CHAPTER III

REVIEW OF RELATED LITERATURE

Research on teaching has a two-fold aim: to build a theory of classroom behaviour of teachers (a theory of teaching) and to conduct empirical studies that help to identify and relate relevant variables, thereby either substantiating or questioning hypotheses arising from this theory. On this basis, literature pertaining to research on methods of teaching can be classified into two broad categories - literature intended to build up the theory and that intended to validate hypotheses arising from the theory. With a much broader meaning being given to teacher behaviour now, research on teaching methods now tends to cover a wider area and takes cognizance of a larger number of variables.

The present study had two primary goals, i.e. to compare the effectiveness of two instructional strategies - a discovery format and an expository format - for teaching higher level writing skills in English to +2 students and also to examine whether acquisition, retention and transfer of writing skills depend on the interaction of instructional strategy with the student's intellectual ability and/or cognitive style. Prior to the actual planning and execution of the study, review of literature was undertaken in order to locate studies having adequate relevance to the present problem so as to arrive at trends depicted in them, which would then serve as guidelines in framing appropriate hypotheses for the present study.

3.1 INSTRUCTIONAL STRATEGIES AND LEARNING / ACQUISITION, RETENTION AND TRANSFER OF LEARNING:

A number of studies were located that examined the
effects of instructional strategies, intelligence and cognitive style on acquisition, retention and transfer of learning of mathematics, science, language arts etc. These studies fall in the sphere of experimental learning and have usually been conducted in real classroom situations on various subject matters. Ordinarily, the term academic achievement is used for such learning. It is thus that in the present chapter, acquisition has been used interchangeably with learning and with academic achievement.

**Discovery Learning and Expository Teaching**: The Comparison between discovery and expository methods is related to parameters that have variously been labelled in literature as "inductive" versus "deductive" (Strike, 1975; Blake, 1982); "high structure" versus "low structure" (Glaser, 1966; Domino, 1971); and "freedom" versus "constraint" (Cronbach and Snow, 1977).

The studies conducted from 1930 onwards till 1950 were so designed as to compare discovery learning with its theoretical opposite - the traditional expository teaching- and since the objective of discovery learning generally is learning of a rule or generalization, the criterion tests used involved measures of immediate or delayed ability to use the rule on familiar examples, to transfer the use of the rule to unfamiliar examples, or to verbalize the rule itself. A few long-term curriculum studies (McConnell, 1934; Thiele, 1938; Swenson, 1949; Anderson, 1949) that compared drill and generalization methods of teaching number facts to second or fourth grade students, found the generalization method to be superior except in criterion situations calling for immediate and automatic recall of knowledge relatively unchanged in form from that learned in the training situation. Though these are very often cited as providing empirical support for discovery learning, the rote/meaningful factor seems to have been much more salient than the discovery variable in each of these studies. Furthermore, students taught by generalization
method had the added advantage of concrete props in the McConnell study (1934) and of organized grouping of materials in the Swenson study (1949). The evidence, however, is valuable since the studies were of considerable duration.

Gestalt writings on insightful problem solving by Katona (1940), Duncker (1945) and Wertheimer (1959) are also cited as supporting the discovery learning view. Barring Katona's (1940) study, the other three do not report research findings as such but are sophisticated analyses of the nature and conditions of insightful problem-solving from the Gestalt point of view, which use observations, informal anecdotes and demonstrations to illustrate the principles under discussion. Wertheimer (1959), for example, compared relatively rote reception learning with insightful learning to teach a procedure for finding the area of a parallelogram and found that students taught by rote reception learning became confused when the orientation of the parallelogram was changed. On the other hand, students who had obtained some insight into the structure of the parallelogram were able to handle much more difficult cases well.

Like the long-term curriculum studies quoted earlier, these studies following the Gestalt emphasis on insight deal far more with the rote/meaningful dimension of problem solving than with the relative efficacy of the expository and discovery approaches.

Katona's (1940) study is more genuinely experimental and tested the relative merits of memorization and discovery learning of simple geometrical puzzles. He established that students, who worked out their own solutions and understood the principle, were more effective in memorization and transfer than pupils who were given expository rules to help them. He suggested that "formulation of the general principle in words is not
indispensable for achieving application". Similar findings were reported by Hendrix (1947) but in a clearer way - "Groups that discovered the principle independently and left it unverbalized exceeded those who discovered the principle, then verbalized it; and both exceeded in transfer those who had the principle stated for them and then illustrated".

Haselrud and Meyers (1958) conducted a coding study with college students and found that when codes are discovered solely from concrete instances (as in discovery learning) as contrasted with a procedure of giving specific directions on decoding (as in expository teaching), the latter method is better on original learning but there is no significant difference on a later transfer test.

A few useful dictums, that emerge from the work on learning by discovery in the 1930's, 1940's and 1950's and were substantiated by clinical experiments, may be termed as principles of discovery learning. Katona (1940) concluded that "self help" was superior and Hendrix (1947) suggested that an unverbalized awareness was more effective in learning than a verbalized awareness. Haselrud and Meyers (1958) suggested that fast learning under guidance was no guarantee of transfer and that maturity affects the learning and transfer potential of learning.

To test the proposition that discovery learning facilitates retention and transfer, 72 college seniors were taught to decipher cryptograms through different instructional sequences (Guthrie, 1967). Results showed that expository teaching resulted in faster acquisition but impeded remote transfer whereas discovery learning facilitated transfer but not retention. Expository teaching groups showed greater ability to apply the learned rule to new examples and learned this capability in half the trials needed by the discovery
Discovery learning group demonstrated greater skill in solving cryptograms involving new rules, both similar and dissimilar to the rules practiced in instruction.

In a study by Worthen (1968), fifth and sixth grade pupils were taught mathematical concepts over a six week period through discovery and expository teaching. The study provides some of the better data in discovery learning since characteristics of the two teaching methods were quite well defined. Pupils were exposed to sufficiently large doses of these two kinds of pedagogy; same amount of time for instruction by each method was allowed; students were tested at the end of six week period of treatment, then after 5 weeks and eleven weeks; tests involved both measures of the ability to use knowledge directly and the ability to transfer knowledge to the solution of novel problems. Results indicated very small differences in the learning of pupils exposed to the two methods. While expository teaching led to slight superiority on the immediate measure of retention, discovery learning led to slight superiority on the delayed measure of retention and transfer of concepts to new situations. Moreover, discovery group also performed slightly better on the two tests requiring the discovery of principles to solve problems. Thus, Worthen's study showed that conditions that favour recall of what is learned may not be the most favourable for transfer - i.e. if the goal is to parrot back information, rote learning may be efficient but the acquisition of understanding may lead to effective transfer, even though it may interfere with giving quick answers to short questions.

Both these studies (Guthrie, 1967; Worthen, 1968) show that performance on problems involving new rules is greater following a discovery lesson than following an expository lesson. These studies support the conclusion that discovery learning
facilitates the student’s ability to find and apply new subject matter rules; and thus he mathemagenic skills that further facilitate the ability to perform successfully in novel situations by giving the learners an opportunity to practice problem-solving in a situation, which is more representative of actual problem solving than is expository teaching.

In a study by Olander and Robertson (1973), 13 teachers taught mathematics to 374 students using contrasting discovery/expository methods but using the same textbook over a period of one year. The investigators made no significant test for interaction and the regression slopes plotted by them seem not to have differed greatly between treatments.

More recently, Peterson (1979) compared the more traditional teacher-centered instruction with more open, informal methods. She concluded that teacher-centered instruction leads to better performance on achievement tests while the open, informal methods like discovery learning or inquiry approach are associated with better performance on tests of creativity, abstract thinking and problem-solving.

**Discovery and Guided Discovery Learning**: A few experimental studies in which varying amounts of guidance were furnished to different groups of subjects in order to stimulate discovery in problem solving situations were conducted (Stacey, 1949; Craig, 1956, 1965; Corman, 1957). Stacey (1949) studied the effects of directed versus independent discovery on solving a group of simple meaningful problems with sixth graders, and found that active participation and self-discovery were more efficacious for learning than was passive participation, involving only recognition or identification of information presented to the learner. However, no significant differences were found with respect to mean scores of the two groups on a transfer test. Similar results
were obtained by Craig (1956) using similar kinds of material but with college students. Each of two groups of college students was given a different amount of direction during discovery of the bases determining solution of multiple choice verbal items. The group receiving the greater direction, including short summary statements of the bases determining correct responses, learned and retained significantly more principles than did the more independent discovery group, which was, in effect, a "no-help" group. As in the Stacey (1949) study, no differences were found between the groups on a transfer test. This evidence suggests the desirability of teachers and experimenters being liberal with information designed to assist learners in the discovery of principles.

Corman (1957) studied the effects of various amounts of guidance on the learning, application and verbalization of the principle and the method required to solve the problem. He concluded that guidance facilitated the learning and application of principles and methods and that withholding guidance could impede the problem solutions. Students who received information about the principle verbalized it better than those who received no information. Giving information was more effective than withholding it as far as application of principle to new matchstick problems was concerned, although this effect varied with the level of student ability, difficulty of the problem and amount of information provided about the principle.

Craig's (1965) study reveals that providing continuing tasks and not stating the rule at the conclusion of initial learning rather than discovery perse, enhance motivation to learn. Stacey's (1949) and Craig's (1956, 1965) results were unfavourable for the discovery learning strategy.
Discovery Learning, Guided Discovery and Expository Teaching: Kittell (1957) after a series of experiments on discovery learning, suggested that too much direction inhibits learning and too little results in the discovery of a very small proportion of the principles in the allotted time, and so fails to exploit the discovery but an intermediate amount of guidance (explanation of principles, organization of materials) was significantly superior to the two extremes. In his study of sixth graders, the independent variable was teaching a word task using one of the three methods - discovery, guided discovery and directed learning - the guided discovery group was superior in learning, retention and transfer to groups receiving either less or more direction.

An experiment was performed by Kersh (1958) with college students as subjects in order to test the hypothesis that learning by independent discovery is superior to learning with direction because the learning is more meaningful in the former case. The subjects were required to learn two arithmetical tasks to a common criterion. A two factorial design was used which involved three teaching treatments. The discovery group was required to discover the rules for itself with "no - help" given; guided discovery group was given clues to help them discover the rules. While in the former, there was evidence of post - experimental practice, in the latter there was none. The directed group (rule - given) was told the rules outright and given some examples for practice. Kersh found that on test of original learning, the directed group was superior to the other two groups because of the practice in the activity during learning. But on the retest one month later, discovery group was superior to both the other groups, probably because they were motivated to continue their efforts to learn the rules and practice them.

Kersh (1963) examined the learning which took place in arithmetic lessons for rule learners (guided discovery), discovery learners (unaided discovery) and rote learners (expository teaching).
He found that on immediate recall, rote learners were at least as good as the discovery group and were much better than the rule learners. In terms of retention, discovery was superior to rote and to rule; and in transfer, it was much superior to rote, but rule learners fell somewhere between the extremes. Looking at the motivational effects of discovery methods, he concluded that independent discovery procedure is superior to learning by rote and this superiority is explained by him in terms of motivation (i.e. Allport’s concept of functional autonomy) than in terms of understanding. Larson (1963) found that at least part of the superior retention of Kersh’s discovery group was attributable to Zeigarnik effect - a tendency to remember more incompletely than completed tasks.

Kersh (1958, 1963, 1964) concluded on the basis of his data that under certain conditions of learning, highly formalized lecture-drill techniques produce better results than techniques that attempt to develop understanding and that discovery by itself does not enhance understanding or meaningfulness. He also concluded that guided discovery, where the teacher intercedes between the environment and the learner but still allows him to discover the principles, seems to offer a useful middle way between independent discovery and highly directed learning. He also concluded that there is greater transfer under discovery learning; the student learns techniques for discovering new generalizations.

Forgus and Schwartz (1957) compared three groups in the learning of code based on a principle. Learning the principle made the memorization of the code much simpler. Their results on retention and transfer test indicated that learning the principle by either 'discovery' or 'guided discovery' techniques was superior to rote learning but no significant differences were found. Similar results were reported by Moss (1960), Maltzman and
others (1950) and Tomlinson (1962) but results opposite to these were reported by Ray (1957) and Rowlett (1960) since they reported that guided discovery was superior to direct detailed instruction in remembering and transferring principles of micrometer use and orthographic projection.

Gagne and Brown (1961) compared two discovery presentations with differing degrees of guidance to a rule-learning (RULEG) presentation. The study was conducted with high school students, who were to derive formulae/learn principles involved in the solution of number series problems. Under guided discovery, pupils were led to derive the rule by verbal directions that focussed their attention on critical information in an example. Best performance scores on the problem solving test (a transfer test that measured the pupil’s ability to discover new rules for previously unencountered number series) administered as measure of terminal performance, were obtained by guided discovery group, worst by RULEG group, with the discovery group falling between the other two. They explained that during learning, guided discovery method required the student to recall and apply the previously learned concepts whereas the RULEG method did not require it. Since the recall of concepts was more systematic in guided discovery than in unaided discovery, it produced greater learning and transfer. Gagne and Smith (1962) reported that students, who were required to verbally explain their actions while solving problems, performed better than students not required to do so.

In Wittrock’s study (1963), pupils worked problems involving the deciphering of a code by either one of the four methods. (i) Teacher gave rule and answer; (ii) he gave rule, but not the answer; (iii) he gave the answer only; (iv) he gave neither rule nor answer. The most effective initial learning came from group 1 and the least effective from the group 4 (minimum
direction). The best conditions for long-term learning came from the 'intermediate direction' groups 2 and 3.

Johnson and Stratton (1966) compared five teaching methods—3 expository teaching methods, one discovery program and one mixed program of teaching concepts. In Expository 1, definitions of terms were given which were related to a higher order class and students were to write their own definition of terms. In Expository 2, the term was used in sentences which were part of a short story; students were to read the story and complete a sentence that required the use of the term. In Expository 3, synonyms for the new term were given. In discovery learning, examples of objects and events were given and students had to discover the correct categories to which these belonged to classify them. The results showed that the last group did better than those in all other groups.

On a transfer test involving new number series both within and outside the scope of the general derivation rule, Roughhead and Scandura (1968) found no differences in performance between the group taught the general rule by expository method and the group taught the specific formulae by discovery learning but significant differences between these two groups and a third group taught the specific formulae by an expository method. They concluded that discovery group had learnt the more general derivation rule which the other groups had not. Since a discovery lesson promoted greater transfer than an expository lesson, it was quite possible that students learned a more general rule with the discovery approach and the degree of transfer observed in a problem solving situation is determined by the scope (range of situations to which the rule applies) of the rule learned by the student.

Anthony (1973) examined seven conflicting studies that
examined the effects of rule learning (Expository teaching) and discovery instructional presentations on the ability to find new rules. He found a low rate of performance during learning for the discovery group in all those studies that showed either no difference between the two methods or a difference in favour of expository method. The discovery group showed a greater capability for discovering new rules than the expository group in all those studies that showed a high rate of successful performance during instruction. So his analysis revealed a very high and significant relationship between learning during discovery instruction and success in finding new rules. The implication for education that follows is that rule learning lesson should be more beneficial if a high degree of student success cannot be ensured during discovery learning.

Sharma (1978) in an experimental study of teaching natural science at the primary level in Central schools found that guided activity was more effective than self activity in respect of concept formation in natural sciences.

Miyan (1982) examined the effectiveness of three methods of teaching Mathematics - tell and do, guided discovery, pure discovery - in developing mathematical creativity but found no significant differences between the three groups. However, guided discovery was found to be most effective in enhancing originality as compared with the other methods.

Bhalwankar (1985) studied the effects of expository and guided discovery methods of teaching mathematics on the achievements of students of different levels of intelligence. He employed 2 X 3 factorial design. The criteria used for studying the comparative effectiveness of these two methods were achievement scores on test items based on knowledge, comprehension and application objectives. Retention of the content was also measured.
by administering the same test after three weeks of the conclusion of the experiment. Major findings of the study were: (i) Guided discovery and expository methods were equally effective on knowledge and comprehension objectives with respect to both immediate post-test as well as retention test. (ii) The expository method was more effective than the guided discovery method on the criterion of scores on application objectives with respect to students of high intelligence. (iii) The guided discovery method was more effective than the expository method on the criterion of percentage of retention scores on the application objective in the case of students of low intelligence. The main educational implication of the study is that all teaching methods are effective in certain situations and not so effective in other situations, i.e. content and objectives determine the methods to be used.

Certain trends may be drawn from the review of the various studies.

1. Research in the field has over the years become more sophisticated and less concerned with the simple method A versus method B problem; and has become removed from the classroom with respect to the nature of learning tasks and the teaching methods involved. It has become laboratory research on the problems of transfer, learning, verbal mediation and task instructions rather than research on teaching in the traditional sense. Focus is more on the details of the learning processes involved in the two methods - i.e. the motivational effects of discovery method in Kersh's (1958, 1963) work; the effects of varying amounts of guidance by the teacher in the stimulating discovery in Craig's (1956) and Cormia's (1957) studies; and the interaction between amounts of guidance and direct and transfer learning criteria in Wittrock's (1963) study. Thus research has become less dominated
by the model and more specifically concerned with the psychological processes implicated in the model.

2. These studies vary in many significant details like amount of actual guidance provided in the guided discovery treatments; the taxonomic level of the task involved - whether comprehension, application or problem-solving; the amount of learning time allotted to each group; and appraisal of learning through a measure of the pupil's ability to recall or to transfer what has been learned to the solution of new problems. Thus it seems rather impossible to draw conclusions as to the general superiority of one method or the other.

3. A number of studies (Corman, 1957; Kittell, 1957; Kersh, 1958, 1963; Gagne and Brown, 1961; Wittrock, 1963; Guthrie, 1967; and Anthony, 1973) show either partial or clear trends in favour of discovery as opposed to expository methods. However, there is not always a linear relationship between the degree of structure and the amount learned (Andrews, 1984) and these findings are often clouded by difference between sub-categories of students or between immediate and follow up measures of learning.

4. On the other hand, various other studies (Stacey, 1949; Maltzman et al., 1950; Forgus and Schwartz, 1957; Haselrud and Meyers, 1958; and Craig, 1956, 1965) found either no significant differences or a tendency in favour of the more directive learning methods.

5. It is not unwarranted to conclude that unaided discovery learning can boast of little evidence of advantage and so should be cautiously used since even its theoretical advantage - i.e. a possible enhancement of long term cognitive skills - has not been conclusively established.

6. When the objective of teaching is adequate comprehension of a principle or concept, it is not unsound to use the expository
When application of genuine problem-solving is desired, guided discovery, wherein a degree of structuring is involved, is clearly preferable to autonomous discovery as shown in studies by Craig, 1956 and Corman, 1957. Since student performance in a discovery lesson is crucial to the attainment of desired results, the teacher must ensure successful performance through stimulation of prerequisites and guidance that leads the student to actually discover the rule. This guidance, while stimulating recall of the necessary concepts and directing the learner's attention to relevant information in the problem solution, does not give the student the solution but merely makes it more probable that the student will discover it. With this intermediate amount of guidance, problem solving skills are better learned than either when the student is left to flounder in a pure discovery situation or when instruction is an expository presentation. Blake (1982) reviewed the relevant literature and concluded that guided discovery, more than unaided discovery, is the most effective discovery learning pattern.

The distinction between learning conditions for initial and long-term use is a just and valuable one and it highlights the need to specify accurately our learning goals in thinking about method and technique. It is seen that when three or more levels of structure are studied, there is often a curvilinear relationship between structure and learning — specially with respect to transfer and generalization. Pupils who have once discovered a principle are much less bewildered when they must think for themselves in the next situation. This leads one to suggest that in every field of study, some of the teaching should be by discovery learning and such teaching should be spaced throughout the curriculum. Taking the case of English teaching, parts of the
English syllabus may be well handled by initial fast learning - necessary technicalities of verse form, of punctuation and of spelling, while other parts may need learning which produces maximum relevance to the pupil in terms of retention and transfer characteristics.

3.2 INTELLIGENCE AND LEARNING/ACADEMIC ACHIEVEMENT

Prior to a discussion of aptitude x treatment interaction (ATI) studies, research that has been conducted to establish empirically the relevance of intellectual abilities for explaining variance in academic performance needs to be briefly reviewed.

Ever since the introduction of intelligence tests, researchers have conducted studies to examine the relationship of intelligence to learning or academic achievement. Early studies of Hollingworth and Cobb (1923), Strang (1937), Dysinger and Gregory (1941), Gowen (1955) and many others established that superior intelligence was associated with high academic achievement.

Later, Stephens (1956), Mitchell (1963) and Keller and Rawley (1964) suggested intelligence as being the major factor influencing academic achievement. On the basis of results obtained, Torrance (1965) concluded that pupils with more intellectual skills and capacities are likely to accomplish more on academic tasks and jobs that require such skills. Passi (1971) reported a significant correlation between verbal and non-verbal intelligence and achievement. Mathur and Hundal (1972) reported correlation between intelligence and achievement as high as 0.83. Several researchers, Mallick (1977), Ammerjan (1978), Riedal (1980) and Lavizzo (1981) reported that the correlation between intelligence quotient and grades in vocational courses was lower than the one found between intelligence quotient and academic courses. Kaile (1981) found intelligence to be significantly and
positively correlated with achievement in English, first language and second language.

Krishna and Aggarwal (1983) discovered that reading ability tends to exhibit significantly positive association with verbal and nonverbal intelligence.

Mishra (1986) studied the relationship between creativity and problem solving ability at different levels of intelligence and found high correlation between high intelligence and problem solving ability but insignificance correlation between low intelligence and problem solving ability.

Bell (1986) studied the influence of age, intelligence and training on the acquisition of a formal operational concept and concluded that highly intelligent students had a greater frequency of correct responses.

Roberta et al. (1986) indicated on the basis of their study that more intelligent students are assumed to require less instruction than their less intelligent pears in learning new concepts and skills.

Gakhar's (1986) study, aimed at investigating the relationship between intelligence and academic achievements of college students, found significant correlation for science, commerce, arts and home science group.

Nevertheless, certain studies failed to show any significant relationship between intelligence and reading ability (Safer and Allen (1973) were of the view that reading ability should not be considered a phenomenon confined to average or above average IQ since there are good and poor readers at all intelligence levels.
Joshi (1984) conducted a normative survey study on a sample of 720 students studying in urban and rural schools in Moradabad. The statistical techniques used for analysing the data were mean, percentage, t-test and correlation. The major findings of the study were: (1) the growth status of language ability was a function of structural factors operating within (intelligence, sex etc.) and outside (socio-economic status, locality and type of school) the individual. (2) There existed a significant relationship between intelligence and growth of various English language abilities.

Khare (1986) conducted a comparative study on 253 boys and 300 girls from four districts in U.P. and concluded that intelligence was an important factor in achievement in all the seven areas of English - spelling, comprehension, composition, pronunciation, applied grammar and vocabulary.

This brief review shows that most of the research in the field shows a signification or relationship of intelligence with learning/acquisition/academic achievement. It also shows that there exists wide variations in the range of 'r' value between intelligence and achievement thereby leaving scope for exploring the possibility of identifying factors other than intelligence, which may be responsible for causing difference in student learning or achievement.

3.3 INSTRUCTIONAL STRATEGIES AND INTELLIGENCE:
THEIR INTERACTIONAL EFFECT ON LEARNING, RETENTION AND TRANSFER OF LEARNING.

How accurate a predictor is IQ when quality of instruction is radically improved? This is a question that has to be settled before going on to the debate on whether discovery or expository teaching strategy leads to better learning, retention
and transfer for high and low ability learners. To determine the relationship of intelligence to instructional strategy. Stolurow (1964) taught fractions through an easier programme where he ordered the fractions consecutively, and through a harder one where he presented the fractions in mixed or scrambled sequences. His results revealed that achievement between high and low ability groups differed little with the easier programme since it did for the low ability pupils what the Highs could do for themselves whereas high ability group secured higher scores with the harder programme. This indicated that the most efficient instruction for students of low ability will produce achievement which has zero correlation with intelligence. Evidence that easier, more symbolic treatments can reduce the advantage of those high in general ability or v:ed, and therefore, can be advantageous for lows was cross-validated by Davis (1967) and Frederick (1971). Thus it is seen that improved instructional strategies are likely to result in improved learning for low-ability pupils too and this brings us directly to the issue concerning aptitude-treatment interactions.

Mathematical subject matter has been reported in the majority of the longer studies on ATI, as in earlier studies reviewed that compared the efficacy of discovery, guided discovery or expository teaching. Research dealing with mathematics is relevant to questions of language learning since the universe is systematic and ordered; mathematics is, among other things, a rationalization of experience; and descriptive work in language study also reduces a world of experience to order. Therefore, the possibility of common problems existing between mathematics and language teaching cannot be ignored.

Sobel (1956) had one group of teachers guide pupils in discovering how to apply concepts of ninth-grade algebra while the control group teachers taught in a conventional
deductive manner. The inductive treatment was found to be superior among classes with a high mean IQ and there was no treatment difference in classes of lower ability, either in immediate or three month delayed post-test.

Evidence contrary to that of many discovery/expository comparisons is found in the studies by Grote (1960) whose sample of 180 eighth graders was assigned to one of five conditions to learn physics after being divided into thirds on ability. Since the instructional task had two parts, Grote created two conditions of straight discovery/didactic instruction and two others that used both methods in opposite order, while the fifth group served as control. Outcome measures represented immediate learning on each part of the task and retention and transfer after one and six weeks. Retention was greatest from didactic treatment and transfer best from the mixed approach with discovery first. The analysis showed strong main effects for aptitude and disordinal ATI. The transfer measure gave ordinal patterns; the order discovery then didactic was particularly helpful to lows. The result that the didactic instruction was best among high IQ on retention scores could perhaps be explained by the fact that instruction in the experiment lasted only 39 minutes.

Yabroff (1963) compared inductive/deductive forms of programmed instruction (PI) using 272 college students who were categorized into high and low ability groups on the basis of Miller Analogies test. The programme on statistical topics had two versions within each treatment. 2 X 2 X 2 anova was performed on post tests of knowledge and problem-solving. The two methods were about equally effective overall and three way small but significant interaction appeared on the time score of the problem solving post test (lows solved problems more quickly after deductive PI and highs after inductive PI). The
inductive treatment benefited the high ability group of students. Similar results were reported by Koran et al. (1971) using Yabroff's materials and criterion materials to 167 teacher-education student.

Using Gagne's instructional programmes on number-series formulae, Becker (1967) conducted a study with high-school students. He based his hypotheses on the results of a pilot study - that those high on verbal tests and low on mathematical reasoning would achieve better in the didactic treatment while low-verbal, high quantitative students would do better with discovery. The results, however, showed no ATI effect although both aptitudes were positively related to achievement regardless of instructional method.

Tanner (1968) taught principles of mechanics for 389 ninth graders through expository-deductive, discovery-inductive and unsequenced discovery methods requiring three and a half class periods for instruction and testing. Results showed that discovery treatments were a bit better for high IQ subjects; sex and expository treatment for low IQ subjects interacted significantly as far as comprehension and lateral transfer criteria were concerned: Expository methods were best for boys while discovery produced better performance among girls.

With a small sample of young learners, conservation of numbers was taught in instructional activities of about 20 minutes duration, either through pure discovery, discovery guided by visual cues, or direct, expository teaching (Peters 1968). The aptitude measures were a test of language facility (LCT) and a test of analytic style (AS). Some differences in regression slope were large enough to be important, if established on a large sample and a longer treatment. Analytic style seemed not to interact but language ability seemed to make an appreciable
difference in learning from perceptually guided discovery and no
difference in the pure discovery treatment. Highs on the pretest
did about equally well in all treatments, but lows did much better after the verbal expository treatment.

Scores on immediate and delayed post test for each unit were related to Otis mental ability scores by Maynard and strickland (1969) when they compared discovery/guided discovery/teacher presentation - application (N=400) during three units of eighth and ninth grade mathametics. Three weak ATI's were obtained. Among highs, discovery was slightly advantageous in two units and guided discovery in the third. Among lows, the deductive method was as good as the inductive method.

Thomas and Snider (1969) gave six weeks of instruction to eighth graders on the unit 'Early man in America' in guided discovery and didactic form. In the discovery treatment, the teacher followed a basically inductive approach and guided discussion to preclude learning of unsound responses, whereas in didactic teaching, the teacher presented generalizations and illustrations according to a detailed outline. Data included the Henmon-Nelson measure of IQ and three outcome measures - an achievement post-test, the Watson-Glaser test of critical thinking and a measure of remote transfer. The results revealed that at all IQ levels, more content was learned from didactic teaching; critical thinking and problem solving showed disordinal ATI effects; and guided discovery was advantageous for students with high IQ whereas below IQ 120, direct exposition gave better results on all outcomes.

The Concept Attainment experiment has been a popular technique for analytic studies of inductive processes, wherein the experimenter alters the stimuli or the conditions of learning so as to modify the amount and nature of induction. Dunham
and Bunderson (1969) compared pure discovery to guided discovery and showed that the way a task is structured changes the ability correlates of success. Success in a treatment where meaning was supplied seemed to depend more on a reasoning factor; whereas when no structure was supplied, it was memory that counted. One group received only minimal instructions and the other was told of two logical rules which, if followed, would allow S to organize information from successive trials so as to attain the solution quickly. No significant main effect appeared probably because the rules did not 'get across' to most subjects in the guided discovery group; their means, however, were superior to those of the first group. Interesting aptitude relationships emerged - success in the pure discovery group depended heavily on associative memory, while success in guided discovery depended on general reasoning. This study is important for education in that it seems to confirm which ability determines one's success depends on the way one stores incoming information.

No significant interactions appeared in a study by Barrish (1970) in which general ability and measures of divergent thinking were the aptitude variables. Subjects (fifth and sixth graders) were stratified on both IQ and divergent thinking and then randomly assigned within strata to groups to be taught mathematical topics by discovery or didactic methods. The study claims a novel design wherein the four selected teachers worked in an 'open plan' arrangement with various subgroupings of the total group and at some point in the experiment, each teacher applied each method to one group of students. The results did not show a consistent trend over the two grade groups and the two dependent variables but for an ability main effect. The small sample size (N=96) was possibly the reason for the weakness in the experiment.
Looking for interactions arising in one month of inductive-deductive instruction in English, Rizzuto (1970) took verbal ability and sex as aptitudes in six eighth-grade classes (N = 165). Under the inductive approach, teachers acted as catalysts for discussion by asking open-ended questions and directing students' attention much as in guided discovery. Under deductive approach, they taught in a formal precise manner. Treatment period extended over 20 class periods of 45 minutes each. Recognition and transfer post test were administered immediately after treatment and then after a two week delay. Anova was employed and the Sex x Treatment interaction was significant on the delayed post test; girls did much better in the inductive treatment while boys found it only moderately advantageous. The interaction for ability on the immediate test fell short of significance.

Hermann (1971) compared 'ruleg' (rule-then-example) and 'egrule' methods of programmed instruction which were crossed with concept learning and principle learning in a 2 x 2 design. Sample comprising of 256 fifth and sixth graders was divided for analysis into high IQ and average IQ (above and below IQ 110) and instructed in a single session. Post tests four weeks later provided retention, near-transfer and far-transfer scores. Two significant ordinal ATI'S were obtained for IQ, but Cronbach and Snow (1977) point to the possibility of this being a chance occurrence with 84 statistical tests that were employed.

A particularly well-planned study by Babikian (1971) contrasted expository, laboratory and discovery methods of teaching Archimedes principles. All groups worked on the same concepts and used the same exercises and review questions. He made a 2 x 2 x 3 analysis of variance with sex and IQ as factors; he had 18 cases per cell after squaring off his design. The IQ main
effect was as expected - Highs were superior. Boys surpassed girls in each IQ x Sex comparison within treatment, generating a sex main effect. A significant treatment effect was seen; all groups under discovery treatments performed poorly except boys of high IQ. Groups in expository and laboratory treatments differed very little but expository method was better for lows on most subtests. Cronbach and Snow (1977) estimated variance components on Babikian's data and adjusted them to restore the information lost by blocking on aptitude. The components showed very strong IQ and treatment main effects.

Mayer and Greeno (1972) and Egan and Greeno (1973) have reported on a series of studies related to the issue of differential efficacy of discovery and expository teaching under quite controlled conditions. The topic for instruction (Mayer and Greeno, 1972) was the binomial theorem and its applications to simple probability problem. College students were divided into high, medium and low groups in terms of their scores on the mathematics aptitude test. The results showed that while medium and high groups required almost identical time to master the materials in the two methods, the low group was much slower on the discovery method and made more errors.

Egan and Greeno study (1973) is notable for its discussion of processes carried on during learning. The work of the learner presumably called upon one set of abilities in the rule treatment wherein the rule was given to them and upon another in the discovery treatment, wherein they had to infer the formula from examples. The posttest had a strong relation to aptitude in the discovery group and almost none in the rule group; thus the discovery method was distinctly disadvantageous to students of low ability. Meaningful and better integrated knowledge produced by discovery method seemed more readily transferable to new problems. However, the better original learning
in the rule condition which was chiefly due to its superiority at low ability levels, prevented this qualitative difference from appearing as a main effect on transfer problems. Their data suggests that in order to profit from a discovery learning procedure, learner must have a body of related knowledge to which he can tie in new knowledge. Similar results have been reported by Mayer (1974) who concluded that the common experience presentation and discovery instruction result in greater transfer because they both activate a broader assimilative set in learning.

The inductive method gave comparatively poor results and no interaction with ability in a short study by Nelson and Frayer (1972) on seventh graders studying simple geometric concepts (N = 228). The discovery group did somewhat less well than the expository group even though they spent three times as long in study. Similar results were reported earlier by Scott (1970) working with 256 sixth graders.

Peterson, Janicki and Swing (1980) found that students differences did interact with the teaching method. The sample comprised of ninth grade students and the methods used were inquiry, lecture recitation and public issues approach. Students with high verbal ability performed best on a test after the lecture - recitation method and students with lower verbal ability after public - issues approach. A three way interaction involving student anxiety, student ability and type of instruction was also found. High anxiety, low ability students did poorly with the public issues approach but responded well to the inquiry method.

Yadav (1985) studied the efficacy of guided discovery method over lecture method at different intellectual levels. The results showed that students acquired significantly better through guided discovery than through lecture method at all levels.
Roberta, Ferrera and Joseph (1986) studied the relationship between Student's learning and transfer of inductive reasoning rules. The results indicated that more intelligent students are assumed to require less instruction than their less intelligent peers in learning new concepts and skills.

The following trends can be discerned from the results of the studies reviewed. 1. Most studies (Sobel, 1956; Yabroff, 1963; Maynard and Strickland, 1969; Thomas and Snider, 1969) found that discovery method benefits highs and is equal to or worse than expository method for Lows. Thus evidence does exist to reveal that brighter students may profit from discovery learning but the evidence is ambiguous for average and slower children. So Cronbach and Snow (1977) postulate that in order to profit from a discovery learning procedure, the learner must have a body of related knowledge to which he can link the new knowledge to be acquired. Since the low-aptitude students didn't have such a body of knowledge within themselves, learning by discovery was an enormously difficult task for them.

Though frequent significant interactions between discovery/expository treatments and high/low intelligence learners are found, main effects are rarely large. Cronbach and Snow (1977) have suggested that this lack of clear-cut superiority of either discovery learning or expository teaching may be due to the fact that the students' attitudes, needs, capabilities and behaviour influences his or her ability to learn from the two formats being compared. Since the differences in student characteristics from one study to another were not identified or analyzed, these studies yielded seemingly contradictory results.

3.4 COGNITIVE STYLE AND LEARNING / ACADEMIC ACHIEVEMENT:

Interest in Cognitive style developed partly because traditional
research on ability failed to expose the processes generating individual differences. Cognitive style has turned out to be one individual difference that has been linked to academic learning in general (Annis, 1978; Annis and Davis, 1978; Frank, 1984; Kiewra and Frank, 1986). The scope and diversity of research on field dependence is truly impressive, ranging from interpersonal relations to learning and memory, cross cultural differences and mathematical achievement. Studies of the role of cognitive style in student learning have used both the cognitive and social characteristics constituent in the field - dependent - independent dimension to conceptualize relations between learning behaviors and cognitive style. In a large number of studies with college populations, relatively field - independent students were found to perform significantly better in the mathematics, sciences, engineering and architecture domains than field - dependent students e.g. Greenfield (1970); Margulis (1971); Hunt and Randhawa (1973).

Shrock (1979) studied the role of cognitive style in problem-solving performance and concluded that field- independence contributed significantly to problem-solving variance.

On the basis of his findings, Letteri (1980) indicates that the cognitive profile is a basic determinant of an individual's level of academic achievement and can accurately identify specific learning deficits significantly contributing to low academic achievement. Graffin (1982) conducted a study entitled 'An investigation of the relationship between student's Cognitive style on the field dependence - independence dimension and their writing process' and reported that field independent subjects obtained higher holistic scores than did field - dependent subjects.

Atang (1985) reported that individuals’ field dependence/independence was not a significant factor in their
performance in the pretest and the posttest.

Fritz (1985) reported that neither locus of control nor field independence/dependence was related to academic achievement in samples of gifted students.

Arrington (1989) concluded that field-independent subjects are more proficient problem solvers than field-dependent subjects. His findings are similar to those of Shrock (1979).

McDuffie (1989) conducted a study entitled "The effect of intelligence, creativity and cognitive style on success in composition" with a sample of 109 college freshmen to obtain a composite portrait of a successful academic writer. The findings demonstrate that students with high performance scores in writing are more affected by intelligence and cognitive style than by creativity. In fact, creativity scores on originality had no correlational significance with success in academic writing performance.

The trend of results suggests that cognitive style of the learner is related to academic achievement and in a few specific instances where its effect on writing proficiency or acquisition of writing skills was examined, it showed an effect. Another trend that seems to emerge is that field independent cognitive style group score better than field dependent cognitive style group.

3.5 INSTRUCTIONAL STRATEGIES AND COGNITIVE STYLE: (THEIR INTERACTIONAL EFFECT ON LEARNING, RETENTION AND TRANSFER OF LEARNING)

The interactional effect of field dependent/independent cognitive style with instructional approaches has been studied by a few researchers, out of which some treat cognitive style as aptitude; others as an intellectual attribute to be modified.
and still others make it the dependent variable. Two stylistic variables that have particularly entered research on interactions are conceptual level (CL) and field independence (FI). Researchers have actively searched for aptitude-treatment interactions (ATI), hypothesizing that the cognitive style of field dependence/independence will interact with the structure of a task; Lows (Field dependents) needing more structure and Highs (Field-Independents) needing less.

A study by Lee, Kagan and Rabson (1963) revealed that high analytic subjects learned analytic concepts faster than inferential or relational concepts, whereas low analytic subjects learned relational concepts rapidly and analytic concepts slowly. While this is a significant interaction, the contrast obviously is between kinds of content learned rather than modes of instruction. The finding, nevertheless, might have an important implication for school learning: the best way to organize lessons might differ for subjects differing in style.

Davis (1967) in a brief experiment (N = 30) used concept identification tasks but obtained negative results. Results showed that field-independence had an ordinal interaction with a particular aspect of the difficulty of the tasks used, but it did not interact with the kinds of complexity where Davis had expected 'cognitive style' to produce an interaction.

Beller (1967) examined language-training methods for poor nursery school children (N = 81) who were classified as descriptive-analytic and as contextual-relational on Sigel's test of conceptual styles. Training was given to pairs of children in 13 brief sessions through three treatments-descriptive-analytic method, contextual-relationship method and a control condition. ATI, not statistically significant, was found on all immediate posttest outcomes; subjects given training that matched their own
styles were always superior to subjects given training that didn't match. The transfer data suggested that the contextual-relational method facilitated transfer to new material but there were no ATI. Results showed ATI, favoring the matching of treatment and style.

In McLachlan's (1969) study, 64 eleventh graders chosen from the extremes on conceptual level (CL) and then matched on sex, status as an art student and verbal ability, learned about Picasso's 'Guernica' by lecture and discovery methods. Short answers to questions about the painting's meaning and the relevance of the parts to it were written by subjects as a posttest. The ANOVA showed main effects favoring lecture and high conceptual level. Integration was related to conceptual level in the discovery group and very little related in the lecture group.

Coop and Brown (1970) tried to extend Beller's (1967) result to college students with two treatment conditions - one teacher - structured and factual; the other requiring independent problem solving. The structured method was better on the average and did not interact with the analytic/non analytic cognitive style dimension.

A study that used programmed instruction sequences, varying in the amount of structure provided, (Schwen, 1970) is also relevant here. This was a small-step program condition wherein each generalization was presented individually with examples and discussion, and the learner answered questions with corrective review after each section before proceeding to the next one. Thus it broke the learning sequence down so that each learning block covered one generalization at a time. However, no relation between field dependence, independence and retention three weeks later was found.
Tomlinson and Hunt's (1971) sample comprised of 120 eleventh grade students from opposite ends of conceptual level distribution. The conceptual level X treatment interaction was significant - Highs were markedly superior to lows in the two inductive treatments. In the ruleg conditions, highs did a little worse than lows. Lows did far better with ruleg instructions than in inductive treatments; among highs, the treatment difference was small.

Grieve and Davis (1971) compared expository/discovery teaching in ninth grade geography, using groups randomly chosen from the high and low halves of an field - independence distribution (N = 74; instruction spread over 11 hours). With boys, ATI was significant and disordinal; with girls, ATI was not significant. The significant ATI for boys revealed that expository teaching was best for highs, discovery was best for lows in producing both knowledge and transfer.

The one potentially important effect observed in Fry's (1972) research is that persons high in ability and low in conceptual level did considerably better under external direction and this effect had been predicted by him mainly on the basis that low-conceptual levels are less able to use independence.

Hunt et al's (1974) study involved an hour of instruction on Hemingway to students of ninth grade made homogeneous on conceptual level and matched on sex and general ability. Anova showed no significant main effects or interactions but the casual inference data displayed a borderline ATI; inductive teaching was best for all subjects but synectic teaching gave a steeper positive slope. These findings suggest that low conceptual level students are helped by more directive teaching whereas highs do better when they have more control over the situation. The earlier conclusion that didactic instruction suits less able
students better than inductive teaching is superficially similar to this conclusion.

In a study by Bolocofsky (1980), tenth grade students classified according to field-dependence on Group Embedded Figures Test were administered reading comprehension tasks under the conditions of competition and non-competition. A significant interaction between field dependence and competitive motivation was found: field dependent subjects increased their performance significantly while competing. Field independent subjects exhibited only a slight and non significant change. Hence, the effectiveness of competition as a motivational tool for enhancing classroom performance appears to be mediated by individual students differences in field dependence.

Andrews (1984) compared the effects of discovery (DL) and expository (EA) teaching formats on students with independent and dependent learning styles. The discovery learning method encourages the learner to generate conclusions inductively from ambiguous materials, whereas in the expository teaching format, the structure of the material is presented at the start to help guide student learning. Independent students were expected to learn more productively via the freedom of the discovery learning situation while the structure of the expository teaching format should be beneficial to dependent learners. On a post test immediately following treatments, the discovery learning format was found to be superior for both subgroups of students. The superiority was markedly greater for the independent students so that the predicted aptitude - treatment interaction (ATT) was also present: Independent students out performed dependent students in the discovery learning condition while the reverse was true in the expository teaching setting.

Walker (1984) conducted an experimental study to test the
effectiveness of two methods of teaching sixth grade science students via either the inductive guided discovery or deductive expository teaching methods. He examined the relationship of cognitive style to teaching effectiveness and possible aptitude treatment interaction which might exist in the study. Forty subjects assigned to either of two sixth grade science classes took part in the study. Group embedded Figures Test (GEFT) was administered to both treatment groups prior to the study. 2X2 factorial ANOVA was used to determine whether the results of the study were significant beyond the .05 alpha level of significance in testing the hypotheses for the dependent variables- initial learning, retention and time on task. Neither the teacher nor the observer of the student behaviours during the unit were aware of the individual cognitive style identity of the students. The evidence from the study suggested a significant main effect for cognitive style for initial learning variable (F = 6.83; P.05). However, no main effect for teaching methodology was found. For the retention variable, there was also a highly significant main effect for cognitive style (F = 7.80, P.01) but no main effect for methodology was found. It was apparent that field independent students performed at higher levels of initial learning, retention end time on task behaviour, irrespective of methodology.

Hubble (1985) in his study involving 58 high school students tested the hypothesis that field dependent and field independent learners differed on a verbal task. The sample was required to evaluate three levels of class inclusion statements under two condition of reading passage organization. Field independent learners overall evaluated literal assertions, simple deductions and complex deductions with greater accuracy than field-dependent learners. The hypothesis that group differences should be larger on complex deductions than on simple deductions
were not supported statistically although means were consistently as expected.

Ballard (1985) investigated the interaction of cognitive style and achievement of selected students of English as a second language. GEFT (Group Embedded Figures Test) and CAT (California Achievement test) were used as criterion measures. A significant correlation between field independence and California Achievement test language scores and second language proficiency levels was obtained.

Dugger (1985) compared the effects of two contrasting instructional approaches representing field independence-dependence cognitive dimension on mathematics problem solving performance and concluded that field dependence-independence dimension applied to teaching improved the students’ performance.

Kang (1985) examined the relation of field dependence - field independence cognitive style and personality with performance on Cloge test for Korean students of French as a second language. The results showed that performance on Cloge test was not affected by the students field dependence - field independence cognitive style.

Hadsel, Wilson and Mikula (1986) sought to establish if students with low or high convergent aptitude or with low or high divergent aptitude would perform differently in response to either of two methods of composing paragraphs: deductive (topic sentence to details) and inductive (details to topic sentence). The results showed that the deductive teaching method group (grp.1) recorded the greatest gain in all three areas of the post test i.e. topic sentence, unity and development - but lost that gain in the delayed retention test to end the experiment with the lowest means. The inductive teaching method
group (grp.2) recorded a lower mean in the topic sentence and unity for post test but completed the experiment with the highest means of all the groups. The control group showed the greatest improvement overall, passing group 1 and drawing close to group 2 though starting lower in two categories. The study indicates that a carefully balanced presentation of both methods produces greater overall improvement for students. The finding suggests that the method of teaching paragraph writing could make a difference for students and points to a need for further research.

Higgins (1986) studied the relationship between field dependent - field independent styles and persistence and performance in an instructional television curriculum. The conceptual framework was the influence of field dependence and field independence as predictor variables of persistence rates and performance levels in the impersonal pedagogical approach of instructional television - an approach that is incongruent with the cognitive style of field dependent learners, who prefer reliance on interaction or the 'field' for analysis and structure in ambiguous information seeking conditions. He concluded that field independent learners excelled field dependent learners in successful performances in both the natural sciences and the behavioral sciences.

Tootle (1986) analyzed the relationship between field dependence/field independence styles and levels of learning. The results indicated that field independent subjects scored significantly higher than field dependents on the comprehension and application level tests, but no significant differences on the knowledge level test were seen. It suggests that in adult population, as course content becomes more complex and test items more demanding requiring a higher level of operative processing, a field independent cognitive style may be favorable for achievement of learning outcomes.
Tumposky (1986) examined the effects of inference strategy training on field dependent/field independent second language learners. One assumption was that second language learners could be trained systematically to use inference strategies and that such training would promote second language proficiency by improving the quality of the learners' interaction with the target language. Inferencing is included as a crucial component of several second language acquisition models. No significant main effect was found for treatment nor was there a significant interaction between treatment and cognitive style, although more field independent learners appeared to be less sensitive to type of treatment than were field dependent learners.

In Stoeltje's (1988) study, significant differences were found between field dependent and field independent third grade students \((N=82)\) in word recognition, performance of defining a word presented in context, in composite vocabulary performance, performance in locating resources, in reading comprehension, in composite reading comprehension and in total reading performance. Field independent group performed better on all of the reading tasks. Results showed that cognitive style is an important factor in school learning and field dependence/field independence dimension particularly appears to be significantly related to reading performance in lower elementary grades. So cognitive style tests could become an important diagnostic tool for the classroom teacher.

Kiewra and Frank (1988) tested the factual and higher order achievement of field-independent and field dependent learners after exposure to lecture material by an immediate test without review of notes, or by a delayed test with a review of notes. During the lecture, students engaged in one of the following three learning techniques - personal notetaking, notetaking on a skeletal outline or listening while examining
detailed instructor’s notes. Field-independent learners were found to achieve higher scores on factual and higher-order achievement tests than did field-dependent learners. Differences in factual performance were reduced from immediate to delayed testing, indicating that field-dependent learners benefit more from the initial encoding function. Though this study is not directly relevant to the present research being undertaken by the investigator, it is significant in that the better higher-order achievement of field-independent learners perhaps shows that cognitive style differences are involved in higher-order learning and that certain compensatory activities may yet be developed to promote higher-order learning and performance among field-dependent learners. One possibility is providing higher-order questions with corrective feedback during review.

The study entitled ‘Effect of cognitive style and immediate testing on learning from a lecture’ (Kardash, Lukowski, Bentmann, 1988) is significant in that its purpose was to examine Kiewra and Frank’s (1988) conclusions. The hypothesis was that provision of knowledge of a criterion in the form of an immediate test was an equally plausible explanation of Kiewra and Frank’s results. All subjects reviewed their notes prior to the delayed test but some received an immediate test prior to delayed testing one week later, others didn’t. The results showed no difference in performance on delayed test between field-independent and field-dependent students who had received an immediate test. However, field-independent students performed better than field-dependent students in the ‘no-immediate test’ condition.

The following trends emerge on the basis of the brief review of related literature:

1. The field dependence/independence cognitive style has been found repeatedly to interact with classroom instructional
procedures designed to facilitate learning and many researchers like Kogan (1971), Keough (1973), Witkin et al (1977), have stressed the importance of considering its influences in the development of techniques designed to enhance academic performance.

2. The case seems well documented that relatively field dependent and field-independent persons tend to favour different learning approaches. It seems field independent persons are likely to learn more than field dependents under conditions of intrinsic motivation.

3. Survey of research by Witkin et al (1977) led them to the finding that field-independent persons tend to follow active participant approaches to learning, while field-dependent persons more often use spectator approaches.

4. The approaches favored by one kind of persons do not necessarily lead to better achievement than those favored by the other kind. Whether one approach will lead to a better learning outcome than others seems to depend more on the specific characteristics of the learning task and the particular circumstances in which learning takes place. So it appears that neither end of the field dependence/independence continuum is necessarily or uniformly favourable or unfavourable, rather the value of the deviations in either direction depends on the demands of particular situations.

5. On account of difference in processing the information/material, field independent learners generally perform more accurately than do field dependent learners on higher-order tasks (Annis, 1979) and on lower-order tasks too unless encoding and/or external storage conditions help field dependent learners to compensate for their deliberate and passive learning styles. As for example, Frank's (1984) study revealed that field independent
learners generally achieved higher scores on factual and higher order tests than did field dependent learners but in Kiewra and Frank's study (1988), differences in factual performance were reduced from immediate to delayed testing, indicating that field dependent learners benefit more from the storage function of note-taking than from the initial encoding function.

In order to forge generalizations about instructional procedures and practices, more powerful and consistent evidence from contemporary research is required. The brief review indicates the inadequate sample size in some studies or the brief treatment period in others. However, they are valuable since they suggest possible mechanisms in learning that give rise to aptitude-treatment interaction.

3.6 RESEARCH ON TEACHING OF WRITING SKILLS IN ENGLISH

Research, that has tried to establish the effectiveness of different strategies in the teaching of writing skills in English is being given separately because most of the studies located in this field do not investigate the efficacy of guided discovery and expository teaching but deal with various other instructional strategies, procedures and techniques. As such they could not conveniently be categorized under any of the earlier sections. Yet at the same time these studies are valuable and so needed to be reviewed in order to arrive at certain generalizations, that would help in formulating hypotheses for the study.

What kinds of instructions have the greatest impact in enhancing students abilities to deal with a wide variety of composing problems? What instructional strategy results in more effective writing skills? To answer this question, Hillocks (1986a) conducted a meta analysis of experimental treatments in classrooms.
After screening hundreds of studies against a set of criteria, they selected 60 well designed studies with 72 experimental treatments and their control treatments, each of which was coded for a variety of variables. The meta-analysis, based on the techniques developed by Glass (1978) and on important developments by Hedges (1981) enables Hillock et al to compare the effectiveness of treatments across studies. They identified six instructional methods of teaching writing-grammar, sentence combining, model composition, Scales and guided revision, inquiry and free writing.

Grammar: Research by Braddock, Lloyd-Jones and Schoer (1963); and several others indicated strongly that the study of traditional school, grammar (i.e. definition of parts of speech, the parsing of sentences etc.) has no effect on raising the quality of students' writing. Rather a heavy emphasis on mechanics and usage (e.g. marking every error) results in significant losses in overall quality. Every other instructional method examined in Hillocks review (1986a) is stronger. If knowledge of formal grammar is used at all, the review suggests it is probably used at the level of editing or proofreading- i.e. levels that exercise very little control over purpose, plans, content and style.

Models: A second extensively used method of instruction in composition is the presentation of model compositions, thought to exemplify principles or characteristics of good writing. This method was widely in use in the ancient academies of Greece and Rome as also in the ancient Indian education system during Vedic times, where pupils were required to recite orations from memory in the hope that they would incorporate the rhetorical principles involved into their own thinking and would have specific examples to guide their own composing of orations. This was not very different form what modern cognitivists have
shown about discourse processing - for example, that our processing and production of stories are guided by bare-bones outlines or schemata of the essential elements of stories (Stein and Trabasso, 1982).

This method was found to be significantly more useful than the study of grammar, yet the effect size for such treatments was small (0.217 standard deviations). Treatments that used the study of models almost exclusively were found to be less effective than other available techniques. The results are rather surprising because most writing in day-to-day situations makes use of identifiable patterns or forms. The explanation could perhaps be that these treatments require the students to identify characteristic features of models and then imitate them by making use of the same features in their own writing. However, these treatments do not teach students the procedures for producing such an imitation, since identifying a good piece of writing is quite different from producing it.

**Sentence Combining** : A number of research studies (Faigley 1979; Morenberg et al 1978) have shown that direct instruction in producing more complex syntactic structures results not only in greater syntactic complexity, but in increased quality. This sentence combining is the procedure wherein students are presented with sets of two or more sentences and asked to combine the sentences using some structure stipulated in the materials. From 1973 onwards, sentence combining treatments have excluded direct instruction in grammar and grammatical terminology. Research shows this method, on the average, to be twice as effective as free writing as a means of enhancing the quality of student writing.

**SCALES** : Equally powerful are the instructional methods that make direct or indirect use of scales in instruction. These methods present students with sets of criteria for judging and
revising compositions. Such instruction is likely to affect most aspects of composing, influencing the selection of content, the development of plans, the development and arrangement of gist units and the content and structure of verbatim units (Sager, 1973;). Through using the criteria systematically, students appear to internalize them and bring them to bear in generating new material even when they don’t have the criteria in front of them.

**FREE - WRITING**: Free writing asks students to write freely about whatever is of interest to them. As a major instructional technique, it is more effective than teaching grammar in raising the quality of students writing, but less effective than the other methods examined.

**Inquiry**: Hillocks (1986) observes, "The focus of instruction with the greatest power is inquiry. (It) involves using sets of data in a structure to help students learn strategies for using the data in their writing. These strategies range from recording and describing to generalizing, presenting evidence, discriminating through the use of criteria, hypothesizing and so forth". Teachers, using this focus of instruction, typically present students with data (a set of objects, a drawing, a set of scenarios, information about a problem), designate a task to be performed using the data, and provide guidance in performing that task. This procedure is repeated using similar tasks but different data, till such point as students gain proficiency in using the strategies required by the task. Research (Hillocks, 1979, 1982) shows that the process of observing and writing is far more effective in increasing the quality of student writing than the traditional study of model paragraphs that illustrate the use of strategies. Research indicates learning to write involves far more than learning about rhetoric and discourse. On the average, these treatments were seen to
be three and a half times more effective than the traditional study of model pieces of writing.

The results of the analysis for focus of instruction appear in fig 3.1. They are reported in effect sizes that answer the question - What is the difference between the experimental groups' gains and the control groups' gains in studies having a particular focus in common among the experimental groups? Effect sizes are reported in standard deviations.

**Fig 3.1**  
**Focus of Instruction - Experimental/Control effects**

<table>
<thead>
<tr>
<th>Focus of Instruction</th>
<th>Experimental Effects</th>
<th>Control Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30 Grammar</td>
<td>0.30</td>
<td>0.00</td>
</tr>
<tr>
<td>n = 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.35 Scales</td>
<td>0.35</td>
<td>0.00</td>
</tr>
<tr>
<td>n = 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.36 Inquiry</td>
<td>0.36</td>
<td>0.00</td>
</tr>
<tr>
<td>n = 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.57 Free writing</td>
<td>0.57</td>
<td>0.00</td>
</tr>
<tr>
<td>(n = 10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Adapted from Hillocks, 1982.

However, it needs to be pointed out that while the results for the various treatments differ greatly from each other, they
all have some place in the writing curriculum. Indeed, sentence combining, scales and inquiry all make occasional use of models. Similarly, free writing is combined with sharing ideas, peer feedback, redrafting, even prewriting activities.

Such treatments represent a clear advance over traditional instruction in writing — instruction that usually provides no prewriting activity, no opportunity for revising and no feedback until after the writing is a fait accompli. Hillocks' review (1986a) has strongly established that effective writing involves a complex process that includes prewriting, drafting, feedback from audiences, and revising.

In a study entitled 'The effects of Peer editing on the writing proficiency of low - achieving tenth - grade students', Karegianes, Pascarella and Pflaum (1980) employed a quasi experimental design to determine the effects of a highly - structured peer - editing treatment on the essay writing proficiency of low achieving tenth - grade students. The effects of subject, sex, pretreatment essay proficiency, and reading levels were controlled statistically. The peer edit group had significantly higher (p < 0.05) writing proficiency (as rated by trained independent judges) than did students whose essays were edited by teachers. The findings have implications for use of peer - editing as a potentially effective instructional technique in the teaching of writing proficiency.

Research studies by Bereiter (1980), Flower and Hayes (1980, 1981), Bereiter and Scardamalia (1982) and Scardamalia and Bereiter (1983) indicate that the processes and sub-processes of composing are hierarchically related and recursive, i.e. the act of writing any set of words in a composition requires a review of what has already been written. Bereiter and Scardamalia (1982) hypothesize that children write briefly, not for lack of
knowledge but for lack of adequate means of tapping the knowledge they do have. So they need to learn to conduct memory searches. Techniques such as brainstorming, clustering and mapping may help them to conduct memory searches and write longer and more effective compositions. Such prewriting activities are referred to as the process approach to writing.

Flower and Hayes (1980) reported that the relationship among the various plans and processes in composing (such as purposes, and constraints; discourse knowledge and processes; content knowledge and processes; gist units, semantic units; verbatim units; graphemic units; editing) are not only hierarchical but recursive. That is, writers don’t set goals once and proceed to content and discourse knowledge. Rather they continually reconstruct goals, plans and content because the space available in working memory requires that larger plans be held in long term memory while short-term memory focuses on the generation of relatively brief graphemic unit: Each reconstruction of goals, plans and gist units affords opportunities to assess and change what has been written. It should be noted that the necessity for such continuous reconstruction suggests why writing is so difficult for so many people.

Applebee (1981) found that the average preparation for writing amounts to about three minutes and that the most students are likely to is a paragraph or an essay. Such conditions may account for the brevity of writing reported by researchers (Emig, 1971). Under such circumstances, students may not be able to develop their capacities to conduct memory searches, construct and reconstruct complex plans, transform data, process much more than they might produce in an extended conversational turn or revise in more than a mechanical fashion.

Mavrogenes and Padak (1982) in their study 'The reading
Road to writing' report a 24 week experiment, testing the effects of a programme in language development, including both reading while listening and lessons in syntactic manipulation, on students' level of syntactic maturity and reading achievement. The results showed that the experimental treatments increase students' syntactic maturity. The interrelationships among the various language skills, specifically between reading and writing is borne out by several other studies (Squire and Applebee 1968, Evachenko, Ollila and Armstrong, 1974; Mills 1974, Loban 1976, and Grobe and Grobe, 1977).

Considerable evidence exists to support the efficacy of the holistic approach to writing instruction as compared to the reductive approach. Hartwell (1985) found that the overall writing process was hampered when learners and instructors concentrated on basic grammatical skills, as in a reductive approach. Similar results were reported by Meckel, (1963); and Rose (1983); who found that the reductive approach, while improving the mechanical skills, does little to improve overall writing quality.

Dalton and Hannafin (1987) examined the effects of a year-long word processing program on holistic writing skills. An analysis of writing samples taken upon completion of this study suggested that word processing alone was of little consequence for able learners, but proportionately most effective for low achieving students.

Hayes (1987) tested the effectiveness of an experimental writing approach—process oriented writing—as a means of improving writing achievement for seventh grade students. Findings indicated a significant difference in the total mean scores between the pretest and the posttest for the experimental group.

In a study by Vonder Haar (1988), the chief purpose
was to relate features of inquiry to writing and to observe, through case studies, how interviewing methods provide a particularly important inquiry strategy for student writing. Interviewing was described as intrapersonal and interpersonal questioning. The cases studied reinforced that interviewing strategies provide adolescent writers with practical approaches to understanding and to writing.

The study entitled 'The effects of highly structured versus less structured lessons on student writing' (Knudson, 1988) attempted to determine whether the degree of substantive facilitation provided to students affected their writing. The learning situation, wherein the teacher assists the student in selecting the topic to be written about and possibly structures the paper, is an example of substantive facilitation. This substantive facilitation is linked to the presentation/frontal mode of teaching composition by Smagorinsky (1986). The presentation or frontal mode (Goodlad, 1984) is characterized by the teacher's placement at the head of the class, telling students what to do. The students' role is the imitation of whatever has been presented to him/her. Although both treatments were primarily in the presentation mode; and in each treatment, some element of substantive facilitation was present (i.e. prewriting activities led by the teacher); in one treatment, increased substantive facilitation was present in the form of questions intended to guide the student writers to expand narrative content, including use of detail, increased use of descriptive vocabulary, and more complete sentences. Results showed that the treatment with less substantive facilitation resulted in superior student writing and the treatment with increased substantive facilitation produced mechanical, fill-in-the-blank responses. The MANOVA (multivariate analysis of variance) for effect of treatment was significant, $F(8, 265) = 2.91, p < 0.01$ in favour of the less structured strategy. One important implication is the assessment of the presence
and degree of substantive facilitation needs to be continued with respect to teaching learners how to write.

Soltis and Walberg (1989) report the findings of a secondary analysis of the data on 13 year olds and their writing. The findings suggest that essay-writing performance appears to be associated significantly with a student's ability and peer group and a component of quality of instruction.

Knudson (1989) tested the effectiveness of four instructional strategies on students' writing. Informational writing was taught to 138 students in Grades 4, 6 and 8 in a school district in Southern California. Writing samples were collected after treatment and again 2 weeks following the experiment. Results of nonorthogonal repeated measures analysis of variance indicated significant effects for treatment and reading level with informational writing. The most effective strategy was the presentation of model pieces of writing, followed by free writing.

Spainhower (1989) in his study entitled 'How college students' responded after a comparison of conventional and non-conventional lessons on selected writing skills', surveyed 400 students enrolled in writing course at Weber State college during 1986-87. Most students did prefer the terminology, explanation and illustrations of the non-conventional lessons and felt they had gained more insight from innovative lessons than from conventional lessons.

Review of research in the foregoing section serves to reveal the following trends.

1. Research seems to have established that writing is a complex and difficult process (Bereiter, 1980), Flower and Hayes (1980, 1981), Bereiter and Scardamalia (1982) and Scardamalia and
Bereiter (1983) and as such, current school practices to teach writing are inadequate in many respects. As a result, the effectiveness of different strategies in the teaching of writing skills in English has become the focus of critical attention.

2. Hillocks' (1986a) review has strongly established that effective writing involves a complex process that includes pre-writing, drafting, feedback from audiences and revising. This is in keeping with the essentials of holistic approach wherein learners are taught that writing consists of three distinct steps: pre-writing or planning; writing and revising. This approach concentrates attention on the process of writing as opposed to specific mechanics.

3. Results of various studies (Meckel, 1963, Rose, 1983; Hartwell, 1985) have contraindicated the reductive approach for the teaching of writing/composition skills while acknowledging the favorable effect of the holistic approach (process-oriented approach) in improving the learning of writing skills of even low-achieving learners (Hayes, 1987).

4. Hillocks' (1986a) review also reports that the focus of instruction with the greatest power is inquiry although all the other treatments studied e.g. models, sentence-combining, scales, free writing all have some place in the writing curriculum and each of these treatments makes occasional use of either models or sentence combining etc.

5. A large number of studies (Squire and Applebee, 1968; Evachenko, Ollila and Armstrong, 1974; Mills, 1974; Grobe and Grobe, 1977, Loban, 1976) showed significant correlations between reading skills and writing skills and so establish the interrelationship among the various language skills, specially between reading and writing.

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6. Significant interaction of treatment with writing ability have been reported in a few studies (Knudson, 1989).

7. The findings of Karegianes et al (1980) that peer-edit group had significantly higher writing proficiency than did students whose essays were edited by teachers has abundant implication for use of peer-editing as an instructional technique in teaching of writing skills in English.

3.7 HYPOTHESES OF THE STUDY:

The study was designed to test the following hypotheses in respect of acquisition of higher-level writing skills in English.

1. Difference in instructional strategies leads to differential effects on acquisition of higher-level writing skills in English.

2. Intelligence significantly affects acquisition of higher-level writing skills in English.

3. Cognitive style of the learner significantly affects acquisition of higher-level writing skills in English.

4. a. Interaction of instructional strategies X intelligence contributes significantly in the acquisition of higher-level writing skills in English.
   b. Interaction of instructional strategies X cognitive style has a significant effect on the acquisition of higher-level writing skills in English.
   c. Interaction of intelligence X cognitive style contributes significantly in the acquisition of higher-level writing skills in English.
5. Second-order interactions of instructional strategies X intelligence X cognitive style contribute significant variance in acquisition of higher-level writing skills in English.

A similar set of five hypotheses was formulated in respect of retention of higher-level writing skills in English.

6. Difference in instructional strategies leads to differential effects on retention of higher-level writing skills in English.

7. Intelligence significantly affects retention of higher-level writing skills in English.

8. Cognitive style of the learner significantly affects retention of higher-level writing skills in English.

9 a. Interaction of instructional strategies X intelligence contributes significantly in retention of higher-level writing skills in English.
   b. Interaction of instructional strategies X cognitive style has a significant effect on retention of higher-level writing skills in English.
   c. Interaction of intelligence X cognitive style contributes significantly in retention of higher-level writing skills in English.

10. Second-order interactions of instructional strategies X intelligence X cognitive style contribute significant variance in retention of higher-level writing skills in English.

Following hypotheses were formulated in respect of transfer-of-learning of higher-level writing skills in English.

11. Difference in instructional strategies leads to differential effects on transfer-of-learning of higher-level writing skills in English.
12. Intelligence significantly affects transfer-of-learning of higher-level writing skills in English.

13. Cognitive style of the learner significantly affects transfer-of-learning of higher-level writing skills in English.