

A Theory of Learning to Teach

Gagne (1962) has proposed that learning tends to have a hierarchical structure. This structure is made up of a network of learning sets all of which are subordinate to the desired terminal behavior. In applying this idea to the analysis of learning tasks, Gagne uses the following approach: beginning with the final task, the question is asked, "What kind of capability would an individual have to possess if he were to perform this task successfully were we to give him only instructions?" The answer to this question identifies a new task which, while conceived of as an "internal disposition," can be measured directly

as a performance. This new task is a behavior which represents a subordinate set; it is possible to define a new task or series of tasks which are removed one more level of abstraction from the terminal behavior in question. By continuing this procedure, it is possible to arrive at a hierarchy of subordinate knowledges which are increasingly simple, more general, and more indirect in their determination of the terminal behavior being acquired.

Application of Gagne's ideas about the structure of learning to the problem of teaching students in Educational Psychology 333 to utilize an inductive strategy to formulate theories and hypotheses about behavior tends to focus attention on the sequence of tasks which must be mastered before an inductive application of knowledge is possible. To suggest that there may be an unalterable sequence of events which is common to any given subclass of divergent productions would seem to be a contradiction in terms. The idea is clarified by recalling that to fulfill Gagne's criterion for a structure of knowledge, all that is needed is a hierarchy of necessary but not necessarily sufficient conditions. Thus if divergent thinking is defined as the synthesis of two or more ideas, facts, or concepts; then the necessary conditions for any given divergent response can be defined as the ideas, facts, or concepts which have to be combined. Support for this contention may be found in Judson's finding that increasing the association value of a word related to an original solution to a problem tended to increase the probability of that solution (Judson, Cofer, & Gelfand, 1956). Stated very simply this finding implies

that before two ideas can be synthesized with an original response, both ideas must be present in the repetoire.

The ideas suggested that it might be possible to write a teaching program which trains subjects to think divergently. Thus if the behavior of interest can be described as the synthesis of two little known facts, it would be possible to construct a learning program which begins by providing appropriate experiences with the two facts in question and asks a question which could be (but is not necessarily answerable by the synthesizing of the two into a new idea. Furthermore, this same procedure could be adapted to the situation in which a divergent production is contingent upon the acquisition of several specific competencies or to use Gagne's terminology "learning sets."

While it is often assumed that the utility of programmed instruction is limited to materials that can be learned by "drill" or rote learning, there have been several successful attempts to extend programmed instruction to materials which are more complexly structured. Thus programs exist for teaching appreciation of poetry (Reid, Ciardi, & Perrine, 1963), interpretation and application of psychological literature (Pressey, 1967), and creativity and problem solving (Crutchfield, 1965). These examples provide support for the hypothesis that programmed instruction can be used to advantage in shaping complex thought processes. One aim of the present study is to develop a program for the application of psychological knowledge which is based on the concept of a hierarchy of learning sets.

STATEMENT OF PROBLEM

The model which treats the teacher as a planner or an inductive theorist is not intended to be a description of the normal or usual behavior of the typical teacher as he exists today. What is being presented is really an ideal model; i. e., it is proposed that inductive theorizing would, if incorporated into the teacher's behavioral repertoire, lead to a higher quality of educational innovation and teacher problem solving than is typical today. What seems to be needed is a kind of educational technologist who combines scientific understanding with great sensitivity to the nuances of the classroom situation. The inductive theory approach may provide a heuristic to facilitate innovative teacher behavior.

The major purpose of this project is to evaluate the effectiveness of a learning program designed to teach students in educational psychology to apply psychological knowledge and data to a series of problems based on video tapes of unrehearsed classroom behavior. More specific objectives are the following:

1. To design a learning program in the application of psychological knowledge which is based on the concept of the teacher as inductive theorist.

2. To design the above-mentioned program in a manner which incorporates Gagne's theory of learning as a hierarchy of learning sets. This approach will make it possible to test not only the inductive theory notion itself but also the efficiency of

one methodological approach to teaching people to theorize in an inductive manner. By writing a program, the sections of which are learning sets, and administering all factorial arrangements of these learning sets to different groups of students, it will be possible to locate some of the prerequisites for this kind of application of psychology.

In order to insure that any conclusions made in regard to objectives 1 and 2 are valid, a series of control procedures will be needed. The specific purposes of these procedures will be::

1. To demonstrate that any effects which occur are not due to differences in the student's knowledge of relevant psychological material.

2. To demonstrate that any effects which occur are not due to differences between various sections of the course. Such differences could occur because of motivational or ability differences between students in different sections of the course of differences in the orientation and quality of instruction in different sections.

3. To demonstrate that any effects which occur are more pronounced when the learning sets are presented via programmed instruction (practice plus feedback) than when students are provided with practice in problem solving but no feedback or when neither feedback nor practice are provided. These controls are instituted to provide some evidence that programmed instruc-

tion is a suitable vehicle for introducing innovative behavior into the behavioral repertoire of the student. Findings relevant to this point should be useful since a search of the literature revealed only one other instance in which programmed instruction was used for such a purpose (Crutchfield, 1965).

4. To further clarify the uniqueness of the contribution of programmed instruction to innovative teacher behavior, an attempt will be made to show that a learning program is more effective than a carefully written set of instructions which cover the same basic points.

METHOD

By applying Gagne's approach (1962) to the problem of devising a training program for inductive theorists, the investigator constructed the hierarchy of learning sets depicted in Appendix D. To generate this theory it was first necessary to conceptualize the desired terminal behavior; e. g., what would a teacher trained in the inductive theory approach do when confronted with a problem in applied psychology. This behavior is briefly described in Frame 11 of Appendix D. The operational definition of this same behavior may be found in the "Application of Knowledge Scale " (Appendix B). The next step was to determine what the student would have to know in order to do well on the A-K Scale. Answering this question led to the inclusion of the learning sets shown in Frames 8, 9, and 10 of Appendix D. Using this same approach with the subordinate set in Frame 8 led to the inclusion of Sets 6 and 7. The remainder of the hierarchy was generated in a like manner.

Independent Variables

Variable A. Kind of practice in making applications of psychological knowledge

If, as specified in the theory, inductive applications of psychological knowledge can be made only after all the subordinate learning sets depicted in Appendix D have been acquired, it then becomes important to establish the conditions under which

acquisition of each subordinate set is most likely to occur. Three such learning conditions were investigated:

A_1. Practice with feedback. Ss who were assigned to this condition completed the program shown in Appendix E and Problem I and Problem II which are shown in Appendix G. The program was written so that sections correspond to specific learning sets in the theory. Appendix D diagrams these learning sets and states which sections of the program correspond to which sets. The program provided practice in applying the results of several psychological studies to the attainment of the objective outlined in Problem I.

Problem I presented S with a study not encountered in the program and required that he generate some new ideas from this study. Thus Problem I provided knowledge of a psychological study which was relevant to the stated objective and additional practice in applying such data. Unlike the learning program itself, no attempt was made in Problem I to provide the student with feedback.

Problem II was similar in format to Problem I in that knowledge of a relevant study was provided and the student was asked to make use of a study to generate a plan to attain a stated educational objective. This time, however, the objective was different in that the student's performance on Problem II was a measure of the degree to which the strategy of utilizing information acquired in the program and in Problem II would trans-

fer to a new problem in which the stated objective was different.

A_2. Practice with no feedback. Ss who were assigned to this condition completed Problems I and II but did not work the I-A-P-K Program. As in A_1, knowledge of a relevant study was provided. A_2 differed from A_1, however, in that in condition A_2 Ss received less practice than Ss assigned to A_1. Thus if practice and feedback are relevant variables in this kind of learning, it may be predicted that groups assigned to condition A_2 should not do as well on Problem II as do groups assigned to A_1.

A_3. Knowledge only. Ss who were assigned to condition A_3 completed only Problem II. As in A_1 and A_2, knowledge of a relevant study was provided. Ss in A_3 received no practice and no feedback; hence to the extent that practice and feedback are important variables, it may be predicted that groups assigned to condition A_3 should not do as well on Problem II as those assigned to A_1.

Variable B. Training in specifying educational objectives in terms of observable behavior

The Specification of Educational Objectives Program (S-E-O) is shown in Appendix F. It was written so that portions of the program correspond to specific learning sets in the hierarchical theory of learning. Appendix D diagrams these learning sets and states which sections of the program correspond to which sets. Two experimental conditions were used to test for the

effects of this variable. In condition B_1 all portions of the S-E-O Program were completed. In condition B_2 none of the sections were introduced.

Variable C. Instructions to subjects

The value of developing a clear statement of educational objectives is clearly evident in one of Bloom's reports on the development of a taxonomy of educational objectives (Bloom, 1956). Many institutions participating in this program found that once they had developed a clear statement of their educational goals, it became immediately apparent that innovations were needed in some aspects of their approach to education. Hilgard (1966) and Mager (1961) have provided some support for this position; Mager has gone so far as to suggest that once the instructor has provided the learner with a precise statement of the sort of performance which is expected, the learner will in most cases be capable of proceeding to the objective with no further assistance from the instructor.

These statements have important implications in regard to tests of hypotheses about learning programs. If Mager's statements are correct, it may well be that in many cases all that programmed instruction really accomplishes is to tell the learner in a clear and unambiguous manner what is expected of him; e. g., what he is expected to do. If this is so, a clear description of what the learner is expected to do might prove just as adequate as a learning program and considerably less time consuming

and expensive.

To determine whether such a hypothesis might be supported for the inductive applications and objectives training programs, a summary of the main points in these programs was prepared and given to all students assigned to condition C_1. Control groups were assigned to a "no summary" condition (C_2).

Design

It seemed desirable to avoid the confounding of treatment effects with differences due to variables such as instructor expertise, student motivation, and others which might differ from section to section of the course. In addition it should be interesting to compare the amount of variability attributable to differences between sections to the amount of variability due to treatment variables A, B, and C. Finally, and most important of all, were the main effects and interactions of variables A, B, and C.

In order to accomplish these aims, all treatment variables were arranged in a complete factorial design. Three replications of this design were obtained in each of six sections of Psychology 333 thus making it possible to look at the main effects of variables A, B, and C with the effects of instructor expertise, student motivation, and other variables which might vary systematically between sections controlled out of the picture. A schematic of the factorial arrangements of variables A, B, and C and the way this arrangement was replicated within and across

different sections of the course is shown in Figure 2. There were 12 treatment groups in each of the six sections or a total of 72 cells in the design. Subjects in each section were randomly assigned to one of the 12 treatment groups so that within any given section at least three subjects were originally assigned to each group. There was some attrition during data collection due to students dropping the course or failing to complete the assignment. The number of subjects left in each cell at the end of the study is shown in Figure 2.

Dependent Variables and Hypotheses

Abstraction-Operational Scale (A-O)

The A-O Scale is shown in Appendix A. This scale was used to evaluate the educational objectives which Ss gave in response to Section I of the problems. The A-O Scale was constructed by abstracting the main points in Section C of the learning program and placing them on a 5 point ordinal scale. Objectives which were abstract, unspecified, or vague were assigned lower values on the scales, while objectives which had been stated in terms of observable behavior and hence could be easily communicated were assigned to the upper values. In cases in which S stated more than one objective, raters were instructed to rate primarily on the basis of that objective which was most clearly stated.

Since the A-O Scale is essentially a measure of the extent to which the subject has stated his objective in terms of obser-

Section	Replication	Treatment combinations and ns fo						
Sect. I	R_1	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	A
	R_2	n=3	n=3	n=3	n=3	n=3	n=3	
	R_3							
Sect. II	R_4	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	A
	R_5	n=3	n=3	n=3	n=3	n=3	n=2	
	R_6							
Sect. III	R_7	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	A
	R_8	n=2	n=3	n=1	n=3	n=3	n=2	
	R_9							
Sect. IV	R_{10}	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	A
	R_{11}	n=3	n=3	n=3	n=2	n=3	n=2	
	R_{12}							
Sect. V	R_{13}	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	A
	R_{14}	n=3	n=3	n=3	n=3	n=3	n=3	
	R_{15}							
Sect. VI	R_{16}	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	
	R_{17}	n=2	n=3	n=3	n=3	n=3	n=3	
	R_{18}							

Figure 2: Treatment combinations (experimental groups)

*N=201

ıent combinations and ns for each cell in the design*

$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3
$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
n=3	n=3	n=2	n=3	n=3	n=3	n=3	n=3	n=3
$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
n=3	n=3	n=2	n=3	n=3	n=2	n=3	n=2	n=3
$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
n=2	n=3	n=2	n=3	n=3	n=3	n=3	n=3	n=2
$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3
$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
n=3	n=3	n=3	n=3	n=1	n=3	n=3	n=1	n=3

imental groups)

vable behavior, it follows that experimental groups which have completed the learning program on specification of educational objectives should do better on this variable than groups which have not. For this reason performance on the A-O Scale is essentially a test of the adequacy of the S-E-O Program. From this observation comes Hypothesis I.

Hypothesis I. Experimental groups which have received programmed training in the specification of educational objectives (Condition B_1) will perform significantly better on the A-O Scale than groups which have not.

Application of Knowledge Scale (A-K)

The A-K Scale is shown in Appendix B. This scale was used to evaluate the plans which Ss were asked to generate in Section II of the problems. The A-K Scale is designed to assess the degree to which S has succeeded in making an inductive application to the given situation of the experimental findings provided in the problem. At the lower end of the scale are placed plans which seem to be based on neither empirical data nor on any real sensitivity to the uniqueness and individuality of the given situation. Such applications seem to be based on stereotyped thinking. To be scored at the upper end of the scale, a plan must be based on psychological data but must also take into account other important variables which are operating in the situation (e. g., developmental variables, sex differences, personality, group structure, and leadership).

Since the A-K Scale is essentially a measure of the degree to which S utilizes both relevant psychological data and his own observations of the situation in solving the problems, it follows that scores on the A-K test should provide a test of the adequacy of the I-A-P-K learning program, as predicted by the theory (see Appendix D). The A-K Scale constitutes the terminal behavior which the theory seeks to explain and is found in box 11 of Appendix D. The theory makes it plain that all learning sets which are presented in the I-A-P-K Program (Sections E, F, and G) must have been acquired before a high score on the A-K Scale is possible. From this follows Hypothesis II.

Hypothesis II. Experimental groups which have completed the inductive application program should do better on the A-K Scale than groups which have not.

According to the theory being tested here, successful completion of the inductive applications program (Sections E, F, and G) should not in and of itself guarantee success on the problems. As can be seen from Appendix D, the theory explicitly states that before S can be expected to "translate psychological studies into terms which are applicable to the classroom" (box 11), he must do more than complete the inductive applications program (boxes 6 and 9). In addition he must be able to "identify psychological studies which are relevant to a stated educational objective" (box 10). But before the learning set in box 5 can be acquired, S must have mastered the learning sets in boxes 1, 2, and 3 which are presented in the objectives training pro-

gram. Thus the theory suggests Hypothesis III.

Hypothesis III. Experimental groups which have completed both the I-A-P-K Program and the S-E-O training will be rated significantly higher on the A-K Scale than groups which have completed only the I-A-P-K Program.

Relevance Scale (R)

The R Scale is shown in Appendix C. This scale was used to assess the degree to which S viewed the ideas which he specified in Section II as being derived from, or at least related in some way to, the objectives he formulated in Section I. This scale was formulated to test several of the causal relationships which are specified in the theory. (See Appendix D.)

More specifically, the R Scale provides a means of testing the relationships outlined in boxes 1, 2, 3, 10, and 11. First it should be apparent that the S's score on the R Scale is in essence a test of whether the learning set in box 10 has been acquired. Since the theory states that this set cannot be acquired until S has acquired the sets in boxes 1, 2, 3, and 4; and since all of these latter sets are contained in the learning program on specification of educational objectives; it follows that, if the S-E-O Program is successful, it should facilitate performance on the R Scale.

Hypothesis IV. Students who have received programmed training in the specification of educational objectives will perform significantly better on the R Scale than those who have not.

Subjects

The subjects who participated in the study were 201 students enrolled in a junior level course in educational psychology at Iowa State University. Prerequisites for this course include a course in introductory psychology and a course in developmental psychology.

In all cases participation in this project was introduced as a class project. Completion of the project was considered to be mandatory for successful completion of the course. In order to insure that the project did not disrupt the normal conduct of the various sections, each instructor was given the option of deciding on the specific way in which to present the project to the students. In no case was a grade other than pass-fail assigned to the project. In some sections, the project replaced a final exam; in others, the student was allowed to drop his lowest quiz score in return for participating; and in one, the student was asked some questions on the general nature of the project as part of the final exam. All students in all classes were expected to participate in the project.

Procedure

The total time allocated for data collection was one week. On the first day of the experiment, materials and instructions were handed out to each participating subject. The particular set of materials which a given subject received depended upon the treatment group to which he had been assigned. The instruc-

tions for each of the 12 treatment groups are shown in Appendix H. After the instructions and materials were handed out, Ss were asked to check to be sure that their packets contained all the materials indicated in the instruction sheet for their particular treatment group.

The experimenter then stated that the general purpose of the experiment was "to try out some new ideas for teaching students in Psychology 333 how to apply psychology in a real classroom situation." Each class was then shown a video tape which depicted four preschool children interacting with five female Iowa State students in a situation somewhat analogous to a nursery school. The children in the tape were shown a picture of a train moving along a railroad track towards a bridge which was broken. The children were asked to make up a story about what was happening. Each child was encouraged and supported in this situation by a female student in educational psychology. In addition there was a "teacher" who attempted to coordinate the activities of the group and to encourage all members to contribute. Ss were encouraged to take notes on the content of the tape, and it was explained that these notes would be helpful in working the programs and problems. Since the quality of the sound on the video tape was rather poor, the experimenter followed the presentation of the tape by providing the subjects with a brief resume of some of the significant aspects of the tape. Following the showing of the tape, Ss were instructed to begin working the programs and problems. Following a work period of approximately 20 minutes

during which E was available to answer questions, the Ss were dismissed with the instruction that they complete the project outside of class. In all cases, Problem II was to be returned two class periods after the initial session. For Ss who had to work the problems and programs, part of the assignment was to be returned at the next meeting of the class. This was done in an effort to get Ss to make full use of the time alloted rather than trying to complete the entire assignment the night before it was due.

After all data had been collected, a feedback session was provided for the purpose of explaining to the Ss the theory and methodological approach of the study.[3] At the beginning of this session, a questionnaire designed to assess interest in and overall reaction to the study was completed by all Ss. This questionnaire is shown in Appendix H. At the conclusion of this session, Ss were allowed an opportunity to ask questions and thanked by E for their contribution to the experiment.

Assignment of materials to raters

In order to insure that systematic rater errors due to order or fatigue were not confounded with treatment effects, it seemed highly desirable to insure that raters were presented with exper-

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[3]This could only be done for 4 of the 6 treatment groups due to the fact that one of the instructors preferred to discuss the experiment with the class himself rather than having E do it.

imental materials in such a way that one complete replication of the experiment (e. g., one experimental unit from each treatment condition) was rated in each time segment of the rating process. Since the design called for analysis of differences between sections, it was also important that all sections be represented at least once in each time segment.

Figure 3 shows the sampling scheme for one time segment of the rating procedure. This scheme satisfies the requirements cited above in that one complete replication (two units from each of the six sections of the course) is presented to each rater during the time segment in question. Since there were not enough experimental units available for each rater to be presented with all possible arrangements of treatment conditions, order effects were controlled by means of random assignment. This was accomplished as follows:

1. Each time segment consisted of 12 units.

2. Section numbers (I-VI) were assigned to each unit by random sampling without replacement.

3. Treatment group numbers (1-12) were then assigned to each unit by random sampling without replacement in such a manner that each rater was assigned to at least one S in each treatment cell.

4. The materials of a particular S who belonged to the section and treatment group specified for a particular unit by the procedures in 2 and 3 above were then assigned to each

Rater 1		Rater 2		Rater 3	
I*	1*	III	5	V	8
II	2	IV	6	VI	9
III	3	V	7	I	10
IV	4	VI	8	II	11
V	5	I	9	III	12
VI	6	II	10	IV	1
I	7	III	11	V	2
II	8	IV	12	VI	3
III	9	V	1	I	4
IV	10	VI	2	II	5
V	11	I	3	III	6
VI	12	II	4	IV	7

*Roman numerals refer to sections of the course; Arabic numerals, to treatment groups.

Figure 3. Sampling scheme for one time segment of the experiment. (There were six such time segments for each rater for the rating of Problem II and three additional segments for Problem I.)

unit by random sampling without replacement. The experimental design called for at least three replications of the 12 treatment combinations in each section. This meant that after the section number and treatment number were randomly assigned to a given unit, there were at least three subjects who were eligible for assignment. For classes which were larger than 36, there were instances in which more than three draws were discarded. For those cells in the design in which there was attrition, all three raters were required to rate all experimental units. Thus if only one S was present in a given cell, then all three Ss rated that person. If two Ss were present, both were rated by all three raters.

This procedure resulted in a design in which the minimal number of observations in any given cell was three and the maximum was six. Thus for cells in which data from only one subject were available, three ratings of this unit were made changing n for that cell to three. For cells in which there was no attrition a different rater rated each of the three subjects so that n remained at three. Finally, for cells in which data were available from two subjects, each of the three raters rated both subjects resulting in an n of 6. The resulting cell frequencies for Problems I and II are shown in Figures 4 and 5.

Training of raters and assessment of reliability

Approximately one week was allocated for the training of raters. Raters were first given copies of the programs and prob-

Section	Number of ratings (n) in each cell*							
	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$
Sect. I	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3
Sect. II	n=3	n=3	n=3	n=3	n=3	n=6	n=3	n=3
Sect. III	n=6	n=3	n=3	n=3	n=3	n=6	n=3	n=3
Sect. IV	n=3	n=3	n=3	n=6	n=3	n=6	n=3	n=3
Sect. V	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3
Sect. VI	n=6	n=3	n=3	n=3	n=3	n=3	n=3	n=3

Figure 4. Number of ratings (n) in each cell of the experimental design for data obtained in Problem I

*$\underline{N}$=162

Section	Number of ratings ($\underline{n}$) in each cell*											
	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_2C_1$	$A_2B_2C_2$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_2C_1$	$A_3B_2C_2$
Sect. I	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3
Sect. II	n=3	n=3	n=3	n=3	n=3	n=6	n=3	n=3	n=3	n=3	n=3	n=3
Sect. III	n=6	n=3	n=3	n=3	n=3	n=6	n=3	n=3	n=6	n=3	n=6	n=3
Sect. IV	n=3	n=3	n=3	n=6	n=3	n=6	n=3	n=3	n=3	n=3	n=3	n=6
Sect. V	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3
Sect. VI	n=6	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3	n=3

Figure 5. Number of ratings ($\underline{n}$) in each cell of the experimental design for data obtained in Problem II

*$\underline{N}$=243

lems which had been used in the study. These materials were thoroughly discussed during the first training session. The purpose of this discussion was to provide the raters with some idea of the general sort of responses which were being prompted in the programs and hence a clear notion of what to look for in the problems to be rated.

Following this period of familiarization with the materials, the raters were given a set of rating forms and written instructions for use of the scales, and all were asked to rate the same 5 problems. This completed the second session. The next training session consisted of a discussion of areas of disagreement in the ratings; ambiguity in the scales and instructions were thereby pointed out, and necessary revisions were made. Then the raters were given 5 more problems to judge. Subsequent sessions followed the same format.

Two groups of raters were used. Three raters judged Problem I; the second group of three rated Problem II. The raters were two faculty members and four doctoral level graduate students. All had had teaching experiences in the developmental-educational psychology sequence at Iowa State. The author participated in both groups of raters. To minimize the possibility of a rater x treatment interaction due to experimenter effects, all data were coded so that it was impossible to tell what treatment group any given experimental unit represented.

Statistical Analysis

Six analyses of variance were performed on the data obtained from this experiment. Three of these analyses were done on the A-O, A-K, and R scores for Problem I. The remaining three analyses were done on these same measures for Problem II. Since cell frequencies were unequal, the usual computational approaches for analysis of variance were not appropriate. Because the disparities between cell frequencies were within a two to one ratio, an unweighted analysis of the means was used to provide a very close approximation to the results which would have been obtained with an exact analysis (Snedecor & Cochran, 1967, pp. 475-478).

In the unweighted means solutions the means for each treatment combination cell were computed, and an ordinary analysis of variance was performed on these means. As the estimate of experimental error, the pooled-within-cell mean square was computed by calculating the sum of squares for each individual cell, adding the sums of squares for all cells together and dividing by the sum of the degrees of freedom for individual cells. In order to correct for bias attributable to the unequal cell frequencies, this pooled-within term was then divided by the harmonic mean ($\bar{n}_h$). This correction factor was computed by the formula:

$$\frac{1}{\bar{n}_h} = \frac{1}{abcd}\left(\frac{1}{n_{11}} + \frac{1}{n_{12}} + \cdots \frac{1}{n_{abcd}}\right)$$

where a is the number of levels of Factor A, b is the number of levels of Factor B, c is the number of levels of Factor C, d is the number of levels of Factor D, and n_{abcd} is the number of observations present in cell abcd. Since all effects were considered fixed, this corrected-within term was the proper denominator for all F ratios in all the analyses of variance which were performed on the data for Problems I and II.

Since practice on Problem I constituted one level of main effect A, the variable A had to be defined somewhat differently for those analyses in which ratings of behavior on Problem I constituted the dependent variable. Thus for all analyses on Problem I, there were two rather than three levels of practice: A_1, practice with feedback, and A_2, knowledge only. In all other respects the design was identical to that in the analysis of Problem II data. An unweighted analysis was conducted on the means of the 2 x 2 x 2 x 6 = 48 treatment cells.

As was noted earlier for those cells in which one or more Ss had failed to complete the project, all raters rated all experimental units. For Problem I this procedure resulted in 14 cases in which all three raters had rated the same S. This overlap was used to provide a check on rater agreement. Product moment correlations were computed between each rater pair for the 14 observations.

Data on the A-O, A-K, and R Scales were collected for Problem II in the same basic design as for Problem I. The only

difference in design was the inclusion of three rather than two levels of A. Thus for Problem II the levels of practice were A_1, practice with feedback; A_2, practice with no feedback; and A_3, knowledge only. All analyses of variance performed on data for Problem II were on the $3 \times 2 \times 2 \times 6 = 72$ treatment cell means. As in Problem I those cases on which all raters rated the same person were used to obtain an estimate of reliability. There were 21 such cases in the data for Problem II.

RESULTS

For Problem I the 14 cases in which all raters had rated the same person were used to obtain an estimate of rater agreement. Product moment correlations between raters for these cases ranged from .10 to .35 for the A-O Scale, from .51 to .63 for the A-K Scale, and from .47 to .75 for the R Scale. These coefficients are obviously not as high as is desirable in this type of design. A possible reason for this will be discussed later.

The results of the analysis of the data for the A-O Scale are shown in Table 1. Only the main effect of factor B (training in specifying educational objectives in terms of observable behavior) was found to be significant. The means for this effect are shown in Table 2. It is evident from Table 2 that the differences between B_1 and B_2 are in the direction predicted by Hypothesis I.

Table 3 shows the results obtained on the A-K Scale. Two significant main effects were present in these data: the effect of factor A (kind of practice in making applications of psychological knowledge) and factor D (sections of the course). The means for these effects are presented in Table 4. The means for factor A are in the direction predicted by Hypothesis II.

An analysis of variance similar to those discussed above was performed on the R Scale ratings. No significant effects were found in this analysis.

Table 1. Unweighted means analysis of variance of the A-O Scale data for Problem I (high transfer)

Source	df	SS	MS	F
A Kind of practice	1	1.09626	1.09626	2.4318
B Objectives program	I	2.71318	2.71318	6.0185*
C Instruction	1	0.07053	0.07053	_[a]
AB	1	0.22087	0.22087	_[a]
AC	1	0.04688	0.04688	_[a]
BC	1	0.79105	0.79105	1.7547
ABC	1	1.50734	1.50734	3.3436
D Sections	5	0.67216	.13443	_[a]
AD	5	1.89517	.37903	_[a]
BD	5	1.98603	.39721	_[a]
CD	5	4.09487	.81897	1.8167
ABD	5	1.95214	.39043	_[a]
ACD	5	3.38004	.67601	1.4995
BCD	5	2.91183	.58237	1.2918
ABCD	5	2.27033	.45407	1.0072
Within sub-classes	114	164.4564	.45081[b]	_[a]
Total		190.0651		

*Significant beyond the .025 level.

[a]No F values are shown for effects where F was less than 1.00.

[b]The within mean square was corrected by the formula $s^2/\bar{n}_h$.

Table 2. A-O Scale means for the significant main effects.

Significant main effects		Means
B_1	Specification of Educational Objectives Program (S-E-O)	3.6149
B_2	No S-E-O Program	3.1389

For Problem II there were 21 cases in which all three raters rated the same person. The product moment correlations between raters for these 21 observations ranged from .56 to .84 for the A-O Scale, from .27 to .61 for the A-K Scale, and from .31 to .53 for the R Scale. While these correlations are substantially higher than those obtained from Problem I, the level of agreement is still not as high as is desirable.

An unweighted means analysis of variance of the A-O Scale failed to disclose any significant main effects or interpretable interactions; hence no summary table is presented for this variable.

Table 5 contains the result of the unweighted means analysis of variance of the A-K Scale. Only the main effect due to sections D and the practice A x instructions C x sections D interaction effects were significant. The means for the D effect are shown in Table 6. A plot of the ACD interaction is presented

Table 3. Unweighted means analysis of variance of the A-K Scale data for Problem I (high transfer)

Source	df	SS	MS	F
A Kind of practice	1	1.41832	1.41832	7.5306**
B Objectives program	1	.17751	.17751	—[a]
C Instruction	1	.42207	.42207	2.2410
AB	1	.63043	.63043	3.3473
AC	1	.10575	.10575	—[a]
BC	1	.34731	.34731	1.8441
ABC	1	.13010	.13010	—[a]
D Sections	5	2.94755	.58951	3.1300*
AD	5	1.02052	.20410	1.0837
BD	5	1.69165	.33833	1.7964
CD	5	.27050	.05410	—[a]
ABD	5	1.30265	.26053	1.3833
ACD	5	.46945	.09389	—[a]
BCD	5	1.21420	.24284	1.2894
ABCD	5	.66950	.13390	—[a]
Within subclasses	114	68.70780	.18834[b]	—[a]
Total	161	81.52532		

*Significant beyond the .025 level.

**Significant beyond the .01 level.

[a]No F tests are shown for effects where F was less than 1.00.

[b]The within mean square was corrected by the formula $s^2/\bar{n}_h$.

Table 4. A-K Scale means for the significant main effects due to kind of practice (A) and section (D)

Kind of practice in making applications of psychological data		Mean
A_1	Practice with feedback	3.5574
A_2	Knowledge only	3.2136
Sections of the course		**Mean**
D_1		3.2292
D_2		3.3802
D_3		3.4009
D_4		3.2292
D_5		3.9065
D_6		3.1666

Table 5. Unweighted means analysis of variance of the A-K Scale data for Problem II (low transfer)

Source	df	SS	MS	F
A Kind of practice	2	.76715	.38358	2.4125
B Objectives program	1	.43680	.43680	2.7472
C Instruction	1	.07220	.07220	—[a]
AB	2	.06184	.03092	—[a]
AC	2	.01500	.00750	—[a]
BC	1	.01022	.01022	—[a]
ABC	2	.63598	.31799	1.9999
D Sections	5	2.35261	.47052	2.9592*
AD	10	1.54518	.15452	—[a]
BD	5	.73626	.14725	—[a]
CD	5	.93238	.18648	1.1728
ABD	10	1.82676	.18268	1.1489
ACD	10	5.85541	.58554	3.6826**
BCD	5	.21714	.04343	—[a]
ABCD	10	2.18286	.21829	1.3729
Corrected error	171	87.0048	.15900[b]	—[a]
Total	242	104.6526		

*Significant beyond the .05 level.

**Significant beyond the .005 level.

[a]No F tests are shown for effects where F was less than 1.00.

[b]No error mean square was corrected by the formula $s^2/\bar{n}_h$.

Table 6. A-K Scale means for the significant main effects due to sections

Section	Mean
D_I	3.28
D_2	3.31
D_3	3.42
D_4	3.08
D_5	3.51
D_6	2.99

in Figures 6 and 7.

The analysis of the R Scale data yielded a significant main effect due to variable A (kind of practice). These results are presented in Table 7. No A main effect was predicted for the R Scale; furthermore, inspection of the means for this effect (See Table 8) reveals a trend for the mean rating on the K Scale to be higher for Ss who have had neither practice nor feedback than the mean for Ss who had received one or both of these treatments.

Questionnaire Responses

In order to describe the motivation of Ss under the various experimental conditions, treatment means for items 1 and 4 from

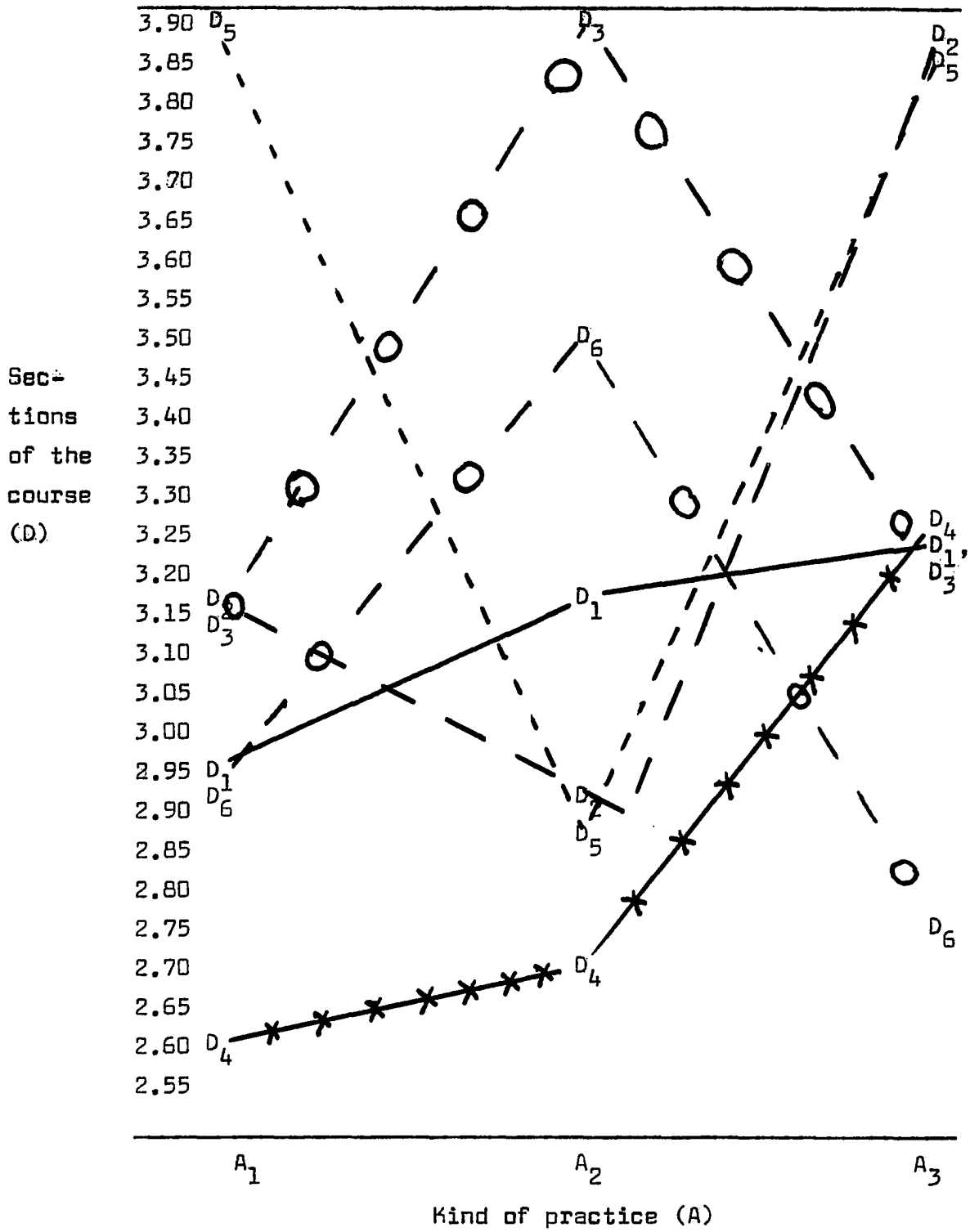

Figure 6. Means for the combinations of kind of practice (A) within different sections of the course (D) for the summary present condition (C_1)

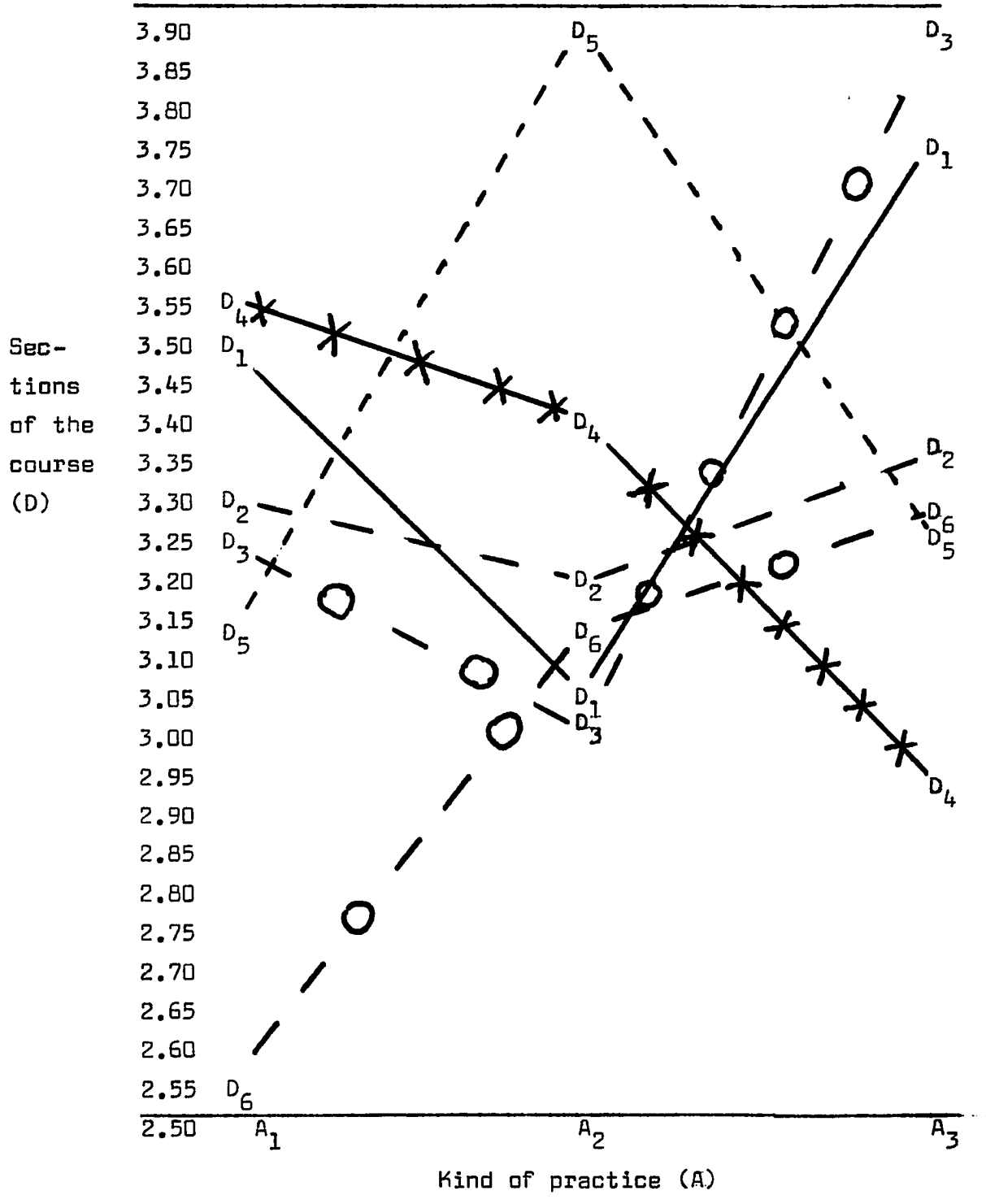

Figure 7. Means for the combinations of kind of practice (A) with different sections of the course (D) for the summary absent condition (C_2)

Table 7. Unweighted means analysis of variance of the R Scale data for Problem II (low transfer)

Source	df	SS	MS	F
A Kind of practice	2	.93078	.46539	3.0974*
B Objectives program	1	.46641	.46641	3.1042
C Instruction	1	.36480	.36480	2.4280
AB	2	.24306	.12153	[a]
AC	2	.20396	.10198	[a]
BC	1	.19604	.19604	1.3048
ABC	2	.02235	.01118	[a]
D Sections	5	1.65515	.33103	2.2032
AD	10	.88365	.08837	[a]
BD	5	.67072	.13414	[a]
CD	5	1.42385	.28477	1.8953
ABD	10	.33786	.03379	[a]
ACD	10	1.41682	.14168	[a]
BCD	5	.57359	.11472	[a]
ABCD	10	2.38550	.23855	1.5877
Corrected error	171	82.21680	.15025[b]	[a]
Total	242	93.99135		

*Significant beyond the .05 level.

[a]No F values are shown for effects where F was less than 1.00.

[b]The error mean square was corrected by the formula $s^2/\bar{n}_h$.

Table 8. K Scale means for the significant main effect due to kind of practice (A)

	Description	Mean
A_1	Practice with feedback	3.16
A_2	Practice with no feedback	3.19
A_3	Knowledge only	3.42

Table 9. Means for S's overall evaluation of the project for variables A and B

	Description	Mean
A_1	Practice with feedback	58.75
A_2	Practice with no feedback	52.66
A_3	Knowledge only	57.31
B_1	Specification of Educational Objectives Program (S-E-O)	58.75
B_2	No S-E-O Program	52.86

Table 10. Comparisons of mean levels of S's interest in Problem I and Problem II

	n	Mean	F	t
Problem I	99	59.30	1.51*	1.37
Problem II	100	55.00		

*Significant beyond the .05 level.

Table 11. Comparisons of mean rates of interest for the main effects of Variables A and B for Problems I and II

Problem I				
Subgroup	n	$\bar{x}$	F	t
B_1	49	63.43	1.22	2.08*
B_2	50	55.26		
A_1	51	60.27	1.17	.50
A_2	48	58.27		
Problem II				
Subgroup	n	$\bar{x}$	F	t
B_1	49	56.38	1.06	.55
B_2	51	53.67		
A_1	51	56.16	1.01	.48
A_2	49	53.80		

*Significant beyond the .05 level for a two-tailed test.

the questionnaire shown in Appendix K were computed. On the questionnaire items S was asked to rate his response to some aspect of the project on a 100 point scale. Anchoring statements were provided at the 1, 50, and 99 points; but S was encouraged to use any and all numbers between 1 and 99.

In item 4 S was asked to rate his overall response to the project. Table 9 shows the mean responses to this item for all levels of variables A and B. Item 1 required a rating of interest in the problems. Each problem was rated separately, thus making possible a comparison of the interest level of the two problems. This comparison is of interest here because all of the significant positive findings presented thus far were found in ratings of performance on Problem I. There was no support for any of the hypotheses in the data obtained on Problem II. One plausible explanation for this would be a difference in the interest level of the two problems.

Table 10 shows the mean rating of interest for the two problems. The two-tailed t test for this comparison failed to reach significance at the .05 level, thus suggesting that the null hypothesis of no significant difference between the means be accepted.

Table 11 shows the means for treatment groups A_1, A_2, B_1, and B_2. The pair of means corresponding to each main effect were compared by means of t tests. Since these were ad hoc comparisons, all tests were two-tailed. Only the comparisons for

Table 11. Comparisons of means for the main effects of Variables A and B for Problems I and II

Problem I				
Subgroup	n	$\bar{x}$	F	t
B_1	49	63.43	1.22	2.08*
B_2	50	55.26		
A_1	51	60.27	1.17	.50
A_2	48	58.27		

Problem II				
Subgroup	n	$\bar{x}$	F	t
B_1	49	56.38	1.06	.55
B_2	51	53.67		
A_1	51	56.16	1.01	.48
A_2	49	53.80		

*Significant beyond the .05 level for a two tailed test.

the S-E-O Program on Problem I reached significance. There is some evidence in these data of an interaction between variable B and Problems I and II. The nature of this interaction is apparent in Figure 8. While the level of interest is generally slightly higher for Problem I than for Problem II, this difference is large only when both groups have received the S-E-O Program (B_1). Thus the S-E-O Program seems to have stimulated more interest in Problem I than it did in Problem II.

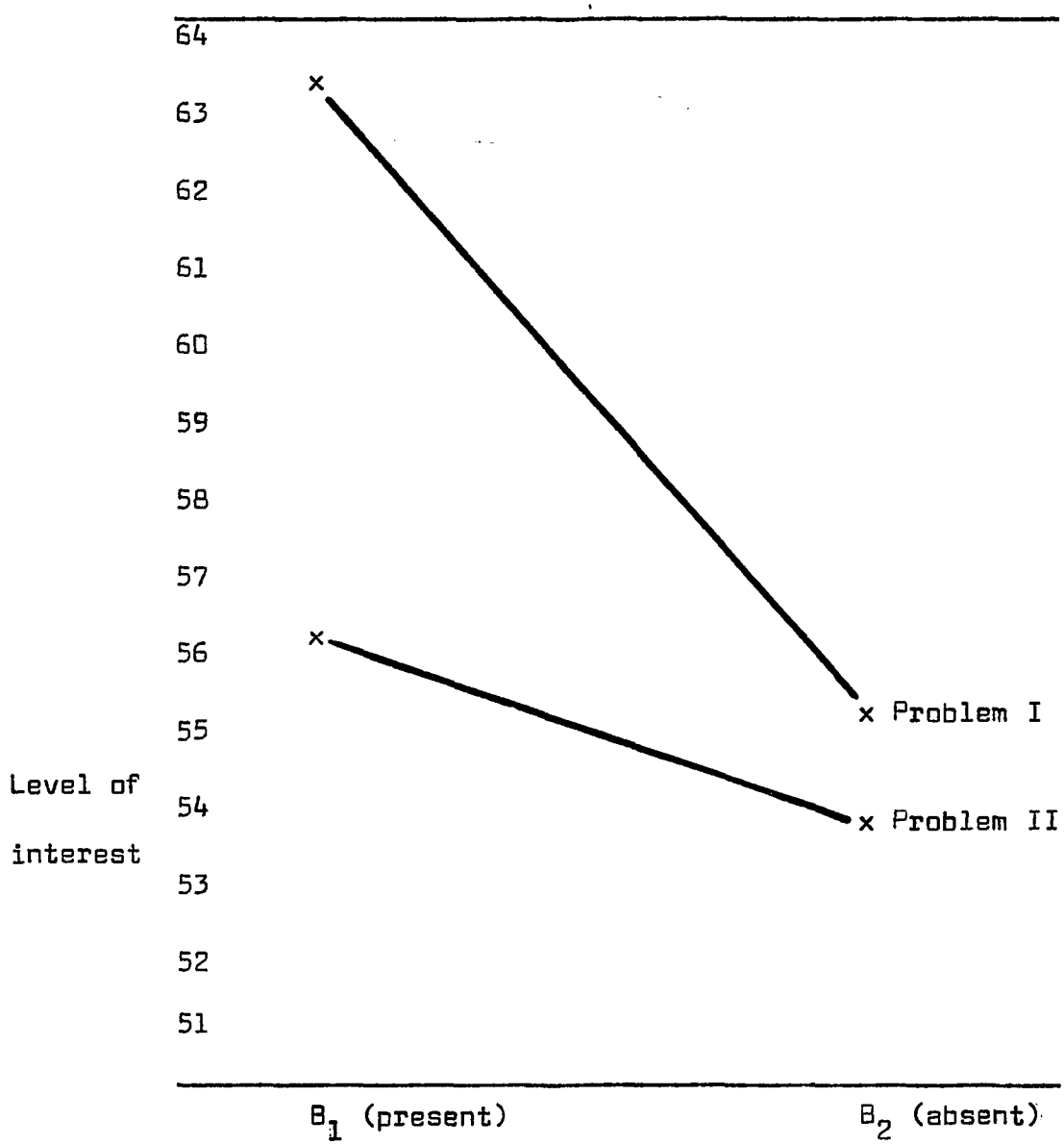

Figure 8. Mean level of interest for variable B for Problems I and II

DISCUSSION

One of the major characteristics of these data is the difference in the results for Problem I as opposed to those for Problem II. For the A-Q Scale a B main effect was hypothesized whereas for the A-K Scale an A effect was hypothesized. Both of these predictions were supported by the results of analysis of variance on Problem I. Thus Hypotheses I and II were supported by the results of this portion of the study.

For Problem II the situation was quite different. No support for any of the hypotheses can be found in any of the three analyses of variance which were performed on the data for Problem II. The only treatment effect which was significant was the A (kind of practice) effect for the Q scale. No main effect was originally hypothesized for this variable; furthermore, the means suggest a trend for those groups which received programmed instruction to perform less adequately than groups which had been provided with relevant knowledge but no practice in applying knowledge.

Taken at face value this finding implies that practice and feedback in applying psychological knowledge as defined in this study resulted in a decrement in the degree to which said applications were relevant to the objectives which the student had formulated. Such a finding is difficult to interpret in light of the fact that no parallel result occurred for Problem I in which the R Scale values for variable A were nonsignificant but

in the opposite direction from those reported for Problem II. It is probably best to conclude that there is no evidence that either of the learning programs produced an increment in the degree to which problem solutions were relevant to the student's stated objectives. Whether the decrement observed in Problem II is real or merely an artifact, it seems obvious that in future work, either the relevance criterion must be discarded or revised or the programs must be modified so as to improve performance on this criterion.

As to the observed difference in results between Problems I and II, one important difference is to be found in the subject matter on which they are based. Problem I deals with creativity; Problem II, with concept formation. Since creativity was the subject matter on which the programs had focused, there should have been a great deal of transfer of knowledge of content from the programs to Problem I. Since Problem II was concerned with a different area of psychological knowledge, it constituted a low transfer condition. If the hypothesis had been confirmed for Problem II, this would have suggested that the programs had done more than just transmit knowledge to the student. Such results would have supported the notion that the programs had provided some heuristics which facilitate planning or problem solving behavior so that the students who completed the program were better prepared to solve new problems than those who had not. One obvious interpretation then is that students who com-

pleted the program learned something about operationalizing creativity and generating ideas about how to get preschool children to behave "creatively." However, the data do not support the idea that anything other than knowledge about creative behavior and how to apply this particular body of knowledge were acquired.

There are at least three explanations of the data which must be considered as possible alternatives to the interpretation above. One is the possibility that the differences which occurred were simply due to measurement error. The reliability coefficients which were obtained for Problems I and II were obviously not as high as are desirable in this type of design. However, there is some evidence that they constitute an estimate of agreement which is both inexact and minimal. They were limited in accuracy by the very small number of observations on which they were based. They also may have been limited in size by the fact that the observations which were included came from only two of the six sections of the course which were used in the study. The variability which existed between sections in the data will not be reflected in the obtained reliability coefficients, thereby systematically reducing the range of the variables in question and reducing the absolute value of the correlation coefficients between raters (Hays, 1963, p. 510). The fact that two hypotheses which predicted different main effects for two different scales were confirmed suggests that the precision of the instrument may have been greater than indicated by the reliability coefficients. The reasoning which underlies this statement is based on Campbell and Fiske's discussion of convergent and divergent validity (1959, pp. 81-84). These authors define convergent validity as "a confirmation by independent measurement procedures." In contrast to the above di-

vergent validity refers to the fact that a valid measure of a trait should not predict other behaviors or test scores to which it is supposedly unrelated. "Tests can be invalidated by too high correlations with other tests from which they were intended to differ" (Campbell & Fiske, 1959, p. 81).

Campbell and Fiske's ideas about validity can be extrapolated from the situation in which one is dealing with a correlation matrix based on two or more traits to the present study in which there were two traits each of which were hypothesized to be uniquely sensitive to a different independent variable. In this paradigm the confirmation of the predictions of an A main effect on the A-K Scale and a B main effect on the A-D Scale and no B main effect occurred for the A-K Scale may in a sense be considered as evidence of divergent validity. It seems improbable that divergent predictions such as these could have been supported had rater agreement been as low as some of the obtained correlations would suggest.

A second alternative is the possibility that each of the three raters was responding reliably but to different dimensions of a complex, multi-dimensional stimulus. This could result in low rater agreement (provided the dimensions were orthogonal) and statistically significant results between treatment groups. There is some evidence to suggest that this phenomenon did occur in the present study. Thus at one point it was decided to combine the A-K and R Scales into a single measure to improve reliability. Not only did this fail to improve the reliability as much as would have been predicted by the Spearman Brown Formula, but it also resulted in a measure which was insensitive to any treatment effects; i. e., none of the ANOV results were significant for this measure.

A third alternative explanation considered is that the difference in the results obtained for Problems I and II can be

explained in terms of motivation rather than the cognitive quality of the program per se. Such motivational effects could occur because of the actual content and/or quality of construction of the problems or because the learning programs succeeded in generating student interest in one problem but not in another.

The data which are relevant to these possibilities are presented in Tables 9, 10, and 11. Since there was no overall difference in the level of interest for the two problems, the observed differences in treatment effects are not to be attributed to differences in the incentive value of the content of the problems. Apparently the problems were relatively equivalent in this regard.

The graph of the means for B_1 and B_2 for Problems I and II (Figure 7) together with the finding that the mean level of interest was significantly greater under condition B_1 than under B_2 for Problem I suggests the presence of an interaction effect. It would seem that the S-E-O Program (B_1) which focused on ways of operationalizing the concept of creativity was successful in generating an interest in Problem I which also deal with creativity. This interest did not transfer to Problem II which was concerned with reading readiness and concept formation.

If as has been suggested above the differences in results between Problems I and II cannot be attributed to errors in measurement or to a difference in the incentive values of the two problems, then the only remaining conclusion which seems tenable

is that, while the programs were successful in providing students with knowledge about creative behavior and in teaching them how to apply this knowledge, the students did not learn the way of reasoning through problems which the programs had been designed to communicate. This finding was anticipated during the planning of the experiment. Since this was only a first attempt to develop the educational technology in question, it did not seem defensible to demand extensive amounts of time from the students who participated. For this reason it seemed advisable to limit the size of the programs to the smallest amount of practice which could conceivably produce a significant effect on the dependent variables of interest. This consideration resulted in limiting the scope of the program to one content area (creativity) and one classroom situation (preschoolers telling stories about a series of pictures). The examples and problems which were provided in the program differed only in that they were based on different studies; in all cases the general objective was the same, the relevant content area was the same, and the situation was the same. The obvious limitation of such a program was that no systematic practice was provided in generalizing the method of analysis of problems being taught to other problems. It was hoped that by prefacing each section with a clear statement of objectives and providing a summary as well, it should have been possible for the student to have grasped the method and generalized it even without any reinforced practice. The idea that a

summary of the main points of the programs might facilitate acquisition of an inductive strategy seemed plausible enough that it was included as a variable in the design (variable C). None of the six analyses of variance yielded a C main effect which even approached significance. Thus it would appear that merely telling subjects how to apply psychology without providing practice and feedback is of little value. Apparently the only way to learn to solve problems is by solving problems!

It is quite likely that the attempt in the programs to facilitate transfer by means of section summaries may have met the same fate as did the summary of the overall program. For this reason subsequent revisions of the program should provide practice in generalizing the inductive method to several problems in addition to the section summaries.

The findings which relate to the hierarchical relationships between sections of the programs (Appendix D) were highly inconclusive. The AB interaction predicted in Hypothesis III (p. 23) was large for Problem I but failed to reach significance at the .05 level, and hence no comparisons of the treatment group means were made. This finding raises some question as to the degree to which this particular hierarchical model fits the sort of learning process which is being dealt with.

One final result which may be worthy of at least passing comment is the presence of a significant main effect for sections of the course in several of the analyses of variance which

were conducted solely as a control; i. e., it was of no theoretical interest. This particular kind of control has frequently been omitted in studies in which two or more methods of instruction are compared. In the present study had the various treatments been assigned to different sections of the course, thereby confounding treatment effects with differences between sections, it is quite likely that a very different set of findings from those reported might have resulted.

Finally there are several suggestions which may be made in regard to future research in this area. In regard to the development of the programs themselves, there is obviously a need to encourage the transfer of the inductive strategy to problems other than creativity training. This could probably be handled best by increasing the length of the program so that practice is provided in at least two content areas and at least two different situations for each area.

A second area for future research is the improvement of measurement techniques. Such research should, of course, focus on the improvement of reliability. In addition, however, it would be highly desirable to simplify the response format in a manner which would reduce, or perhaps even eliminate, the amount of time required to train raters. These objectives could be best attained in some sort of multiple choice format provided such a format does not reduce validity.

In regard to controls in this type of research, it has been

established that differences between different sections and instructors must be controlled for. Hence this control should be included in future work. It has also been demonstrated that at least for the set of instructions which was used in this study just telling students how to be inductive theorists doesn't work. Thus it would be defensible to ignore this control in future studies.

SUMMARY

This study was designed to investigate programmed instruction as an approach to teaching undergraduate students in courses in educational psychology to apply psychological knowledge to a series of classroom problems. A model of the teacher as a planner or theorist was presented as well as a model of the hierarchy of learning sets hypothesized as necessary but not sufficient conditions for this kind of divergent behavior. A learning program was constructed in which each section of the program constituted one of the hypothesized learning sets in the hierarchy. Thus by administering different sections to different treatment groups, it was possible to test hypotheses about the structure of knowledge underlying this class of behavior. The program which was used was unique in that in many instances more than one responses was rewarded for a particular frame. This procedure was employed to encourage divergent thinking on the part of the students.

Students were encouraged by the programs to state objectives in terms of observable behavior and to generate ideas in an inductive fashion, i. e., to develop generalizations which were based upon both their observations of the situation in question and relevant psychological data.

In addition to testing hypotheses about the success of the programs and the hierarchy of learning sets underlying this

behavior, data were collected to test the null hypothesis that the results obtained could not be obtained simply by writing out a detailed set of instructions specifying all main points contained in the programs. By replicating the entire design in different sections of the course, it was possible to avoid contaminating treatment effects with differences which might be present between sections of the course due to such variables as the orientation of the instructor and student motivation and ability.

There were four independent variables in the study: kind of practice in making applications of psychology, training in the specification of educational objectives in terms of observable behavior, instructions to subjects, and sections of the course. These variables were combined in a four way analysis of variance design. The dependent variables were ratings of the two problems. One of these was considered a high transfer problem in that it dealt with the same content area as had been used in the program. The second was similar to the first but dealt with a different area of content.

It was found that while Ss who had completed the programs performed better than controls on the high transfer problem, this superiority did not carry over to the solution of the problem involving a different content area. This may have been due to an insufficient emphasis on transfer in the teaching programs. Suggestions are made for future revisions to correct this defi-

ciency.

The findings in regard to the control treatments suggested the importance of controlling for differences between classes and instructors in this kind of research. It was also concluded that for the particular set of instructions which were used in this study, just telling students how to be inductive theorists did not work. Thus the results of the program cannot be explained as an instruction. It would appear that practice and/or feedback are important variables to consider in the acquisition of this kind of behavior.

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APPENDIX A: ABSTRACTION-OPERATIONAL SCALE (A-O)

Abstraction-Operational Scale (A-O)

1. No objective stated at all or the stated objectives appear so irrelevant to the problem that one would question whether the assignment was understood by the student. Failure to fill in Section I would be scored here as would cases in which the stated objective seems to have no relevance to the problem as stated.

2. Stated objective adds nothing new to the objective provided in the problem. An objective is stated which seems relevant to the assignment, but the statement is so broad and general that it fails to add anything at all to what was already stated in the problem itself. All responses which simply restate or reword the objective given in the problem would be scored in this category.

3. Stated objective does not specify behavior to be observed. An objective is stated which does clarify the abstract objective which was provided in the problem. This clarification of the objective would probably make it easier to communicate to an outsider. The objective is still very broad, however, in the sense that no attempt has been made to say what specific behaviors will be measured or observed to determine whether or not the objective has been reached. Responses which employ words that are open to many interpretations will be scored in this category.

4. Objective stated in terms of behavior which is very ambiguous. An objective is stated which does clarify the abstract objective which was provided in the problem. This clarification of

the objective would probably make it easier to communicate to an outsider. This objective is stated in terms of behavior; hence there are a finite number of interpretations of what the learner is expected to do during the evaluation process. There is still some ambiguity, however, in that in it no attempt has been made to say how this behavior will be judged. All responses which utilize open-ended evaluation procedures with no attempt to say how these procedures are to be scored would be assigned to this category.

5. Objective stated in terms of behavior on which judges could agree. An educational objective which specifies an open-ended evaluation procedure can be assigned to this category only if the criteria by which said responses are to be judged have been clearly stated. Objectives which utilize some sort of forced choice evaluation procedures are automatically acceptable.

Abstraction-Operational Scale: Examples

1. "To give an individual the opportunity to experience many different sports." (Problem I) "To teach the children the pledge of allegiance." (Note: in these examples it is assumed that there is no attempt made elsewhere in the paper to suggest a relationship between these behaviors and the problem. "Experiencing many sports" would be scored higher than a "1" if the student went on to suggest that "experience sports" could be used as a means to establish such pre-reading concepts as "baseball," "football," "bat," etc.)

2. "To foster creative expression." (Problem I) "To facilitate reading readiness." (Problem II)

3. These examples are from Mager's discussion of educational objectives (Mager, 1961, p.11).

3	4
Words Open to Many Interpretations	Words Open to Fewer Interpretations
To know	To write
To understand	To recite
To really understand	To identify
To appreciate	To differentiate
To fully appreciate	To solve
To grasp the significance of	To construct
To enjoy	To list
To believe	To compare
To have faith in	To contrast

4. "The children will be taught to tell stories which are creative." (Problem I)

5. "The children will be taught to tell stories which are based on some detail which is not directly observable in the picture but the existence of which can be inferred." (Problem I) "The children will learn to correctly name pictures which represent readiness concepts (e. g., bail, cow, train, etc.)" (Problem II)

APPENDIX B: APPLICATION OF KNOWLEDGE SCALE (A-K)

APPLICATION OF KNOWLEDGE SCALE (A-K)

Scores on this variable will be based on the ability of the student to analyze the situation into its significant componants (e. g., to recognize the variables which are operating or may be introduced to obtain stated objectives), to see the relationships among such variables, and to develop generalizations based on these relationships.

Scoring: The unit of analysis will be each variable suggested by the subject as having some relevance to the problem. The discussion of each variable will be rated on the scale below.

1. Recognizes a variable; no attempt to apply it. Student acknowledged some variable (either psychological or situational but makes none of the following kinds of generalizations about it):

a. No statement hypothesized about the effect of this variable on some desired behavior (e. g., to one of the objectives stated in Section I).

b. No statement of a correlation with one of the objectives stated in Section I.

c. No statement about how this particular variable might interact with the effects of some other independent variable which is known to or has been hypothesized to have some effect on one of the behaviors described in Section I.

2. Stereotyped application. An idea which is based on neither empirical data nor any degree of sensitivity to the uniqueness and individuality of the students. No allowance is made for the dev-

opmental level of the students cognitive and language abilities, their span of attention, or any other variable which is prominent in this age group. The application which is suggested could just as well be applied to sixth graders as to pre-schoolers or perhaps even to college students or white rats.

3_a. A deductive application of psychology; an idea which is based on psychological data probably (but not necessarily) one of the studies presented in Problems I and II. Unlike (4) and (5), no attempt has been made to modify or adapt the ideas in a way that takes into account the unique attributes of the situation (e. g., developmental variables, sex differences, group structure and leadership, etc.).

Obviously, there are an almost infinite number of psychological studies on which the student could be basing any given idea. The overlap of these findings and "common sense" psychology is probably great enough that it would be virtually impossible to distinguish this category from category (2) unless some specific guidelines are used. The following guidelines seem defensible in this situation:

(1) Responses based on the studies by Judson, Maltzman, Torrance, and Carpenter (all of which were discussed in the problems and programs) will be assigned to category 3 even if the student fails to specifically state that the idea is based on data.

(2) For ideas which are based on other studies, some evidence is required that the student view what he has done as derived

from a psychological study (e. g., "we learned in Psychology 230 . . ." or studies on "creativity have shown . . .").

3_b. Sensitive to situational variables. An idea that takes account of the unique attributes of the situation (e. g., developmental variables, sex differences, personality, group structure and leadership, etc.). Such applications do take into account the uniqueness and individuality of the situation but seem to be based solely on the student's observations; e. g., no use is made of relevant psychological data. Only one attribute of the situation need be considered to receive a score of 3.0 but less than 4.0.

4. An inductive application of psychology I. As in 3_a this must be an idea which is based on psychological data, probably (but not necessarily) one of the studies presented in Problems I and II. As in 3_b there must be some evidence that the idea has been modified to take into account the unique attributes of the situation (e. g., developmental variables, sex differences, group structure and leadership, etc.). Any attempt to apply psychological data which shows any sensitivity at all to the situation would receive a 4 no matter how feeble the attempt may have been. Some credit may be given for productivity of ideas but productivity alone is not to be used as a basis for assigning Ss to category 5.

5. An inductive application of psychology II. As in 3_a this must be an idea which is based on psychological data probably (but not necessarily) one of the studies presented in Problems I and II. As in 3_b there must be some evidence that the idea has

been modified to taken into account the unique attributes of the situation (e. g., developmental variables, sex differences, group structure and leadership, etc.). The differences between 5 and 4 is the quality of answer accepted. Whereas even the feeblest attempt at developing an idea based on psychological facts and observations of the situation would receive a score of 4; category 5 is reserved for ideas which reflect a detailed insight into the study in question and the situation itself. In papers in which many ideas are presented, at least one idea must meet the criteria for category 5 before the category may be used.

Unit of Response for A-K and R Scales

Before rating you are to divide Section II into units. Each unit should constitute a complete plan. If you feel the student had intended that a series of ideas be used together to constitute a single teaching plan, then you are to make one rating for the entire series of ideas. Do not feel compelled to honor the student's numbering of items in this regard. Ideas numbered in a series may constitute a series of related ideas, or a single unified plan, or some combination of these. It is up to you to decide which ideas belong together.

APPENDIX C: RELEVANCE SCALE

R SCALE

RELEVANCE SCALE (R).

Each idea which is suggested in Section II will be rated as to how well it is related to the stated objective in Section I.

1. Irrelevant. No relation stated (or implied) to any of the objectives in Part I, nor is there any reason to suppose that such a relation exists.

2. Relevance not implied. A relation is not clearly specified, or even implied; but it seems logical (to the rater) that such a relationship may in fact exist.

3. Relevance stated or implied. It is obvious that the student views the ideas which he suggests in Section II as being related to the objectives he has stated in Section I. This relationship may be stated directly or merely implied by the general format of the paper. Any format which implied that A (the idea in question) will result in B (one of the objectives in Section I) is acceptable. The implication of this sort of format is that a causal relationship exists between A and B and that the student is aware of this relationship. In contrast to 4, the student's response does not suggest that he feels the idea was derived from the objective; he could have made use of this same causal relationship with the objective stated in a variety of other ways.

4. Derivation implied. It is clear that the student's idea (Section II) could not have been formulated had the objective (Section I) been stated differently. The operationalization of the objective has apparently suggested an idea which the student

probably wouldn't have thought of otherwise. The student does not state in so many words that the idea was derived from the objective; hence we cannot be certain that he was aware of the process occurring.

5. Derivation stated. It is clear that the student's data (Section II) could not have been formulated had the objective (Section I) been stated differently. Unlike 4 the student is fully aware that the idea was derived from the objective.

APPENDIX D: THEORY OF LEARNING ON WHICH THE PROGRAMS WERE BASED

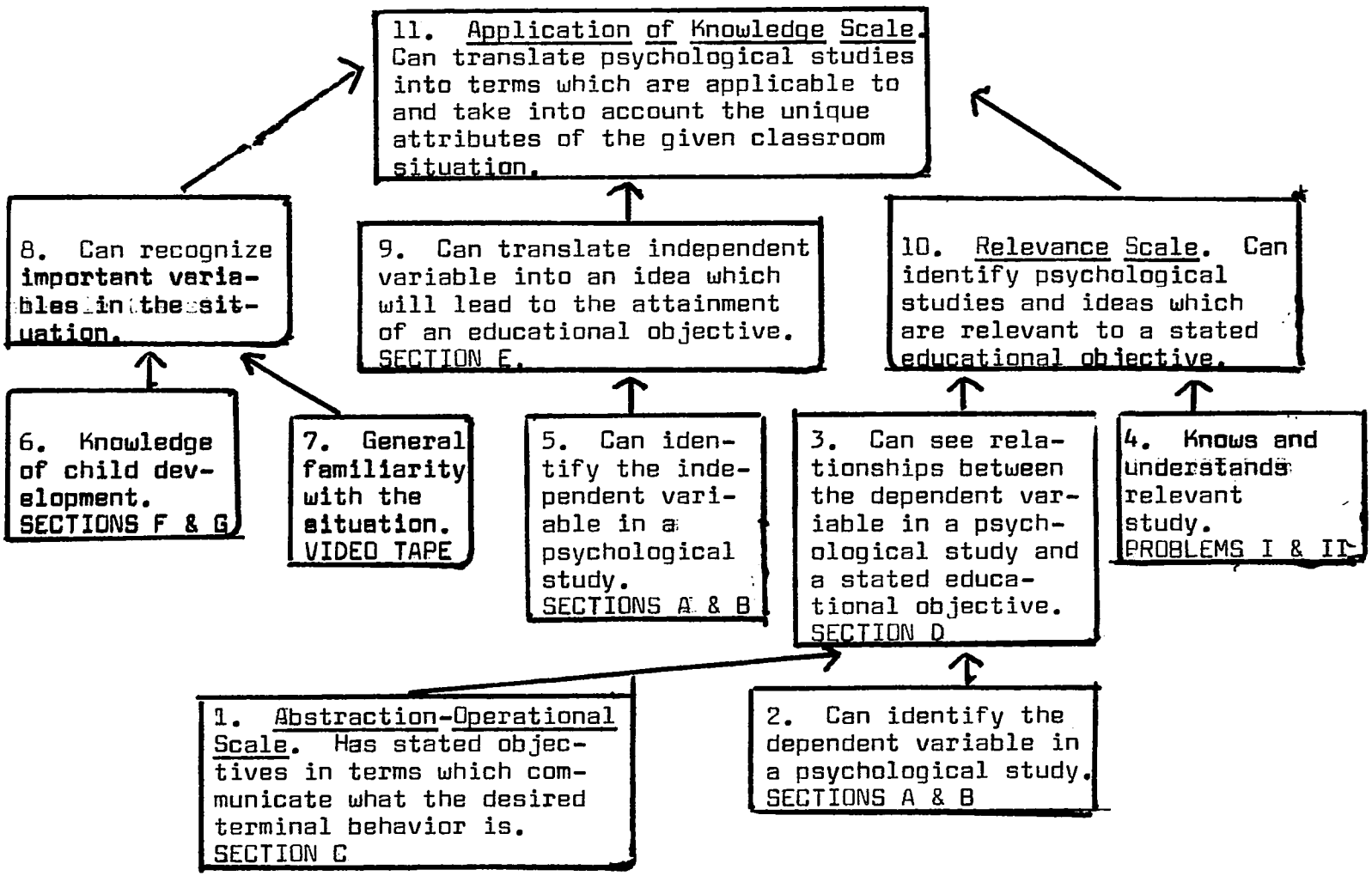

Figure 1 : Theory of learning on which the programs were based .

APPENDIX E: INDUCTIVE APPLICATIONS OF PSYCHOLOGICAL KNOWLEDGE PROGRAM (I-A-P-K)

Section E: Formulating Hypotheses about Classroom Problems:
Psychological Studies as a Source of Independent Variables

Purpose: To provide the student with practice in finding an independent variable which is relevant to a stated educational objective.

Instructions: You will need a copy of the textbook for Psychology 333 (McDonald, Educational Psychology). In order to find ideas in psychology which are relevant to a given educational objective, you need to learn to read a psychology text with a particular question in mind. In this section the given educational objective is "to teach the children to tell stories which are original or creative." The question to keep in mind is, "What sorts of independent variables have psychologists manipulated or changed to produce a corresponding change in original behavior."

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First let's review briefly some concepts you have already learned which are relevant to the purpose of this section. A hypothesis is a statement of a relationship between two or more variables expressed in the form "if A, then B." In the hypothesis "if A, then B," A is the (a) _____ variable and B is the (b) _____ variable.

See next frame for the correct answers.

(a) Independent

(b) dependent

Recall the situation you saw depicted on video tape. We have already established that one possible educational objective in this situation could be "to encourage the children to tell creative or original stories in response to pictures." Suppose you are a psychologist called in to consult with the teacher about various ways of teaching the children how to tell stories which are original. You would think of any proposed solution as an (a) _____. The teacher's objective (original stories) would be the (b) _____ variable. Any proposed change in the classroom environment which is designed to cause or produce an original story would be the (c) _____ variable.

Now see frame 37 for the correct answer.

Answers to frame 36:

(a) hypothesis

(b) dependent

(c) independent

Now lets look at some ideas which psychologists have tried which are possible ways of producing or causing an original or creative response. Read the discussion of the Judson, Cofer, and Gelfand experiment on pp. 294-295 in you textbook. This discussion beings with "So far the experimental work . . ." Keep the following question in mind as you read: "What independent variable is suggested as a possible way of producing original or creative behavior?"

When you have read the discussion turn to frame 38.

In the Judson, Cofer, and Gelfand experiment the dependent variable is:

(circle the correct response)

a. association strength of an original response

b. solving the problem in a way which is original or creative

c. free association to a list of words

Now for the answer see frame 39.

(b) is correct

The dependent variable was an original response. If you missed this, it may have been because you didn't think of "using a heavy object as a pendulum bob" as being original. This solution is original because it is both infrequent and relevant. It is infrequent because few people would ordinarily propose such an idea if other alternatives were present. It is relevant because it is a way of solving the problem.

If you picked (a) you may still be unclear about the concept "dependent variable". The original response "using a heavy object as a pendulum bob" is the dependent variable because it <u>depends</u> on "associative strength". Another way of putting this is to say that the original response "using a pendulum bob ... etc." is (<u>likely/unlikely</u>) to occur if the child free associates to a list of words which is <u>unrelated</u> to the solution.

See frame 40 for the correct answer.

Answer to frame 39 : "unlikely". The original response is likely only when the associative strength of the original response is increased by presenting a list of words which cues or suggests the idea of "using a heavy object for a pendulum bob."

Now that we have established the dependent variable, what is the independent variable? (Hint: What variable does Judson's study suggest as a possible means of teaching children to be creative or original?) The independent variable is _____ _____ .

Now see frame 41 for the answer.

The associative strength of an original response is correct since associative strength is varied by the experimenter in an effort to produce a change in original creative behavior.

In this section we have suggested a way of reading a psychology text when you are looking for a new way of attaining an educational objective (e.g., of teaching children some specified behavior). The question you must ask is "What is the independent variable which this study has found to produce a change in the kind of behavior I want to generate in my students?" Asking this question is the first step in any application of psychology. You will find as you read section F that there is something else you must do as well.

Now see Section F.

Section F. Formulating Hypotheses about Classroom Problems: Operationalizing the Independent Variable for a Particular Classroom Situation

Purpose: Given a psychological study which is relevant to a stated educational objective and the independent variable in the study, the student will be shown how to do the following::

1. translate the independent variable into terms which are compatible with a specified teaching situation.
2. formulate several alternative approaches, each of which constitutes a slightly different translation of the independent variable.

What this really amounts to is an attempt to teach you to use psychological knowledge as a means of generating your own ideas about teaching students.

Instructions: You will probably find that this portion of the program requires somewhat more thought than the sections you completed earlier. Other students who have worked on this section reported that it might be helpful to know ahead of time that you are expected to spend a good deal of time thinking about your answers before you write. On questions which ask you to think of several different ways of doing something, try very hard to think of as many possibilities as you can, don't be satisfied with just one answer. Finally, don't become discouraged if you seem to be making too many mistakes. Instead read the feedback frames carefully. If you're the sort of person who likes to think of new ways to do things, I think you'll enjoy this section.

If we try to apply the independent variable "associative strength of an original response" as a means of getting our group of preschool children to tell stories which are original, then we will have to re-operationalize the concept "associative strength" in a way which will fit the particular situation in which we are working.

In this instance there are probably (a) _____ operational definitions which could be appropriate. This is so because there are (b) _____ factors or variables which are present in the classroom which are different than the variables and conditions under which Judson did his experiment.

See frame 44 for the answers.

Answers to frame 43: (a) many

(b) many

In the space provided below write down several differences between the situation in which Judson conducted his experiment and the situation you saw on video tape (feel free to refer to the text if you've forgotten some of the conditions of the experiment or any notes you may have taken on the video tape).

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Now see next frame.

Answer to frame 44:

There are many factors or variables which are quite different in the Judson experiment and in our attempt to teach preschoolers to tell creative stories. The particular ones you have focused on reflect to some extent such factors as your own interests, knowledge of children, etc. Because we can't possibly look at everything which is going on, I've suggested just a few variables which I think are worth developing.

1. Variables which involve the developmental level of the child:
   a. Age
   b. Language development
   c. Attention span
   d. Interests and motivation
2. Variables which involve the teaching approach which is being used:
   a. The medium of presentation or materials (i. e., pictures)
   b. The social interaction of the children with each other and with the teacher.

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All of the following are operational definitions of "the associative strength of an original response." All might be appropriate manipulations of the situation in the problem, but some are better than others in that they reveal a greater sensitivity to the variables which are operating in the situation. Your job is to find the situational variables which have been ignored in some of these manipulations. Please write your reason for objecting to or agreeing with each manipulation in the space provided. After you have written each answer, refer to the feedback frame which is directly below. Be sure to check your answer before you proceed to the next example.

(a) Ask the child to free associate to the following list of words as you write them on the board:

Underwater train

Engineer

Passenger

Mad scientist

Experiment

Write answer here:_____

_____

See frame 48.

(b) The same list of words in (a) is presented verbally (e. g., teacher says the word, child responds).

Write answer here:_____

_____

See frame 49.

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(c) Ask the child to free associate to the following list of words which are presented verbally by the teacher:

train

bridge

accident

Write answer here:_____

_____

See frame 50.

(d) Ask the child to free associate to the following list of words which are presented verbally by the teacher:

railroad engineer

boat

underwater train

Write your answer here:_____

_____

Now see frame 51.

100

(a) The child can't read. Now proceed to example (b).

(b) The child's vocabulary may not be adequate (see e. g., scientist, experiment). Now proceed to example (c).

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(c) None of these words constitute original responses to the question. If you missed this, go back over page 293 of McDonald. Now proceed to example (d) frame 47.

(d) All these words could be used in an "original" response or story (e. g., railroad engineer is a detail which is only implied, hence to focus on what the engineer did, how he reacted, etc. would lead to a story which, at this age level, would probably be judged creative. Boat would be used to generate an ingenious way to surmount the difficulty of the broken bridge. Underwater train is a little fanciful, but recall that these are young children. If some of these solutions don't strike you as creative, recall the age level of the children. The only problem with this solution that I can discern is the question of vocabulary. It is very difficult to think of a way to find words which we can safely assume are in the vocabulary of a preschooler which would cue an original story. Check the box which best expresses your attitude at this point.

(1) I can think of some words which are within the vocabulary of the average preschooler which I think would cue an original story.

See frame 52.

(2) I can't think of any appropriate words, but I can think of a different way of operationalizing the independent variable "associative strength of an original response" which I think would work better than asking the child to free associate to a list of words.

See frame 53.

(3) I fail to see any way of operationalizing the independent variable "associative strength of an original response" in any way which makes sense in this particular situation.

See frame 54.

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Good for you! I guess you're more imaginative than I am. If you don't mind, I'd like to use your idea in the next revision of the program. Please write the words you thought of in the spaces provided and state briefly what sort of a story you think each would cue off.

Now look at frame 54 for some suggestions about other ways of operationalizing "association strength of an original response."

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Very good! Please write your idea in the space provided.

Proceed to frame 55.

Let's consider some new possibilities. Up to this point we have considered only examples of manipulations which are derived from Judson's study with no real attempt to re-operationalize them to fit the particular situation with which we are working. Let's look carefully at some things we know about preschoolers.

First, we know from studies of intelligence of preschoolers that they typically have more difficulty with items involving spoken vocabulary, understanding directions, and abstract verbal problems than they do with picture vocabulary items, items which invoke eye-hand coordination etc. One way of generalizing these facts is to say that preschoolers have difficulty with _____ items or tasks.

See frame 55 for the correct answer.

Answer to frame 54: verbal

Preschoolers are not very verbal. They seem to understand and perhaps to think better in visual images and concrete experiences than they do with words.

The preceding statements suggest that we might have more success if we operationalized the independent variable, "association strength of an original response" in terms of _____

_____

_____

_____.

After you write your answer, see frame 56.

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There are many different ways of stating the answer to this question, but anything which captured the basic idea that some medium of expression other than verbal ought to be tried is basically correct.

Now suggest some specific media or materials you would like to see tried and tell specifically how you would use them. Don't be satisfied with just one. Try to think of as many ideas as you can. Write your answers in the space provided.

Instead of "free associating to words" the children could:

1. _____
_____.
2. _____
_____.
3. _____
_____.
4. _____
_____.
5. _____
_____.

After you have written your answers, proceed to frame 57

Again there are lots of possibilities. Here are just a few which occurred to me.

Instead of free associating to a list of words, the children could:

1. Show the children a series of pictures such that each in the series should cue off an original response to the one which follows it.

   Example: Show picture of the Easter bunny riding on a train, then show a picture of the train approaching the bridge which is broken.

2. Be provided with special play equipment related to unique or unusual ways of solving the problem of the broken track. A folding bridge or drawbridge would be one such toy.

3. Provided with appropriate playhouse which looks like a railroad engineer cab, passenger car, etc., the children are asked to play various roles, such as, engineer, conductor, etc. Such role playing should increase the probability that the child would consider details of the picture which are only implied, e. g., the presence of people in the train. Stories based on such details would be considered original in the sense that they seldom occur and are relevant to the situation.

Did you get any new ideas from these examples? (Check the appropriate box.)

☐ Yes. Proceed to frame 58.

☐ No. Proceed to frame 59.

110

If you have some ideas you think are worth a try, write them in the spaces provided.

_____

_____

_____

_____.

Now see frame 59.

111

I don't believe we've exhausted the possibilities for using the independent variable "associative strength of an original response." If you couldn't think of any new ideas, maybe you haven't quite gotten the idea yet. What I'm trying to get you to do is to take an independent variable which is relevant to your purpose, translate it into terms which fit the particular subject matter and the students with whom you are working, and use it as a working hypothesis which you can actually test in the classroom. What you are looking for in this specific situation is a teaching plan or manipulation which fulfills the following criteria:

1. Makes use of some non-verbal media of presentation.
2. Maintains the essential quality of Judson's independent variable (that is, it must be a manipulation which provides some experience with a stimulus or situation which may cue an original response).
3. Is different in some respect from the examples in Frame 57.

Now think of a plan or manipulation which fits the criteria above. Write your answer in the space provided.

_____

_____

_____.

Turn to frame 60.

It is quite possible, of course, that you have thought of some ideas which are quite different from those which occurred to me. If so fine! Just be sure your idea involves a medium of presentation which is non-verbal, and that it increases the associative strength of an original response. Frankly, my creative capacities are beginning to be a bit stretched by this exercise, too; but here are a couple of ideas:

1. Example 1 on 97 suggests to me the idea that the story might cue off an original response to another. So how about telling the children stories which could cue off an original response.
2. Example 2 suggests numerous variations on the theme of using play equipment to cue off an original response; i. e., if the child plays with a boat just before seeing the picture, he might very well suggest the use of a boat to carry the train across the water. Such an answer would certainly meet our criteria for "originality."
3. Role play could also be used in an almost infinite variety of ways; e. g., you could ask one of the children to pretend he is an Easter bunny, etc.

Section G. Some Additional Practice in Finding Independent Variables

Purpose: To provide some additional practice with some of the concepts which have been presented earlier in this program.

As in Section F, you will be asked to think of ways of translating the independent variable in a psychological study into terms which fit a particular classroom situation. We want to provide you with practice in generating as many new ideas as possible from each study.

Now reread McDonald's discussion of the experiment by Maltzman below:

"In other studies Maltzman and his associates found that when subjects were instructed to be original and were trained in making original responses, they were better able to solve problems requiring original responses. In one of these experiments they compared two different methods: (1) making many different responses to the same stimulus and (2) making different responses to different stimuli. Though Maltzman found both methods effective, the first method produced greater transfer effects."

Try to approach the material in the manner suggested in the summary above. To see if you have gotten the right idea, try to answer the following question:

In these experiments, the dependent variable was _____.

See frame 63.

Answer to frame 62: Making an original response.

The studies by Maltzman are similar to the situation you saw on video tape in that they_____.

Go to next frame for the answer.

Answer to 63:

Have the same purpose or objective,

Have the same dependent variable, or

Seek to produce a change in original behavior.

Two independent variables were shown to be successful in producing changes in the Maltzman experiments. These were (a)_____ _____and (b)_____ _____.

See answers in frame 65.

Answers to frame 64:

(a) training in originality

(b) the instruction to be original.

Let's try to devise an "originality" instruction for children at this age level. First, from what we already know about the children in this group, suggest some characteristics or attributes which a good creativity instruction should possess. List as many as you can think of.

_____

_____

_____

_____

_____

Proceed to frame 66.

When working with children of this age, it might be rather difficult to devise any instruction which could be counted on to communicate your intent. But let's not just give up. At least we can think of some desirable attributes which such an instruction should possess. Here's one that seems important to me. Perhaps you thought of others.

1. We know that children at this age have difficulty with verbal instructions, test items, etc. So we need to consider the possibility of an instruction which is non-verbal.

From your previous work in psychology, can you think of any experimental technique for making a non-verbal instruction. (Hint: how they are supposed to ?)

_____

_____

_____.

Proceed to frame 67

Well this was a tough one. Do you recall the technique of operant conditioning devised by Skinner. When a pigeon pecks at a bar, he is rewarded by a food pellet. In this situation each rewarded response (bar press) increases the probability of that particular response being emitted again. In effect operant conditioning is a way of telling the pigeon what he is supposed to do. See if you can translate this kind of an instruction into one which would work with preschool children.

Write your answer in the space below:

See frame 68.

120

The answer you wrote in the previous frame should contain most of the following points:

1. The concept with which we want to work is operant conditioning or learning for a reward. If we want a child to learn to be creative, we tell him so by rewarding creative responses.
2. Of course, some translation of the specifics of the bar pressing situation is needed. First, let's consider the type of reward. Obviously we couldn't use food pellets as a reward for children. But why not candy, 10 cent toys, or praise? There are many possible rewards which might be used in addition to the ones I've mentioned.
3. One problem which may not have occurred to you but would certainly become apparent if you ever found yourself trying to reward "creative behavior" in preschool children is that of being certain that you are rewarding only creative behavior. It's much easier to know when a pigeon is pushing a bar than to know when a child is being creative. Having a good operational definition of creativity is the first step towards knowing which responses to reinforce. Assuming the teachers have been trained to identify creative responses when they see them, what would be another difficulty you might encounter. (Hint: Recall the video tape you saw. Did you notice anything which might be relevant to this question?)

Write your answer here:_____

_____

_____

_____

See frame 69.

The problem is that very frequently more than one child is responding at the same time. It would be next to impossible for the teacher to reward all the creative responses of all the children. Now in the space provided, write as many ways as you can think of to deal with this problem. (Hint: Recall the things you know about operant conditioning: how has it been applied in education, what do we know from operant conditioning studies about the cases in which we can't reward every response which the pigeon (rat, or child) makes? If you feel you need more information before you can answer the question, see McDonald's discussion of schedules of reinforcement on p. 403 and/or the discussion of programmed instruction on pp. 93-98.)

1. _____

_____.

2. _____

_____.

3. _____

_____.

4. _____

_____.

5. _____

_____.

After you write your answer,
see frame 70.

There are many things you might have suggested. Here are a few possibilities:

1. Make use of individual tutors, such as, we did on the tape. This is, of course, a rather inefficient use of personnel.
2. Write a learning program designed for children of this age level. With the aid of modern computer facilities and audio-visual aids, such a program is certainly possible. Learning programs don't necessarily have to be read. They can just as well be seen on movies with feedback provided by a computer. Several such programs are already on the market.
3. Even if additional tutors, computers, movies, etc. aren't available, the problem isn't insolvable. We know from basic research that every response doesn't have to be rewarded. Rewarding a response every so often may even produce more learning. So the teacher doesn't have to reward every creative response a child makes. She must be sure, however, to distribute rewards among all members of the class; e. g., she must avoid providing one child with all the praise while other children's responses go unnoticed.

APPENDIX F: SPECIFICATION OF EDUCATIONAL OBJECTIVES PROGRAM (S-E-O)

Applying Psychological Knowledge in the Classroom

Reed Mencke

Iowa State University

[illegible]

The learning process is a test of a new idea about how to teach [illegible] psychology. We believe that students would enjoy psychology courses more if they were given more opportunities to try their hand at making applications of the facts which we presented.

Prior to beginning this program you were shown a video tape of some [illegible] children learning to tell stories. From time to time we will refer to this tape. You will be asked to use your imagination to formulate [illegible] might be done to teach these children to tell stories "[illegible]" or "creative". To help you do this you will read several [illegible] in the text which deal with psychological studies of creativity [illegible]. Next you will be given practice in generating ideas about how [illegible] creativity which are based on the studies in the text. Finally, [illegible] will provide you with feedback to help guide your thinking and to [illegible] further thought about the problem.

Before we begin I suppose a word of apology is in order to those of you [illegible] interested in educating older children, adolescents or adults. [illegible] already mentioned, this program is only a first attempt. Because of this [illegible] have had to limit ourselves to one problem at only one age level. Ideally [illegible] a range of problems in various areas of education. I [illegible] however that you will find in this program the tools you need [illegible] at any educational level. Given these tools you should [illegible] continue the job on your own.

[illegible] Identifying Hypothesis. After all that talk about thinking like a psychologist, making creative applications of psychological studies, I can't wonder why the very first section takes us with a dry, unappealing title as "Identifying Hypothesis." The purpose of this discussion is to provide you with some basic terminology and a review of the concepts of hypothesis, independent variables, and dependent variables. You will need an understanding of these terms to understand the subsequent sections. This is Section I of Unit II, in which the nature of a classroom problem can be clarified by identification of the piece of behavior we want to change as a dependent variable (I'll call it variable Y and I'll show you how to use the independent variable as a behavioral study as a tool to generate ideas about the control of what you're trying).

Proceed to the next page

I30

a. It is a statement of relation between two variables
(using, teaching, children and getting good grades).

b. It predicts that one variable (teaching children) produces
a change in another variable (grades). This relationship is stated
in an "if A, then B" format to make the relationship clear.

[illegible] subject, and I know how to teach it."
(The above statement is important.)

[illegible] what work?

[illegible]

[illegible] to focus in the current answer.

While two variables are mentioned in the statement (e.g., mastery of subject matter and understanding of teaching techniques), there is no statement as to how these variables may be related.

Now rewrite the above items so that it is a reasonable hypothesis.

(Write your answer here)

See page 7 for the correct answer.

There are many possible ways of rewriting this. All have in common the characteristic that some relationship between the two variables is specified.

Examples:

(a) "Because I know my subject matter, I will also be a good teacher."

(b) "Because I am a good teacher, I know my subject matter."

Several of the students who participated in the preliminary trials of the [illegible] have objected to this frame on the grounds that they didn't feel [illegible] the above alternatives (usually a) seemed unreasonable to them. If this is your reaction please note that there is no one way this statement had to be written. Any statement which specifies that one of the two variables depends on the other would be acceptable. For example if you don't agree with either of the examples above there is at least one further possibility I can think of:

(c) "If I do not know my subject matter, then I will not be a good teacher".

Any hypothesis is acceptable which has not already been disproven. As you see in Section C it is very unlikely that any of the above hypothesis have been disproven since terms such as "knowing subject matter" and "good teachers" are much too abstract to be evaluated in any objective manner."

Now proceed to Section B.

Section 8 The Essential Ingredients of a Hypothesis: Independent and Dependent Variable

The essence of classroom experimentation is to produce a change in one variable and study the effect of this variation on changes in a second variable. Two technical terms will be useful here. The independent variable, is the one deliberately varied. The dependent variable is the variable changed by the independent variable. When hypotheses are stated in standard form, the independent variable is readily identified; it is the variable in the "if" clause. In the hypothesis 'if someone makes overt responses while learning, then learning will be faster," the dependent variable is speed of learning.

The dependent variable is the variable in the "then" clause. Thus in the hypothesis "if someone makes overt responses while learning, then learning will proceed more rapidly," "speed of learning" is the (a) _____ variable because speed of learning is changed or increased by overt responding. Another way to state this hypothesis would be to say that "speed of learning" (b) _____ whether or not the responses during learning are (c) _____ or covert.

See frame 9 for the correct answer

(a) dependent

(b) depends on, is dependent on

(c) event

Mr. Thornton wishes to test the following hypothesis: students who study in groups obtain better grades in geography than those who study alone. He uses two sets of students. The students in the first group study alone; those in the second study in groups of three.

The dependent variable in this hypothesis is _____

_____

(See the answer in frame 10.)

The independent variable in this experiment is _____

_____

(See frame 11.)

The dependent variable is grades. If you missed this read the explanation below before you continue.

If you missed this you probably said that one of the study groups was the dependent variable. If a study group were the dependent variable, then something about the group would have to depend on the independent variable. Consider the possibilities this accords to the hypothesis. Does study group depend on grades? Does being in one group depend in some way on being in the other? Not really. But grades do depend on something. Grades depend on _____ which is the independent variable.

See frame 11 for the correct answer

a [illegible] variable might be referred to as "method of studying groups or individuals" or it could be called "studying to prevent".

Recall the situation depicted on video tape which you saw prior to starting this program. Read the following problem which refers to this situation.

Problem 1: Suppose the teacher's stated objective was "to increase the child's creative imagination." To what extent is the goal being realized? How would you alter the situation to make the realization of the teacher's goal more probable? Suggest some specific ways in which you would evaluate the realization of such a goal. What variables which are operating in the situation would have to be controlled and how would you go about doing this?

If a psychologist were to read this problem, he would think of any proposed solution as a hypothesis. The teacher's objective would be the dependent variable and any proposed change in the classroom environment which is designed to produce this change would be the independent variable. See Frame 11 for the answers.

Section C. Stating Educational Objectives in Term of Observable Behavior: The Concept of an "Operational Definition."

An educational objective is a statement about desired behavior change. Such a statement can be formulated at many different levels of abstraction. Which of the following three educational objectives is most abstract and which is least abstract?

(a) We want pupils to initiate educational projects on their own; to refer to outside sources of information in addition to reading the text; and to ask relevant questions during class time.

(b) We want pupils to have an appetite for learning.

(c) We want pupils to show a real interest in their assignments, e.g., to go beyond what is demanded of them.

Write the letter of the objectives you feel is most abstract and least abstract in the space provided.

Most abstract _____

Least abstract _____

Now turn to frame 15 for the correct answers

[illegible]

[illegible]

[illegible] an educational [illegible] possible behaviors [illegible] has been [illegible] very clear [illegible]

While we may agree [illegible] on "appetite for learning," such [illegible] behavior [illegible] an individual [illegible] for learning," [illegible] know how such [illegible] feel, [illegible] to answer the question, [illegible] or [illegible] appetite [illegible] have [illegible] organize [illegible] taste [illegible]

[illegible] for teaching [illegible] ______________________ [illegible] behavior changes. These objectives should not [illegible] ______________________ [illegible] can proceed, [illegible] the desired changes [illegible] terms of (c)______________.

[illegible] next frame [illegible]

(a) educational

(b) abstract or indefinite

(c) behaviors, actions, or responses

Recall the situation you saw on video tape. Suppose you are the school psychologist called in to consult with the teacher in this class. She tells you her educational objective is to teach the children to tell stories which are original and creative. So long as the educational objective is stated in this way, it will be difficult to devise a learning experience which will be successful. This is so because the educational objective "telling original stories" is stated in terms which are too (a)_____. Before making any suggestions, the psychologist will have to define this objective in terms of (b)_____.

See next frame for answers.

(a) abstract

(b) behavior

By behavior we mean what the [illegible] will [illegible] achieved the objective. Since the [illegible] can decide on the kinds of stories they will consider [illegible] or "rational," it will be impossible to communicate [illegible] to proceed.

Let's leave the teacher and the psychologist [illegible] what sorts of stories they will consider "[illegible]" for just a moment, so that I can introduce you to [illegible] term is operationalize. The general meaning [illegible] difficult to define; to operationalize simply [illegible] or to make something [illegible]. When we define [illegible] in abstract terms, it is difficult to communicate to [illegible] what is expected of [illegible]. Even if [illegible] abstract terms is [illegible] of fostering good [illegible].

See the next [illegible] for answer.

"operable" or "operational"

When we find an educational objective stated in abstract terms, we must restate it in terms of observable behavior before we will be able to construct a learning situation which will work. When we do this, we are really _____ the educational objective in question.

See the next frame for [illegible],

operationalizing

Which of the following educational objectives are operationalized? That is, which are stated in terms of specific behavior so that it will be possible to communicate to the learner exactly what is expected of him? Be sure to write all your answers <u>before</u> you turn to frame 20.

		Yes	No
(a)	To understand the principles of salesmanship.	____	____
(b)	To be able to write three examples of the logical fallacy of the undistributed middle.	____	____
(c)	To grasp the significance of Ohm's Law.	____	____
(d)	To be able to name the bones of the body.	____	____
(e)	To be able to list the principles of secondary school administration.	____	____
(f)	To know the plays of Shakespeare. Evidence of the student's knowledge will be obtained from a written essay.	____	____
(g)	To <u>really</u> understand the law of magnetism.	____	____
(h)	To be able to identify instructional objectives that indicate what the learner will be doing when demonstrating achievement of the objective.	____	____
(i)	To be creative.	____	____

See frame 20 for the correct answers.

Here are the correct answers to frame 19.

(a) No

(b) Yes

(c) No

(d) Yes

(e) Yes

(f) No

(g) No

(h) Yes

(i) No

If you missed (f), proceed to frame 21; otherwise, go to Section D.

(f) Recall that you were to say whether or not the following statement is specified in behavioral terms: "To know the plays of Shakespeare. Evidence of the student's knowledge will be obtained from a written essay."

Saying that the student's knowledge of Shakespeare will be evaluated on the basis of his behavior on an essay exam does meet the criterion of being an act of observable behavior so in a sense you are correct. The problem with statement (f) is that just being able to "write an essay" is not the behavior which is relevant to the teacher's particular definition of "knowing the plays of Shakespeare." Unless you are willing to give everyone an A who just writes the essay, you had better specify what categories of behavior you want the student to include (e. g., do you want him to compare the plays on different dimensions, to give the plot of each play, or just to name all the plays?). If you don't specify the behavior you want, how is the student supposed to know which of the preceding points to include, and how would you compare students who perceived the question in different ways?

Is the following definition of creativity operationalized? Tell why you think it is or is not operational.

Children will be asked to make up a story based on a given picture. Originality or creativity will be assessed on the basis of the story they tell.

Check the appropriate box, then write your reason.

Is operational ☐

Not operational ☐

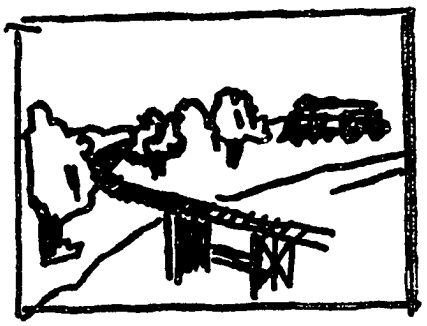
Reason: _____

See frame 22.

answer to frame 21. Saying that the originality or creativity will be assessed on the basis of the story the children tell is not an operational definition or the same reason that "an essay on Shakespeare" is not an operational definition of one's knowledge of Shakespeare. Unless we are willing to consider any story which the children tell as creative, then we really haven't said what kinds of behavior we are looking for. The teacher and the psychologist must put together on some criteria which they can use to decide which stories the children tell are creative and which are not. This is exactly where we left them back in frame 17.

Now let's proceed to Section C in which you will learn about some criteria for judging creativity which are based on psychological research. You will also see how these criteria can be transformed to fit the requirements of a particular classroom, group of students, etc, without changing their basic meaning.

Display I



Here are some things the children actually said in response to the picture shown above. In the frames which immediately follow, you will be concerned with developing criteria for judging which of these responses is creative. Feel free to refer back to this display as you answer the questions in this section.

1. Its a train.
2. The train will fall off the track.
3. Easter bunny is riding on the train to take some Easter eggs to Chicago.
4. It's an airplane flying to Chicago.
5. The train got out of the water because there was a bridge that went up and down in the water.
6. The story of the choo-choo train.
7. The track broke off. That's what happened!
8. Octopus ate the candy that fell in the water.

Read pp. 293-294 of McDonald with the following questions in mind

(no answer required at this point).

(a) What is creativity or originality?

(b) What specific criteria must a response meet in order to be judged "creative"?

After you have read these pages, proceed to frame 26.

[illegible] defining attributes of an artificial [illegible]

[illegible]?

[illegible] your answer here:

1. _____

_____

2. _____

_____

(Ref. Person 17)

[illegible]

1. occurs infrequently; that is, it is unusual in such conditions.

2. is relevant to the conditions.

If you believe either of these two, [illegible]

[illegible]

[illegible] Display I. Study carefully [illegible] [illegible] recorded. Then look at the responses [illegible] [illegible] this picture. In the space provided [illegible] [illegible] would or would not be considered unusual.

Unusual

[illegible] No

______ ______ 1. It's a train.

______ ______ 2. The train [illegible] off the track.

______ ______ 3. Easter bunny [illegible] some Easter eggs [illegible].

______ ______ 4. It's an airplane [illegible].

______ ______ 5. The train [illegible] there was a bridge [illegible].

______ ______ 6. The story of [illegible] train.

______ ______ 7. The track broke off. That's [illegible].

______ ______ 8. Octopus [illegible] the [illegible] fell [illegible].

See frame [illegible] for the [illegible].

[illegible] way the author intended from Display 1.

[illegible]

	Yes	No	
1.	____	✓	[illegible]
2.	____	✓	The train will fall off the [illegible].
3.	✓	____	[illegible] trying to [illegible] some [illegible] to Chicago.
4.	✓	____	It's [illegible] flying [illegible]
5.	✓	____	The [illegible] [illegible]
6.	____	✓	[illegible]
7.	____	✓	[illegible]
8.	✓	____	[illegible]

[illegible] to tell someone else how [illegible] [illegible] or not, [illegible] [illegible] with you. (If [illegible] will [illegible] "yes" or "no" in answer.)

[illegible]: _____

_____

_____

Go from [illegible].

[illegible] must in any something to the effect that it be considered "relevant," a response must take into account some of the major details in the picture. Now check the numbers of all responses in Study 1 which meet this criterion.

1. _____ 1. It's a train.

2. _____ 2. The train will fall off the track.

3. _____ 3. Easter Bunny is flying on the train to take some easter eggs to Chicago.

4. _____ 4. It's an airplane flying to Chicago.

5. _____ 5. The train got out of the water because there was a bridge that went up and down in the water.

6. _____ 6. The story of the Pleasure train.

7. _____ 7. The track broke off. That's what happened!

8. _____ 8. Octopus ate the candy that fell in the water.

See answers in the following frame.

[illegible]

APPENDIX G: PROBLEMS I AND II

Problem I

Recall the classroom situation you saw depicted on video tape. Imagine that you are the psychologist called in to consult with the teacher in this situation. She tells you that her educational objective is to teach the children to tell stories which are creative or original. Read the resumé of Torrance's study on the following page and answer the questions to be sure you've gotten the idea of the study which is discussed. Then use this material to think of as many ideas as you can which might help the teacher to obtain her stated objective. Write up your answers on the form sheet provided. (You will find this form immediately after the answers to the study questions in this booklet.) If you look at this form, you will see that it is divided into two sections which are on separate pages.

In Section I you are to state the specific objectives towards which you are working. Points will be assigned on the basis of the precision and clarity of your statement of objectives, i. e., how well it communicates your intention or purpose.

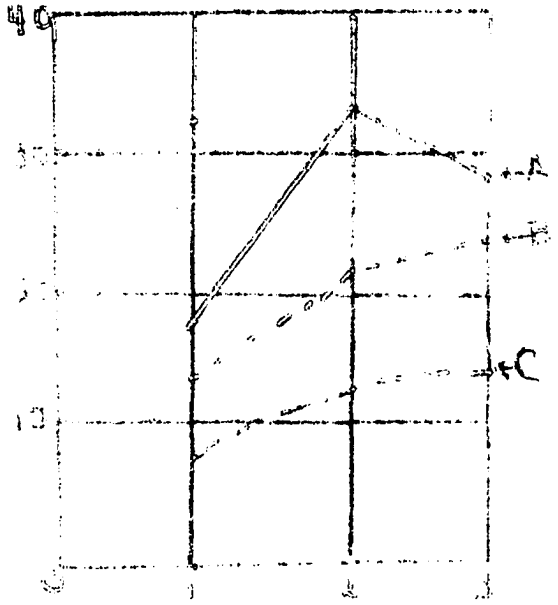
In Section II you are to suggest as many ideas as you can for attaining the objectives stated in Section I. Try to develop as many ideas as you can which are based on the study by Torrance. Analyze each of your ideas in terms of how well it would fit this particular classroom situation. Points will be assigned on the basis of the number and originality of your ideas and on how well they fit the situation in question.

Read the following paragraphs; then turn to the next page and answer the questions. While your grade in Psychology 333 will not in any way be affected by how you answer the following questions, they do constitute a variable which is of particular importance to the study

[illegible] you are participating. So try to answer [illegible] [illegible] [illegible] look back at [illegible] [illegible] answers [illegible] [illegible] all your responses. I don't believe [illegible] [illegible] difficult if you read the paragraph [illegible].

[illegible] relationship between original behavior [illegible] original behavior, it [illegible] relatively infrequently, is uncommon [illegible] relevant [illegible] conditions [illegible] relatively [illegible] modifications; and it [illegible] of problem solving, [illegible] creative process."

[illegible]


A
B
C

Section I. Statement of Objectives. Say specifically what you expect the child to do and how you will know each objective has been attained. Please write your objective incomplete sentences.

Section II. Plan. Suggest as many ideas as you can think of for attaining the objectives you listed in Section I. Feel free to make use of the psychological studies you were just tested on to help you generate ideas. Be sure to consider also the important aspects of the classroom situation itself (1 point for each new idea you suggest).

Problem II

[illegible] the classroom situation you saw depicted on video tape, [illegible] you are the psychologist called in to make suggestions to the teacher. This time, however, the teacher has stated her [illegible] in terms of the educational objective. [illegible] dealing with [illegible] problems. Everything else in the situation remains essentially unchanged except that now your job is to suggest ideas which will promote reading readiness in the children. Read the comments about reading readiness on the following page and study carefully the experiment by Carpenter, and then answer the review questions to [illegible] your understanding this material.

[illegible] make use of this information to generate as many ideas as you can which [illegible] help the teacher to attain her stated objective. Write your answers in the form sheet which you will find just after the last page of the study questions. If you look at this form you will see that it is divided into two sections.

In section I [illegible] the specific objective teacher has stated. Here you [illegible] will be graded on the basis of the precision and clarity with which you restate the objective; i. e., how well it communicates your specific intentions or purpose.

In section II you are to suggest as many ideas as you can for attaining the objective stated in section I. Try to develop as many ideas as you can which are based on the study by Carpenter. Analyze each of your ideas in terms of how well it would fit into a typical classroom situation. Points will be assigned on the basis of the number and variability of your ideas and how well they fit the situation in question.

[illegible] look at the material on the following page bearing in mind that your goal is to [illegible] a plan now to [illegible] reading [illegible] of [illegible] in the [illegible].

Read the following paragraphs; then turn to the next page and answer the questions. While your grade in psychology 333 will not in any way be affected by how you answer the following questions, they do constitute a variable which is of particular interest in the study in which you are participating. So try to answer them as well as you can, and don't look back at the paragraphs or at the answers until you have written all your responses. I don't believe you will find the questions unduly difficult if you read the paragraphs carefully.

"Children come to school with a system of concepts informally acquired; therefore, the teacher must determine the present stage of concept development of each child and its significance to the acquisition of new concepts. Most 'reading-readiness' tests given to kindergartners and first graders are essentially tests of concept formation. From these tests the teacher may estimate whether the child has an adequate grasp of concepts for which he will be learning the word symbols. The child entering the primary grade has acquired concepts of many kinds; he has concepts for most of the objects in his environment, such as the persons in his family, his home, the family car, and the utensils he uses. He has also developed relational concepts, such as 'inside of,' 'outside of,' 'from,' 'to,' 'up,' 'down.' He may have only the vaguest grasp of some other kinds of concepts, such as 'smaller than,' or 'larger than.'"

"Carpenter studied the effects of reinforcement on the learning of concepts. He formed four groups of students and had them learn a set of concepts, using simple materials. The reinforcement used in this experiment was the experimenter's statements, 'That's right' or 'That's wrong.' In the first group, the ex-

[illegible] presence is required (i.e., there is knowledge
[illegible] subscribe to or object upon the property.
[illegible] to convert to an absolute condition for termin-
[illegible].
[illegible] possible to provide use of that only for purposes of
[illegible] symmetric <u>covering</u> [illegible] easement.

answers to questions on the previous pages.

1. (a)

2. (d)

3. (d)

4. (a)

Section I. Statement of Objectives. Say specifically what you expect the child to do and how you will know each objective has been attained. Please write your objective incomplete sentences.

Section II. Now, suggest as many ideas as you can think of for attaining the objectives you listed in Section I. Feel free to make use of the psychological studies you were just tested on to help you generate ideas. Be sure to consider also the important aspects of the classroom situation itself. (I want to see what you suggest)

APPENDIX H: SUMMARIES OF I-A-P-K PROGRAM AND S-E-O PROGRAM

1. The view which has been adopted is that the process by which the teacher attains educational objectives in the classroom is analogous to the way that the psychologist brings behavior under his control.
2. An educational objective is some student behavior that the teacher wants to change. In this sense, an educational objective is like the dependent variable in a hypothesis.
3. The first step in controlling behavior in the classroom is to develop an operational definition of the objective, e. g., to specify in concrete terms what behaviors we want to change. If the behavior you hope to change is such that a judgment or rating by a teacher will be required (as in an essay exam), then the objective is not truly operational or workable until you have specified the kinds of responses you will be looking for as you grade. Such a definition is operational because once you know exactly what you want the learner to do, you can communicate your purpose. To the extent that you can tell the learner exactly what you expect of him, you are more likely to attain the objective you are seeking.
4. Once you are sure you know what specific behavior you want to change, the next step is to decide how to manipulate the situation in such a way that the change will occur. If we choose to derive such a manipulation from studies which have been conducted in the psychological laboratory, then there are two steps which should be followed.
    a. Find a study which seeks to change the kind of behavior in which you are interested. To do this you must decide what the dependent variable is in the study and compare it with your objective.
    b. If the dependent variable matches your objective, then identify the independent variable. Translate this variable into a fairly broad or abstract statement which conveys the purpose of the study and fits the particular situation in which you are working (that is, one which takes into account such variables as the age, interests, and abilities of your students).

For any given independent variable, there are probably many possible operational definitions which could work in any given classroom situation.

5. When you have completed steps 1 - 4, you will have formulated a hypothesis. This hypothesis specifies a manipulation which you hope will change the student behavior which constitutes your objective.

6. The extent to which such a hypothesis will work in any given classroom situation will depend upon two things:

   a. The validity of the psychological research on which it is based.

   b. The skill of the teacher in translating the hypothesis into a manipulation which fits this particular classroom. A good translation is one which:

      (1) Captures the essential meaning of the independent variable in the psychological study; that is, it deals with the same independent variable.

      (2) Incorporates what is known about the particular classroom and student into which the independent variable is to be translated. Frequently a good translation will involve some change in the medium in which the independent variable is present or the use of somewhat different materials.

Did you find that reading this summary was helpful to you in any way? Why or Why not?_____

_____

_____

APPENDIX I: INSTRUCTIONS TO SUBJECTS IN THE DIFFERENT TREATMENT GROUPS

INSTRUCTIONS TO SUBJECTS IN THE DIFFERENT TREATMENT GROUPS

Groups I and II

You should have sections marked A, B, C, D, E, F, and G; and two problems marked Problem I and Problem II.

Sections A-F are due by class time Wednesday, May 8. Section G and the two problems are to be handed in on Friday, May 10. If for any reason you can not meet one or both of these deadlines, please contact Reed Mencke in Room 314 Old Botany Hall, telephone 294-2354. Be sure to write your name and your instructor's name on each separate section or problem you hand in.

Groups III and IV

You should have Sections E, F, and G, and Problems I and II.

Sections E and F are due by class time Wednesday, May 8. Section G and the two problems are to be handed in Friday, May 10. If for any reason you can not meet one or both of these deadlines, please contact Reed Mencke, in Room 314 Old Botany Hall, telephone 294-2354.

Group V

You should have Sections A, B, C, and D; Problems I and II; and a summary section. You are to use the summary as a guide to your thinking as you do the problems.

Sections A, B, C, and D are due by class time Wednesday, May 8. The two problems are to be handed in by Friday, May 10. If for any reason you can not meet one or both of these deadlines, please contact Reed Mencke in Room 314 of Old Botany Hall, tele-

phone 294-2354. In order for you to receive credit for the assignment, be sure to write your name and the name of your instructor on each section and problem you turn in.

Group VI

You should have Sections A, B, C, and D; and Problems I and II. Sections A, B, C, and D are due by classtime Wednesday, May 8. The two problems are to be handed in by Friday, May 10. If for any reason, you can not meet one or both of these deadlines, please contact Reed Mencke in Room 314 of Old Botany Hall, telephone 294-2354. In order for you to receive credit for the assignment, be sure to write your name and the name of your instructor on each section and problem you turn in.

Group VII

You should have Problems I and II and a summary sheet. You are to use the summary sheet as a guide to your thinking as you— solve the problems. Problems I and II are due Friday, May 10. In order to insure that you receive credit for the assignment, be sure to write your name and that of your instructor on each individual problem you hand in.

Group VIII

You should have Problems I and II. These problems are due Friday, May 10. In order to insure that you receive credit for this assignment, be sure to write your name and that of your instructor on each individual problem which you hand in.

Group IX

You should have sections A, B, C, and D; a summary sheet; and Problem II. You are to use the summary sheet as a guide to your thinking as you solve the problems. Sections A, B, C, and D are due Wednesday, May 8. Problem II is due Friday, May 10. To insure that you receive credit for this assignment, be sure to sign your name and that of your instructor on all sections and problems which you hand in.

Group X

You should have sections A, B, C, and D and Problem II. Sections A, B, C, and D are due Wednesday, May 8. Problem II is due Friday, May 10. To insure that you receive credit for this assignment, be sure to sign your instructor's name and your own name to all sections and problems which you hand in.

Group XI

You should have a summary sheet and Problem II. The summary sheet is to guide your thinking as you work the problem. Problem II is due Friday, May 10. To insure that you receive credit for this assignment, be sure to write your name and your instructor's name on the problem when you hand it in.

Group XII

You should have Problem II in your packet. This problem is due Friday, May 10. To insure that you receive credit for this assignment, be sure to write your name on the problem when you hand it in.

APPENDIX J: GUIDELINE FOR RATING PROBLEM I

GUIDELINE FOR RATING PROBLEM I

I. A-O Scale

A. General Procedure

1. Find the best stated objective.

2. Find the most poorly stated objective. If this one scores between 1.00 and 2.00 (i. e., the objective seems totally irrelevant to the objective), lower your rating of 1 by .5 pt. Please note that the above implies that lack of relevance is to be taken into account only in Step 2 and hence should result in a loss of more than .5 pt.

3. Check scoring criteria in 6 to see if a minimal level of acceptable performance has been specified. If there was, add .5 pt. to the score decided upon in 2.

B. Scoring Instructions

1. "Teach children to be creative," = 1.50. "Tell a story," = 1.50; or "tell a story which is creative or original," = 2.00.

2. "Tell a story which is relevant," (with no mention of its being unusual) = 3.50.

3. "Tell a story which is unusual or infrequent," = 4.00.

4. "Tell a story which is unusual and relevant," = 4.25.

5 Sets up some fairly specific points which a judge

could look for in a story, e. g., unusual endings, story based on details not actually present in the story. Such criteria would facilitate but need not guarantee agreement = 5.00.

6. *Responses are stated in terms of behavior which is* specific enough that agreement is at least a possibility and in addition some criteria level has been specified to indicate the minimum level of acceptable performance. This should add .5 pt. to the score you would have assigned on the basis of the extent to which behavior was specified. Note how the scoring of the following examples would compare with the scoring in 1, 2, 3, 4, and 5 respectively.

1_a. "Tell at least <u>one</u> creative story during an hour of classtime," = 2.50.

2_a. "Tell a story in which <u>most</u> ideas are relevant to <u>at least one</u> major detail in the picture," = 4.00.

3_a. "Tell a story in which there is <u>at least one</u> infrequent response," = 4.50.

4_a. "Tell a story in which there is <u>at least one</u> infrequent response and/or one relevant response," = 4.75.

5_a. "Tell a story which contains and elaborates upon <u>at least one</u> detail which was implied but not actually present in the picture," = 5.50.

II. A-K Scale

A. General Procedure

1. Find the best idea (one that will score highest on A-K).

2. Find the worst idea; i. e., one that is invalid psychologically. If you find such an objective, lower the score for 1 by .5 pt.

a. Check scoring criteria for a derivation based on reinforcement.

b. Check scoring criteria for a derivation based on Torrance's study.

B. Scoring Instructions

1. Use the uncertain category (2.50, 3.50, or 4.50) for responses in which the only evidence of sensitivity to the story is one of the following:

a. "Use picture."

b. "Cover part of picture and see if they can adjust the story to the covered detail later on when it is uncovered."

2. Mentions "reinforcing creative behavior."

a. "Reinforce the child," = 3.00.

b. "Reinforce creative behavior," = 3.00.

c. Reinforce by means of

(1) "toys" or other prize = 5.00.

(2) "candy" = 5.00.

(3) "winning a game" = 5.00.

Any of the above constitute a level 5.00 response.

3. Possible derivations from Torrance's study. (These would be scored as psychological applications, 3.00, 4.00, or 5.00).

a. "Tell children to be creative," = 2.50 if no evidence of sensitivity is present; 3.50 if evidence of sensitivity is present.

b. "Instructor asks questions designed to stimulate creative thought," = 2.50 or 3.50 depending on sensitivity score. 2.50 if no sensitivity is present in other ideas. 3.50 if sensitivity is present in other ideas.

c. Any mention of providing the child with a rule which might generate a creative story scores as a 3.00 or 4.00 depending on whether sensitivity is present in other ideas. Example: "Tell child to think of something or someone who might be present on the train and tell a story based on this," = 3.50 if no sensitivity; 4.50 if sensitivity is present.

d. "Tell child to tell as many different stories as possible," (essentially a brainstorming instruction) = 3.50 if no sensitivity; 4.50 if sensitivity.

e. Any of the above spelled out in a manner which clearly considers such variables as the children's vocabulary level or other developmental variables. Example: "Teach children a rule by reinforcement and shaping techniques," = 5.00.

4. Possible derivations from studies in the program.

a. Suggestions as to how to increase the associative strength of a creative response.

(1) Introduce words to "cue" an original story 3.00 if no sensitivity present; 4.00 if sensitivity present.

(2) Use pictures to cue an original story = 4.50.

APPENDIX K: QUESTIONNAIRE

Questionnaire

Name _____

The items below are intended to provide a measure of your attitudes toward and interest in various aspects of the study. You are to rate each on a 1 to 99 point scale. For each item write the number between 1 and 99 which corresponds to your attitude towards the item in question. Please do not use a slash or check. Write the exact number which describes your attitude.

1. Rate the degree to which each problem was relevant to your interests. On the scale below write the number which best indicates this interest.

Problem I

1	50	99
Totally irrelevant to any of my interests	Not sure whether problem is relevant or not	Extremely relevant to my interests

Problem II

1	50	99
Totally irrelevant to any of my interests	Not sure whether problem is relevant or not	Extremely relevant to my interests

2. Rate the degree to which you felt you understood what each of the programs was asking you to do. Write the appropriate number on the scale below.

Problem I

1	50	99
Couldn't understand the problem at all	Not sure whether I understood the problem or not	Understood perfectly

Problem II

1	50	99
Couldn't understand at all	Not sure whether I understood the problem or not	Understood perfectly

3. Rate your reaction to the portion of the program which you completed. Write the number which best indicates your reaction.

Sections A,B, C & D

1	50	99
Very boring - a complete waste of time	Unsure-Don't know whether it was interesting or not	The most interesting assignment I've completed at ISU

Sections E,F, & G

1	50	99
Very boring-a complete waste of time	Unsure-Don't know whether it was interesting or not	The most interesting assignment I've completed at ISU

4. What was your overall reaction to this project? Write the appropriate number.

1	50	99
Very boring and a complete waste of time	Unsure-Don't know whether it was interesting or not	The most interesting assignment I've completed at ISU