

INSTRUCTIONAL SYSTEMS AND SCHOOL
CLIMATE FOR CONCEPT LEARNING AT
DIFFERENT CATEGORIES OF INSTRU-
TIONAL OBJECTIVES

(COGNITIVE DOMAIN)

A. Bhushan and V. Mehra*

Abstract

The study was conducted to investigate learning with respect to four variables, viz., instructional treatment, school climate, levels of intelligence and different categories of objectives. The 166 students (class VII) from the two English medium schools of Chandigarh participated in the study. Main findings of the investigation were: (i) The Integrated System of instruction yielded better results than Conventional Instruction for the teaching of a segment of science such as "Preservation of Self", (ii) The authoritarian and democratic school climates promoted comparable achievement scores for concept learning, (iii) Students attained concepts better in knowledge than in other categories through both

* Department of Education, Panjab University Chandigarh, India.

INSTRUCTIONAL SYSTEMS AND SCHOOL CLIMATE FOR CONCEPT LEARNING AT DIFFERENT CATEGORIES OF INSTRUCTIONAL OBJECTIVES

(COGNITIVE DOMAIN)

A. Bhushan and V. Mehra*

Abstract

The study was conducted to investigate learning with respect to four variables, viz., instructional treatment, school climate, levels of intelligence and different categories of objectives. The 166 students (class VII) from the two English medium schools of Chandigarh participated in the study. Main findings of the investigation were: (i) The Integrated System of instruction yielded better results than Conventional Instruction for the teaching of a segment of science such as "Preservation of Self", (ii) The authoritarian and democratic school climates promoted comparable achievement scores for concept learning, (iii) Students attained concepts better in knowledge than in other categories through both

* Department of Education, Panjab University Chandigarh, India.

the designs, (iv) Differences in the scores through the Integrated System of Instruction and Conventional Instruction was not qualified by school climate. (v) High and low intelligence groups achieved better in knowledge than in other categories of objectives on concept learning, (vi) Integrated System of Instruction and Conventional Instruction yielded equal results in democratic and authoritarian school climates at the two levels of intelligence. (vii) The Integrated System of Instruction and Conventional Instruction yielded equal scores on concept learning both in knowledge and the other categories of Bloom's Taxonomy of educational objectives (viii) Democratic school climate yielded results equal to that of authoritarian school climate for the two levels of intelligence and the two categories of objectives. (ix) The two instructional designs yielded comparable results in democratic and authoritarian school climates with the two intelligence groups for knowledge and intellectual skills and abilities categories of objectives.

I N T R O D U C T I O N

A good number of empirical studies support the idea of Gagne's (1970) learning hierarchy. Although psychologists and educationists have not reached a general agreement with regard to different types of learning, they agree unanimously that distinguishing among various learning types is important for instructional designing as different learning conditions and instructional operations are required for different types of learning. In almost all the attempts of formulating hierarchy of learning types, concept learning is recognized as one important type of learning. It is considered as a pre-requisite for the learning of many complex mental operations which alongwith the same, constitutes majority of the course content of lower/secondary classes.

Concepts are defined as capabilities that make it possible for an individual to identify a stimulus as a member of a class having some characteristic in common eventhough such stimuli differ from each other markedly (Gagne and Briggs, 1973).

The determinants of concept learning are grouped into instruction related variables and the learner related variables. The instruction related variables include instructional treatment and instructional climate. For the former, a review of the literature on instructional systems was made and the 15-components that were considered functional in Indian circumstances were identified. These were integrated to function together to achieve the instructional goal and thus an integrated system of instruction was developed. The System used for the experimental treatment has been presented in Fig. 1

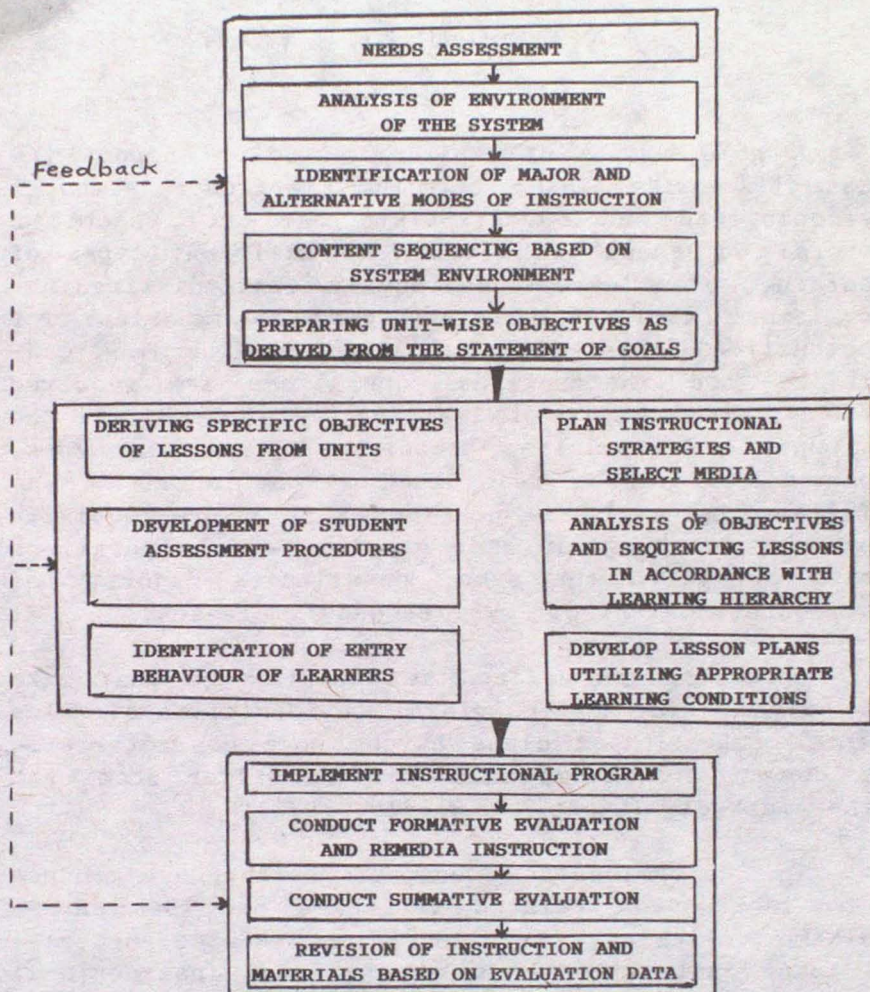


Fig. 1. MODEL OF AN INTEGRATED SYSTEM OF INSTRUCTION

In an Average Indian Class, the major instructional task is carried out conventionally through lectures with black board as the aid, supplemented mainly by laboratory work in science subjects. In these classrooms, students are supposed to listen silently to the lectures, memorize the content matter thoroughly and reproduce it in the exams. This format of conventional instruction were taken as the Control for testing the Instructional System designed for the experiment.

The importance of Psychological climate in which an individual learns has been repeatedly emphasized in educational literature. Functionally, this climate concerns with two aspects, one the organizational climate, another the instructional management. For the purpose of the experiment, the schools with different organizational climate were identified and the teachers, selected to participate in the experiment, were given instructions to manage their classroom instructions in accordance with the organizational climates.

Halpin and Croft (1963), identified 6-distinct types of organizational climates namely, open, autonomous, controlled, familiar, paternal and closed climate. Out of the list, only two climates, the open and the closed were undertaken for the investigation. The open organizational climate was supplemented by the democratic style of class management and the closed climate was supplemented by the authoritarian style of class management. In the democratic style of class-management, teacher is supposed to encourage students for participating in classwork, take cooperative decisions alongwith the students, deliver lectures and give information, solve their learning problems, provide opportunity to students

for self-learning followed by group discussion, show regards for new ideas and initiative, maintain environment of mutual trust and friendship. In authoritarian class management, teacher is supposed to exercise centralized control, do all the planning of the class, direct all activities of the students, deliver all information that students are expected to receive, classify doubts, present explanations, observe strict discipline with respect to code of conduct in school and outside.

On the range of instructional variables, a number of researches have been designed around Bloom's classification of objectives of cognitive domain into hierarchical categories. Bloom and his associates (1956) classified objectives of cognitive domain into hierarchical categories. Bloom and his associates (1956) classified objectives into Knowledge and Intellectual Skills & Abilities. The latter was further classified into comprehension, application, analysis, synthesis and evaluation. Michael Scriven (1967) simplified the classification and categorized the objectives into Knowledge and Comprehension, where the term comprehension connotes a wider class of objectives which include analyzing, synthesizing, evaluating and problem - solving. The present study followed a simplified classification into categories - one Knowledge Category and another category including all intellectual abilities and skills.

Among the learner variables, the one that has received maximum attention of educationists is intelligence. It has shown a high order of relationship with student learning and school achievement.

In order to understand the nature of interaction between instructional programs, climate and other

variables related with concept learning, a brief survey of empirical studies would be beneficial. Baggaley (1955) reported positive correlation among level of concept formation and inductive and deductive thinking. Osler and Trautman (1961) found that different strategies are adopted for learning concepts by children of high intelligence (use mediating processes) and those of low intelligence (use stimulus response associative processes). In concept learning, critical and variable attributes of the specific concept according to Markle and Tiemann (1969) should be the decisive factor for number of examples to be used and also for the complete mastery of concepts, students should discriminate between examples and non-examples. Frayer (1970) stressed that a concept definition significantly reduces the number of examples necessary to master the concept.

Smith's (1975) study revealed that four instructional variables, viz., instructional cues, examples, practice items and feedback interacted to give superior results on concept attainment. Santaliz (1977) found that oral - explanatory (O.E) strategy was found to be superior than the answer - centred (A-C) strategy for teaching specific concepts. Longkitpisal (1979) determined the differential effects of the two concept learning approaches, symbolic and concrete and found that students attained approximately the same level of achievement. Moore (1980) reported superior students' achievement with deductive rather than inductive approach on concept learning. Sherris (1980) indicated that deductively equenced, concept related instructional organization enabled meaningful learning of Biological concepts. Poslock (1982) reported that students using broad categories of cognitive style were disadvantage in learning abstract concepts when presented inductively as compar-

ed to a situation when the same material was presented deductively.

Although different instructional strategies have been employed for teaching of concepts, the ultimate goal has been to increase student's level of achievement and retention. The stress is more on structured instructional systems so as to enable meaningful learning that involves linkage of new ideas to existing concepts in the learner's cognitive structure. Loughran (1979) compared pupil achievement and other aspects in system and non-system approaches to mathematics instruction in the public schools of New York. Systems approach subjects achieved significantly greater than the non-systems approach subjects.

Blair (1981) applied systematic approach to develop an instructional planning team to help the school to become more self-renewing. Results revealed that student and teacher participation increased and problem-solving skills were better utilized and also the school exhibited more self-renewing behaviours.

Malhotra (1982) studied effects of systematic approach to instruction in mechanics of structures on the achievement, transfer of learning, motivation, etc. He reported that students taught under systematic approach achieved significantly higher mean scores on the achievement test and obtained higher scores on the transfer of learning tasks than the group taught under conventional method. Bhushan and Mehra (1985) reported that students exposed to the integrated system of instructions performed markedly higher than the group taught through the traditional teaching, uniformly for concepts and rules in a segment of biology at the secondary level. The

psychological climate has been one of the important variables that has attracted the attention of researchers during the recent years. Bayles (1960) reported that students learn more effectively in a democratic than in an authoritarian classroom.

Lulla (1974) evidenced that, students taught by teachers using indirect behaviour scored higher as compared to their counterparts. It was implied that, direct teacher behaviour may raise the instructional potential of classroom climate.

Although intelligence is not a new academic variable and large amount of research work clustered around this variable tended to resolve issue of its functional importance as academic variable, but, in recent years, a new dimension of instructional designing has exhibited some modes of instruction which were deviating from the conventional findings around the variable. However, still there are some recent studies supporting the conventional point of view about intelligence.

Ameerjan (1981) in his model of determinants of academic achievement found that intelligence level is an important pupil variable for academic achievement. Ingalls (1984) observed that, intelligence was a significant variable in achievement in mathematical concepts, reading and mathematical computation.

So, the present study was undertaken with an objective to study concept learning (or attainment) with respect to the four variables, viz., instructional treatment, school climates, categories of objectives and intelligence level of learners.

The study was designed to test the following hypotheses:

1. The Integrated System of Instruction (TI) and Conventional Instruction (T2) yield equal level of concept attainment scores.
2. Democratic and authoritarian school climates produce equal level of concept achievement scores in science at secondary level.
3. Differences in the scores through the ISI and TI is not qualified by school climate.
4. The two instructional designs yield equal results in democratic and authoritarian school climates at the two levels of objectives.
5. Democratic school climate yields results equal to that of authoritarian school climate for the two levels of intelligence and the two categories of objectives.
6. The two instructional designs yield comparable results in democratic and authoritarian school climates with the two intelligence groups at knowledge and comprehension level of objectives.

METHOD

Sample

The sample comprised of 166 students of Class

VII of the two representative English medium schools of Chandigarh. Age of the students ranged between eleven and thirteen years. One group consisting of equal number of high and low intelligence levels was randomly allocated to the Integrated System of Instruction (ISI) and a parallel matching group to Traditional Instruction (TI). The 84 students were taken from the school which has predominantly authoritarian climate.

Tools

1. Jalota's Group Test of General Mental Ability (GTGMA): The test consisted of 100 items pertaining to numerical reasoning, similarities, analogies and language ability, etc. Time limit was 20 minutes and the test was restricted to pupils of 12-18 years of age. Reliability of the test ranged between 0.879 to 0.979 for classes VIII to X.

2. Halpin and Croft's Organizational Climate Description Questionnaire (OCDQ): The OCDQ comprised of 64 Likert - type items which represent brief descriptions of teacher - teacher and teacher - principal social interaction in school organization. Time limit was 30 minutes. The 64 items in the OCDQ are assigned to eight sub-tests that represent dimensions of organizational climate, viz., disengagement, hindrance, esprit, intimacy, aloofness, production emphasis, thrust and consideration.

3. Integrated System of Instruction (ISI): ISI was designed and validated by the investigator in three phases:- 1: planning the system, 2: designing the system and 3: implementing and monitoring the system.

During Phase 1, the following steps were taken,

viz., needs assessment, analysis of environment of the system, identification of major and alternative modes of instruction, sequencing topics based on system's environment and finally the formulation of unit wise objectives.

Phase 2 covered formulation of instructional objectives, development of the criterion and formative tests (evaluation tools), identification of entry behaviour of learners, planning instructional strategies and selection of media, sequencing of lessons in accordance with learning hierarchy and development of lesson plans utilizing appropriate learning conditions.

Finally, Phase 3 comprised of the stages, viz., implementation of instructional program followed by formative evaluation, remedial instruction and summative evaluation. Revision of instruction and materials was done in light of the valuation data.

4. Achievement Test: In order to construct the achievement test, 130 items were written. This first draft was tried out on 60 students. About 25 percent items with DP below 19 were improved and some were dropped. The improved version of the test was again administered on 50 students. Based on item analysis, 92 items with DP exceeding 20 were finally selected for draft. The final draft consisted of 47 multiple choice type, 6 True - False, 29 matching exercises, 8 fill in blanks and 2 identification type. The reliability coefficient of the test was found to be 0.90. The test was validated against the criterion of "content validity".

Design of the Study

A 2x2x2x2 factorial design was employed to analyse the concept attainment scores with the help of ANCOVA. Here, instructional treatment school climate, intelligence and levels of objectives were the independent variables. Each one of these variables was studied at two levels. Concept attainment was the dependent variable. The variable of instructional design was studied for Integrated System of Instruction (T1) and Conventional Instruction (T2). The variable of school climate was studied for authoritarian (S1) and democratic level (S2). The variable of intelligence at high (I1) and low (I2) intelligence levels and lastly the concept learning was studied for the two categories of objectives, viz., knowledge (O1) and intellectual skills and abilities (O2).

Procedure

The two schools of the Union Territory of Chandigarh were identified on the basis of their organizational climates. Halpin and Croft's OCDQ was administered to ten teachers in each of the fourteen English medium secondary schools of Chandigarh and profiles were constructed for each of the selected schools on the basis of the standard scores on the eight dimensions of OCDQ. Government Model High School (Sector 22) and Shivalik Public School were identified as democratic and authoritarian schools respectively.

In order to select the experimental sample, Jalota's GTGMA was administered to 307 students of class VII from the two selected schools. The students

of each group were arranged in the ascending order of their intelligence scores. The top 27 percent and the bottom 27 percent scores were included in the experiment and were termed as high intelligence scores and low intelligence scores. In both the schools, one sub-group from high intelligence scores and another from the low was allotted to the ISI treatment and a parallel matching group to the TI treatment.

The experiment was conducted in four stages.

Stage 1: Instructions for Classroom Climate

After identification of schools with open and closed organizational climate, instructions for management of the classroom climate on the democratic and authoritarian patterns were administered to the concerned teachers. The open organizational climate was supplemented by the democratic management and the closed organizational climate by the authoritarian management of the class climate. The former was typically termed as democratic school climate and latter, the authoritarian school climate.

Stage 2: Administration of Pre-Test.

Stage 3: Instructional Program.

The Treatment Group was taught by the investigator through the ISI for a period of twelve days, daily for 40 minutes. In every instructional unit, appropriate stimulus material was presented to the students with the help of the overhead projector and the transparencies. Students were instructed to take class notes. At the beginning of the lessons, the hand-outs were distributed to the class, that served

as instructional material. Content was recapitulated and summarized at intervals in the process of imparting class room instruction. Students were required to make responses. Corrective feedback of confirmation were provided. Developmental questions were used to help in the progress of the lessons. Towards completion of each lesson, a semi-structured criterion test, consisting of 5 to 10 short - answer, objective type items on the content of the lesson was conducted each day. It served as feedback for the students. Remedial instruction was provided to clarify students doubts. Students were also given home assignments regularly.

The Control Group was taught by the regular science teacher in the conventional way. The content and time of instruction for this group were equated with that of the treatment group.

Stage 4: Administration of the Post-Test.

After administering the instructional program, the Achievement Test was administered to both the groups. The Pre and Post Test scores were subjected to statistical treatment.

RESULTS

Analysis and Interpretation of Data

The means and S.D.'s of the concept attainment scores of different sub-groups and the summary of ANCOVA for 2x2x2x2 factorial design have been presented in Tables 1 and 2 respectively.

TABLE I
 MEANS AND S.D.'s OF SUB-SAMPLES OF 2x2x2x2
 DESIGN FOR CONCEPT ACHIEVEMENT SCORES

		S ₁		S ₂	
		T ₁	T ₂	T ₁	T ₂
I ₁	0 ₁	M= 78.27 S.D.=13.88	M= 65.19 S.D.=19.77	M= 73.07 S.D.=12.78	M= 64.83 S.D.=16.46
	0 ₂	M= 72.28 S.D.=19.55	M= 57.58 S.D.=17.54	M= 68.41 S.D.=20.40	M= 62.56 S.D.=23.18
I ₂	0 ₁	M= 61.15 S.D.=13.37	M= 45.60 S.D.=14.79	M= 63.00 S.D.=16.97	M= 45.42 S.D.=14.47
	0 ₂	M= 54.32 S.D.=15.71	M= 36.15 S.D.=11.53	M= 55.63 S.D.=25.52	M= 34.20 S.D.=20.60

TABLE 2

SUMMARY OF ANCOVA FOR 2x2x2x2 DESIGN FOR CONCEPT
ACHIEVEMENT SCORES

Source of Variance	ANOVA				ANCOVA			
	SS	df	MSS	F	SS	df	MSS	F
Between Subjects:	135384.37	165			164			
Treatment (T)	16982.30	1	16982.30	30.29	1507.99	1	15077.99	28.90**
School Climate (S)	4.82	1	4.82	0.0086	397.295	1	397.295	0.76
Intelligence (I)	27946.14	1	27946.14	49.84	14831.70	1	14831.70	28.43**
TxS	100.68	1	100.68	0.18	-42.67	1	-42.67	-0.082
TxI	1260.58	1	1260.58	2.25	1049.41	1	1049.41	2.01
SxI	41.02	1	41.02	0.073	49.60	1	49.60	0.095
TxSxI	461.24	1	461.24	0.82	709.53	1	709.53	1.36
Error term	88587.59	158	560.68		81897.46	157	521.64	
Within Subject:	20197.36	166			165			
Levels of objectives(O)	3986.62	1	3986.62	40.24	2705.81	1	2705.81	27.31**
SxO	25.84	1	25.84	0.26	25.85	1	25.85	0.26
TxO	42.56	1	42.56	0.43	31.20	1	31.20	0.32
IxO	270.83	1	270.83	2.73	269.39	1	269.39	2.72
SxTxO	9.35	1	9.35	0.09	14.08	1	14.08	0.14
SxIxO	103.75	1	103.75	1.05	94.44	1	94.44	0.95
TxIxO	67.05	1	67.05	0.68	72.17	1	72.17	0.73
SxTxIxO	37.84	1	37.84	0.38	32.48	1	32.48	0.33
Error term	15653.54	158	99.07		3248.58	157	99.09	

* Significant at 0.05 level.

** Significant at 0.01 level.

Since the 2x2x2x2 ANCOVA had four fixed variables, with repeated measures on levels of objectives, F-ratios for different sources of variation were computed with treatment mean squares as the error term (Edwards, 1971).

Main Effects: The F-ratios for the difference in mean gains of the two treatment groups, was found to be significant at the 0.01 level of confidence, suggesting the superiority of Integrated System of Instruction over the Traditional Instruction in the segment of Science. The F-ratio for the variable school climate was not significant even at the 0.05 level of confidence suggesting that students of both authoritarian and democratic school climate did not differ from one another with respect to attainment scores. The F-ratio for the variable of intelligence was found to be significant at the 0.01 level of confidence leading to an inference that high intelligence group scored higher than the low intelligence group. The F-ratio for the variable, level of objectives was found to be highly significant at the 0.01 level of confidence. The examination of the means suggests that learning at knowledge level was more than that at comprehension level.

Two-Order Interactions: The F-ratios for the two-order interactions, viz., between instructional treatment and school climate, between instructional treatment and intelligence, between school climate and intelligence, between school climate and levels of objectives, between instructional treatment and levels of objectives and between intelligence and levels of objectives were not found to be significant at the 0.05 level of confidence. It reveals that the above mentioned pairs of variables affect

criterion variable independent of one another.

Three-Order Interactions: The F-ratios for the three-order interactions, among the variables (i) instructional treatment, school climate and intelligence, (ii) school climate, instructional treatment and levels of objectives and among (iii) instructional treatment, intelligence levels and levels of objectives were not found to be significant even at the 0.05 level of confidence. It reveals that in these combinations, the variables are mutually independent.

Four-Order Interaction: The F-ratio for the interaction among the four variables of the study, i.e., instructional treatment, school climate, intelligence and levels of objectives was not found significant even at the 0.05 level of confidence, leading to the inference that these variables do not interact with one another with respect to their effect on the criterion variable.

Discussion of Results

Regarding concept learning, the results of the present study provided sufficient grounds to reject hypothesis 1 in favour of a finding, i.e., "The IST (T1) yields better results than CI (T2). The finding was supported by Malhotra (1982) and Bhushan and Mehra (1985) who reported that students exposed to systems approach to instructions performed better than the group taught through conventional teaching. However, the above result appears evident as all the instructional components of the system have established their effectiveness in different contexts and a system, being better than the sum total of all the

components, must have worked still better.

The present study lent support to hypothesis 2, thereby confirming that democratic and authoritarian school climates produce equal level of concept attainment scores in science at secondary level. Results of the study supported hypothesis 3, i.e., Differences in the scores through the ISI and CI are not qualified by school climate. Hypothesis 4 was retained as the two instructional designs, viz., ISI and CI yielded equal results in democratic and authoritarian school climates at the two levels of intelligence. The results also supported hypothesis 5, thereby confirming that democratic school climate yields results equal to that of authoritarian school climate for the two levels of intelligence and the two categories of objectives. Hypothesis 6 was retained as the two instructional designs yielded comparable results in democratic and authoritarian school climates with the two intelligence groups at knowledge and comprehension categories of objectives.

REFERENCES

1. Ameerjan, M.S. A Schematic Model of the Determinants of Academic Achievement. *Journal of Education and Psychology*, July 1981, Vol. XXXIX, No. 2, 111-116.
2. Baggaley, A.R. Concept Formation and its Relation to Cognitive Variables. *Journal of General Psychology*, 1955, Vol. 52, 297-306.

3. Bayles, E.E. *Democratic Educational Theory*, U.S.A.: Harper and Row, 1960.
4. Bhushan, A. and Mehra, V. Effectiveness of an Integrated System of Instructions in a Segment of Biology at the Secondary level. *Indian Psychological Review*, 1985, Vol. 28, No. 3, 14-22.
5. Blair, K.S.S. A Systematic Approach to Change in an Urban Junior High School. Unpublished doctoral thesis, Texas A and M University. *Dissertation Abstracts International*, 1981, Vol. 42, No. 3, 919-A.
6. Bloom, B.S. (Ed.) *Cognitive Domain Handbook 1 of Taxonomy of Educational Objectives*, New York: McKay, 1956.
7. Edwards, A.I. *Experimental Design in Psychological Research*. New York: Holt, Rinehart and Winston, Inc., 1971.
8. Frayer, D.A. *Effect of Number of Instances and Emphasis of Relevant Attribute Values on Mastery of Geometric Concepts by Fourth & Sixth Grade Children*. Madison: Wisconsin Research and Development Centre for Cognitive Learning, Rep. 116, 1970.
9. Gagne, R.M. *The Conditions of Learning*. London: Holt, Rinehart and Winston, 1970.
10. Gagne, R.M. and Briggs, L.J. *Principles of Instructional Design*. New York: Holt, Rinehart and Winston, 1973.

11. Halpin, A. W., and Croft, D.B. *The Organizational Climate of Schools*. Chicago: Midwest Administration Centre. University of Chicago, 1963.
12. Ingalls, S.I. The Effects of Superior Intelligence and Behavioural Handicaps on the Academic Achievement and related Attitudes of Fifth and Sixth grade boys, Unpublished doctoral thesis, University of Utah, 1984. *Dissertation Abstracts International*, 1985, Vol. 45, No. 9, 2836-A.
13. Jalota, S. *Group Test of General Mental Ability (Manual)*, Chandigarh: Ivory Printers, 1976.
14. Longkitpaisal, P. The Effect of Two Instructional Approaches on Logical Concept Learning of First Year College Students. The University of Michigan, 1979. Unpublished doctoral thesis, *Dissertation Abstracts International*, 1979, Vol. 40, No. 2, 725-A.
15. Loughran, P.A. Administrator and Teacher Attitude, Work Environment and Mathematics Achievement in System and Non-System Approaches. Unpublished doctoral thesis, Fordham University, 1979. *Dissertation Abstracts International*, 1979, Vol. 40, No. 3, 1187-A.
16. Lulla, T.P. An Investigation into the Effects of Teacher's Classroom Behaviour on Pupil's Achievement. Unpublished doctoral thesis, M.S. University, 1974. In M.B. Buch (Editor), *Second Survey of Research in Education*, Baroda: CASE, M.S. University of Baroda, 1979.

17. Malhotra, M.M. *Effects of systematic Approach to Instruction in Mechanics of Structures on the Achievement, Transfer of Learning, Motivation, Study Habits and Attitudes of Poly-technic Students.* Unpublished doctoral thesis, M.S. University of Baroda, 1982.
18. Markle, S.M. and Tiemann, P.W. *Really Understanding Concepts* Champaign, III: Stipes, 1969.
19. Moore, M.S. *Interactive and Direct Effects of Method of Instruction, Level of Development of Operational Thought and Type of Concept in Concept Formation.* Unpublished doctoral thesis. The University of Nebraska, 1980. *Dissertation Abstract International*, 1981, Vol. 41, No. 11, 4595-A.
20. Osler, S.F. and Trautman, G.E. *Concept attainment II. Effect of Stimulus Complexity upon concept attainment at two levels of intelligence.* *Journal of Experimental Psychology*, 1961, Vol. 62, 9-13.
21. Poslock, D.B. *The Effect of Cognitive Style and Instructional Strategies on the Attainment of Concepts in Science.* Unpublished doctoral thesis, Columbia University Teachers College, 1982. *Dissertation Abstracts International*, 1982, Vol. 43, No. 5, 1491-A.
22. Santaliz, C.M. *The Effectiveness of Two Teaching Strategies for the Acquisition of Scientific Concepts in High School Students.* Unpublished doctoral thesis, The University