Chapter II

REVIEW OF RELATED LITERATURE

This chapter includes a resume of research studies and other literature relevant to the present study.

Smith\(^1\) used the hierarchical syndrome analysis to examine the assumptions of cumulativeness and hierarchy of educational objectives as classified in Bloom's Taxonomy. The data analyzed were contributed from a study conducted by Kropp and Stoker\(^2\) which involved the construction of four tests based upon the taxonomy rationale. Each of the tests consisted of six subtests corresponding to the major categories of the Taxonomy. Content areas concerned the Lisbon Earthquake, Stages of Economic Growth, Atomic Structure and Glaciers.

Twenty multiple choice items for each of the tests consisted of two parts. The first part


included Knowledge, Comprehension, Application and Analysis categories. The second part included five free response Synthesis and ten free-response Evaluation items. The tests were administered to students in the ninth through twelfth grades.

Hierarchical Syndrome Analysis revealed that in six of the 16 matrices, the initial reciprocal pair consisted of the Comprehension and Application subtests, and in every case this reciprocal pair was then joined by the Analysis subtest. Of the six major categories of the Taxonomy only the Knowledge and Evaluation categories were generally found to behave in a manner inconsistent with the theoretical formulation.

Kropp, Stoker and Bashaw\(^3\) have noted that the Taxonomy has received increasing use by test and measurement, and curriculum specialists in test planning and in evaluating test results. They have also pointed out its use as a point of departure in constructing other Taxonomies or models for categorizing intellectual processes.

\(^3\)Kropp, Stoker, and Bashaw, "Validation of the Taxonomy of Educational Objectives," p. 74.
These authors have suggested that to obtain proper response measures for the attainment of higher level category objectives, content learning by students should be equalized as far as possible.

Rinchuse⁴ used Bloom's Taxonomy of educational objectives to classify and analyze the written examinations administered by the University of Pittsburgh School of Dental Medicine for pre-doctoral courses. He selected a sample of 563 test items from the entire population of the items and obtained final classifications for 518 items, for the remaining items no consensus on classification could be obtained.

The classification of test items was done by four independent judges. Test items were assigned to one of the six major categories in Bloom's Taxonomy of educational objectives: cognitive domain.

It was found that 83.9 per cent of the items

⁴Donald J. Rinchuse, "The Use of Bloom's Taxonomy (Cognitive Domain) to Analyze a Dental School's Examinations," Dissertation Abstracts International 46 (June 1986): 3698-A.
were from the knowledge category, and 16.1 from the comprehension category. No test items were classified into any of the other four categories, viz., Application, Analysis, Synthesis, and Evaluation. Even for the 45 unclassified test items, none of the four judges rated any of the items above level 4 (Analysis) and at least one judge (and most often, two judges) rated the items at levels 1 and 2 (Knowledge and Comprehension).

It was concluded that the University of Pittsburgh School of Dental Medicine's predoctoral written examinations predominantly measure dental students' abilities to recall factual material. This school's predoctoral examinations do not demand students to use higher intellectual skills such as Application of Knowledge, Problem Solving and Critical Evaluation.

Noble \(^5\) conducted an investigation to check

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if the ranking of objectives by secondary school language arts teachers of composition was congruent with the ranking of objectives by widely used standardized commercially published tests of composition.

Objectives were ranked on the basis of the number of items devoted to each in the tests. Through a survey, secondary language arts teachers were asked to rank these objectives based upon their importance in composition classes taught. Little congruence was found between the two sets of rankings in the analysis performed.

Rickard\textsuperscript{6} conducted a study to determine the effect of behavioral objectives alone or behavioral objectives in conjunction with instructional objectives on the performance of a college general chemistry class. Specifically, an attempt was made to determine if the use of behavioral objectives was detrimental to understanding science or science

concepts, and if the use of behavioral objectives in conjunction with instructional objectives would overcome this criticism of behavioral objectives in the physical sciences.

Instructional objectives were defined as broad, implicit objectives which act as a framework for the more specific task oriented behavioral objectives.

The study was designed to provide data on whether student achievement, understanding of science, and understanding of chemical concepts could be influenced significantly by providing the student, in advance of instruction, with either behavioral objectives alone or behavioral objectives in conjunction with instructional objectives.

The sample consisted of two Fall Semester general chemistry classes at North Carolina State University. Since existing, intact classes were used, a non-equivalent control group quasi-experimental design was used for the investigation. Analysis of variance of scores revealed no significant difference in the groups.
Rumsey conducted a study to identify the levels of difficulty encountered by high school chemistry students on topics related to proportional thinking, and then to discover the extent to which student performance on these topics was dependent on performance in selected cognitive development tasks.

Subjects for the study were 215 high school chemistry students who answered a 40-item chemistry retention test following a year of chemistry classroom instruction. A series of Piagetian-like classification measures, including the test of logical thinking and a battery of three Piagetian-like puzzles were also administered to each subject. Hierarchies of difficulty were constructed based on test items clustered by chemistry topic and expected cognitive skill. These hierarchies were developed using the Ordering-Theoretic Method with the McNemar test as a measure of statistical significance.

Empirically derived hierarchies were compared to Piagetian classification and to theoretical hierarchies developed by separate panels with expertise in Piagetian theory and chemistry content. Results of hierarchical analysis indicated that item difficulty was more dependent on cognitive skills requirements than on chemistry topic.

Corbett\(^8\) studied the effect of an expository alone, or in combination with behavioral objectives, on learning at lower (recall and comprehension) and higher levels of cognitive learning (Application, Analysis, Synthesis, and Evaluation) according to Bloom's Taxonomy.

One hundred and six nursing students for the bachelor's degree were randomly assigned to four treatment groups and given different versions of preinstructional strategies before reading a study unit on the nursing implications of coagu-
lation tests. The four different versions of pre-instructional strategies contained behavioral objectives and/or an expository organizer which focused on the conceptual basis of the coagulation process. One version had the context of the expository organizer embedded in the text to extinguish its potency as a preinstructional strategy. After reading the study unit, subjects completed a multiple choice posttest on the content of the unit. Total scores and subscores for lower and higher order cognitive questions were the dependent variables.

A combination of behavioral objectives and an expository organizer produced an educationally significant increase in total scores when compared with the strategy of an expository organizer alone, or with the strategy of behavioral objectives with the content of the expository organizer embedded in the text. Compared with the strategy of behavioral objectives alone, the combination strategy showed a slight increase in total scores, not quite educationally significant.

The hypothesis that an expository organizer alone would be effective for higher order questions was not supported. Behavioral objectives alone
were more effective than expository organisers alone, for both lower and higher order questions. However, when the expository organiser was combined with behavioral objectives, there was a small increase in scores for both lower and higher order questions. The potency of the expository organiser was lost when embedded in the text.

Baley and Field\(^9\) have stated that the physical education teacher is the principal determinant of the amount of progress made by students towards the attainment of program objectives. It is important, therefore, that the people who will teach physical education be carefully selected and properly educated.

Felshin\(^10\) has pointed out that part of the confusion about what physical education is resulted from the practice of defining the field according


to its functions rather than its content. Knowledge and understanding are viewed by him as the most useful aspects of physical education. Since only sound tenets of knowledge can lead to well organized and systematic practices.

He further highlights the necessity to identify physical education as a unified field of study so as to eliminate the cognitive dissonance caused by lists of activities or benefits as definitions of the field.

The UNESCO Charter on physical education and sport states that preservation and development of the physical, intellectual, and moral powers of the human being improves the quality of life at the national and international levels, and that physical education and sport should make a more effective contribution to the inculcation of fundamental human values underlying the full development of peoples.\textsuperscript{11}

On the basis of information and experience gained from teaching physical education at many universities all over the world, Reitmayer\textsuperscript{12} has concluded that physical education is found as a required course in those countries where its theoretical foundations are well understood by the people.

French\textsuperscript{13} investigated the attainment of cognitive and attitudinal objectives among secondary school students. Two methods of teaching life science were developed, one in which emphasis was placed on the lower level cognitive objectives (knowledge), and another in which emphasis was on the higher level cognitive objectives such as application, analysis, synthesis, and evaluation.

The control group teachers emphasized only the lower cognitive processes in all class activities.


and evaluation. Examinations given contained questions which would be classified in the knowledge category according to Bloom's Taxonomy, and were closed-book, thus directed at the measurement of the students' ability to recall facts.

The experimental group teachers emphasized only the higher cognitive processes in all class activities and evaluation (Application and above by Bloom). Evaluation instruments were open-book and open-note tests which eliminated memorization of factual knowledge.

With regard to cognitive learning, it was hypothesized that students who received instruction in and were evaluated correspondingly on the acquisition of the higher learning process of the cognitive domain would attain significantly higher scores after instruction than those students who received instruction in and were evaluated on the acquisition of the lower levels of cognitive learning.

Although the experimental group realized a numerically greater increase in scores than did the control group, the difference was not significant.
Hackett conducted a study to analyze a hierarchy of skills in listening and reading comprehension. Subjects for the study were 1186 students of second, fifth, eighth, and eleventh grades. The design of the study was based on a theoretical position whereby a learning hierarchy, involving positive transfer of learning represents a set of specified intellectual skills which are ordered from simple to complex and are predicted to exhibit relationships compatible with the hypothesis of transfer from lower to higher level skills.

Eleven language comprehension skills were defined as performance objectives and arranged in a hierarchical structure through the use of an heuristic procedural analysis; the skills being (1) identifying the stated main idea, (2) providing examples by detail, (3) reinstating a sequence of ideas, (4) inferring the main idea from specifics, (5) identifying mood, (6) applying standards to

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judge persuasion, (7) predicting the sequence of thought, (8) inferring connotative word meaning, (9) identifying sequence ambiguities, (10) inferring speaker's or writer's purpose, and (11) judging logical validity. Data was collected through two parallel items to yield pass-fail information for each of the 11 skills.

Conditional probabilities of correct responses to listening measures indicated ordered patterns of predictable relationships of lower to higher level skills. Chi-square analysis of these ordered patterns were statistically significant, revealing the predictability of higher level skills from attainment of lower level skills. Scalogram analyses yielded reproducibility coefficients of 0.88, 0.86, 0.80, and 0.83 for grades two, five, eight, and eleven, respectively, indicating the extent to which test scores can be predicted to fit the model of ordered patterns of difficulty. No significant differences between skills of listening and reading were observed.
Ceballows\textsuperscript{15} investigated the effects of two concept teaching methods on cognitive thinking ability. It was hypothesized that concept learning is the product of a number of mental behaviors involving the intake and processing of data such as sorting, grouping, comparing, contrasting, detecting relationships, drawing conclusions, and problem solving. These cognitive activities, as per the hypothesis, could be initiated during the teaching process either inductively or deductively.

An attempt was made to determine which concept teaching method produces better results with students not only in terms of mastery of the concept itself but more importantly in terms of increased reasoning and thinking ability.

Subjects for the study were 36 students from two intact fourth grade classes. A 2x2 factorial design was used. The dependent variables were cognitive thinking ability, as measured by a test

of reasoning skills; a test of conceptualization abilities; and a content achievement test.

The effect of two teaching methods, utilizing inductive and deductive approaches, respectively, on the dependent variables was measured. In addition, the interaction effects of the treatment variables and the subject's sex were explored.

While each of the treatment groups showed post-treatment mean gains on the New Jersey Test of Reasoning Skills, analysis of variance revealed no significant differences between or within groups. Similar results were obtained for the other two dependent variables. On the basis of this evidence it was concluded that for the age group under study, inductive and deductive approaches are equally effective in promoting concept formation/attainment and in fostering the metacognitive strategies that are crucial to higher order thinking.

Kane\textsuperscript{16} has pointed out that the classical

approach to curriculum planning based on the organization of appropriate means to achieve a set of educational goals has come in for a great deal of criticism. The main cause for this criticism has been the fact that teachers rarely pre-specify the ends according to any organized or precise system.

However, he cautions against the abandonment of rational planning merely because it has not been attempted in the past, or because it is extremely demanding. He further notes that only with some idea of the intended direction can the teacher select curriculum content and the approach to teaching.

Meszaros\textsuperscript{17} conducted a study to determine if teacher planning and teaching behaviors would change when teachers used a set of curriculum materials structured around an objectives-based model and taught these materials under conditions based

\textsuperscript{17}Bonnie T. Meszaros, "The Influence of Teacher Use of an Objective-Based Curriculum Program on Teachers' Planning and Teaching Styles and the Effects of this on Student Achievement," Dissertation Abstracts International 47 (March 1987): 3299-A.
on the findings from the teacher change research and if teacher use of the model would be positively related to student achievement.

A new middle school curriculum in social science was tested with 168 students in 10 classrooms belonging to grades six to eight.

Ten teachers volunteered to teach the materials and an additional seven teachers served as the control group. An objectives-based model was built into the student materials and was described in the teacher's guide. The teachers were not given any special instructions on the teaching of field test materials; they were to develop their own methodologies as a part of the study. Data were collected through student tests, classroom observations, teacher interviews, and teacher questionnaires. Analysis of data was done by quantitative as well as qualitative methods.

The results from Mann-Whitney U-tests, supported by comments from teacher interviews indicated that teachers are likely to change their planning and teaching behaviors and use an objectives model when the following conditions exist:
1. textbooks and teacher's guides that teachers use are structured around an objectives-based model,

2. all support materials are provided,

3. lesson preparation requires little time on the part of the teachers,

4. teachers see positive payoffs, and

5. teachers feel at ease using the objectives based materials.

A hierarchical method of multiple regression was used to determine whether teacher use of an objectives model in planning and teaching was positively related to student achievement. Independent variables included student achievement scores, pre-test scores, allocated learning time, student absences, and teacher observation scores. It was found that entering achievement level and teacher use of an objectives model during instruction are statistically significant predictors of student achievement.

The effect of training to facilitate the use of cognitive strategies in creative thinking
and mathematical problem solving was studied by Love\textsuperscript{18}. One specific aspect of creative thinking, restructuring, was the focus of training because of its proposed importance in creativity as well as in solving certain types of mathematical problems.

The study was conducted on 142 fifth and eighth grade students from two Mississippi Public School districts. Experimental design was the Solomon four-group. Subjects were randomly assigned to one of four conditions:

(1) pretest-training posttest, (2) pretest-training-posttest, (3) training posttest, and (4) no training posttest. Subjects in the pretest condition were administered Figural from B of the Torrance Tests of Creative Thinking (TCT) as the pretest. Subjects in the training conditions received a 45 minute training session designed to facilitate cognitive strategies for restructuring problems.

All subjects received Figural From A of the T1CT as posttest. In addition subjects were administered six math problems requiring restructuring.

The results indicated that the training was not effective in increasing either the number or quality of creative responses or the number of math problems solved. On the T1CT, grade 5 students scored higher on fluency, flexibility, and originality while grade 8 students received higher scores for elaboration and extending/breaking boundaries (the criterion most relevant to restructuring). Eighth graders solved significantly more math problems than fifth graders.

The results of this study lend support to the reemergence of creative thinking skills in grade 5, followed by a junior high school slump, particularly in fluency, flexibility, and originality. The ineffectiveness of the training along with the superior performance of grade 8 students on the extending/breaking boundaries and the math problems suggests that either unidentified prerequisite skills, not taught through 5th grade
or maturational factors may be the most significant for the ability to restructure.

Eisner\textsuperscript{19} has proposed a classification system for educational objectives whereby the objectives are divided into three groups, viz., instructional, expressive, and problem solving. An instructional objective in this system is explicit and prescriptive. The goal is demonstrated and measurable student behavior. Expressive objectives are less structured. They cover experiences designed to develop patterns of thought and feeling which individuals can use in creative ways to express their own interests and individuality. Problem solving objectives require students to use their own resources and imagination in solving a specific problem. Ingenuity in solution is the goal.

Gagne\textsuperscript{20} has proposed the classification of


learning into the following eight types:

Type 1: SIGNAL LEARNING: This type of learning involves a stimulus and response conditioning and is truly involuntary in nature.

Type 2: STIMULUS-RESPONSE LEARNING: Here, the individual learns to make very precise movements in response to specific stimuli or combinations of stimuli.

Type III: CHAINING: This kind of learning involves connecting together in a sequence two or more previously learned stimulus-response sets.

Type IV: VERBAL ASSOCIATION: Verbal association is a kind of learning in which the individual learns to form verbal chains of thoughts or reasoning.

Type V: MULTIPLE DISCRIMINATION: In this type, the individual learns to distinguish among objects and calling them by correct names.

Type VI: CONCEPT LEARNING: Here, the individual learns to respond to stimuli in terms of abstracted properties like "colour", "shape", "position", etc., as opposed to concrete physical properties like "length", "specific wavelengths", etc.
Type VII: PRINCIPLE LEARNING: A principle is a chain of two or more concepts. It is learnt through verbalization of the chain of concepts. It is imperative that the concepts be learned prior to chaining them otherwise only a verbal chain will form, not the desired conceptual chain. While in the former case the individual is able merely to "say" or repeat the principle, in the latter, he can apply the principle.

Type VIII: PROBLEM SOLVING: Once the individual learns many principles, he can combine them to form a variety of novel, higher-order principles. Through this process, he solves problems that are new to him, and thus acquires a continually increasing array of new capabilities.

Dressel has stated that Bloom's Taxonomy provides a useful method for analyzing the nature of a given set of objectives and can be used even more effectively if it is studied and understood.

before the objectives are stated. He, however, points out certain deficiencies in the Taxonomy. Firstly, a Taxonomy should be comprised of clearly differentiated, mutually exclusive categories. Whereas the categories in Bloom's Taxonomy, he asserts, are neither clearly differentiated nor mutually exclusive. Secondly, a Taxonomy should be comprehensive so as to provide bases for all possible decisions. The ambiguities in Bloom's Taxonomy reduce its effectiveness in this regard.

Thirdly, the structure of a Taxonomy should exclusively define relationships among the sub-categories. While Bloom's Taxonomy does fulfill this requirement, the defined relationships are not always consistent with teacher or student perceptions.

With regard to the importance of identification and statement of objectives, he states that identification of objectives is essential because the number of possible experiences which can be provided to mould behavior is infinite and choices have to be made. Statement of objectives gives concrete shape to the educational process and
provides the basis for selecting learning tasks and for providing adequate resources.

In the statements of objectives for the graduate curriculum in Physical Education by Snyder and Scott, a number of classifications are discernible, though not explicitly laid down. These classifications include identification of problems and issues, location of sources of information, evaluation of scholarly works, interpretation of literature, learning of methods of research, production of new works, etc.

Rivens is of the opinion that translating long range goals into performance objectives depends on the understanding of the behavioral foundations of desired performance. He further states that effective physical education teachers are those who critically evaluate the validity of stated goals and influence the development of appropriate new goals.

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22 Snyder and Scott, Professional Preparation in Health, Physical Education and Recreation, pp. 184-87.

Melton\textsuperscript{24} studied the effects of behavioral objectives on student learning on the basis of the findings of 22 experiments. He observed that in 14 of the 22 experiments behavioral objectives were found to have a positive effect while in eight there was no significant effect of objectives.

Pratt\textsuperscript{25} has pointed out that to guide teachers and curriculum builders it is necessary to have a classification system which serves the following two purposes: (1) distinguishes among those capabilities that require different means of instruction or evaluation, and (2) includes all the major areas of human development that can be covered by the educational institutions. Such a system should be based on empirical evidence rather than on 'a priori' considerations alone.


Holland et al. have pointed out the usefulness of learning hierarchies in developing an optimal sequence of tasks leading to performance of the terminal objective. Taking a hierarchy as a curriculum developer's hypothesis about the sequence of various tasks, the authors have suggested two methods of validating this hypothesis. One method involves teaching the tasks in the hypothesized optimal sequence and in various non-optimal sequences, and comparing rates of learning. In another method of validation, individuals who can successfully perform the terminal task are tested on the hypothesized prerequisite tasks. If these tasks are really prerequisites, success on the terminal task should be accurately predicted on the basis of the prerequisite tasks.

Remmers, Gage, and Rummel have stated


that acquisition of information in a field is not highly related to the ability to think in that field and to apply the acquired information.

Flanagan\textsuperscript{28} has proposed an empirical approach to the formulation of educational goals whereby after collecting and classifying descriptions of actual observations of effective and ineffective behavior in particular fields of activity, investigators would be able to develop a more general summary listing of the critical requirements for success in the activity.

Citing Bloom’s Taxonomy, but not following it specifically, Stecklein\textsuperscript{29} offers the following classification above the knowledge level: application, ability to recognize assumptions, comprehension and analysis, ability to judge the validity


of inferences, analogous reasoning, problem solving, ability to define problems, and ability to draw valid conclusions.

Speaking from the standpoint of a behavioural technologist, Mechner\textsuperscript{30} equates "knowledge" and "understanding" with behavior and proceeds to state that it is not important to assure whether knowledge is basically behaviour or not. The significant consideration, according to him, is that the only tangible evidence of "knowledge" we ever have is behavioural evidence. The only way to determine whether an individual "knows" something is to see what he does or say under certain conditions.