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CHAPTER II
REVIEW OF RELATED STUDIES

2.1 INTRODUCTION
A collection of research works done by earlier researchers is technically called as 'literature', any scientific investigation starts with a review of the literature. Review of literature gives an idea of the research done previously, suggests basis for hypotheses and provides background for the method of study. It also helps to avoid unnecessary duplication. A careful review always aims at interpreting prior studies and indicating their usefulness for the study to be undertaken. Thus prior study serves as the foundation for the present study. Better perspective for future research can be had with the help of reviewing the previous research works.

2.2 PURPOSE OF REVIEWING OF RELATED LITERATURE
To be precise, the following are some of the purpose of the review of literature:

1. Review of literature gives an idea of how much research has been done in the area of present study.
2. It helps to delimit the problem.
3. It provides the necessary insight to the problem.
4. It helps to avoid unnecessary duplication of previous research.
5. It suggests valuable basis for hypothesis.
6. It suggests appropriate method for the problem under study.
7. It widens the horizon of the research.
8. If any pitfalls or loopholes occurred in the previous study, the investigator will overcome those pitfalls and loopholes.

9. It provides fine background for methodology of research under study.

By keeping this in mind, the investigator has collected relevant Indian studies and foreign studies related to this field. The studies collected and reviewed are presented under the following headings.

- Studies conducted on Learning difficulties
- Studies conducted on Learning styles
- Studies conducted on Science
- Studies conducted on Computer Assisted Teaching Learning (CATL)
- Studies conducted on Experiential Learning (EL)

### 2.3 STUDIES CONDUCTED ON LEARNING DIFFICULTIES

Studies on the learning difficulties such as causes, characteristics, and factors related to learning difficulties and diagnosis of learning difficulties, survey studies, case studies and experimental studies were reviewed and presented under this heading.

Anna Elizebeth Kuruvilla (1999) investigated ‘creativity among the learning disabled children’. The main objectives of the study were:
1. To assess the level of creativity and to compare the creativity scores of learning disabled boys and girls of std IV and V studying in government, government aided and corporation schools.

2. To establish relationship between creativity scores of learning disabled and economic status and literacy of the family. The result shows that
   - Learning disabled children are creative and creative scores of boys and girls show that boys are more creative than girls.
   - Learning disabled children of corporation schools are better than government aided schools and government aided schools are better than government schools in flexibility and originality.
   - Economic status and literacy status of parents and creativity scores were found to be unrelated.

**Bindu Prasad (1998)** discussed 'the objectives and methodology for identification and assessment of children with learning disabilities'. She reviewed the current clinical practices in India and emphasized that diagnosis of learning disabilities should be made on the basis of partial information. Therefore, the need for comprehensive assessment by an interdisciplinary team is more warranted.

**Desai (1985)** conducted a study on ‘learning disabilities of primary school children in Gujarat’. The findings were the most
potential cause of learning disability was poverty and abolition of examinations from standard I and II in the schools of Gujarat.

**Geetha (2000)** attempted to find out the ‘impact of adapted techniques on achievement of dyslexic children’. The objective of the study was to identify children with reading disability

i. To develop remedial package and implement on the selected children

ii. To develop remedial package and to evaluate the progress of the children with dyslexia. The result reveals that there is increase in scores of post test.

**Kusuma Harinath (2001)** studies ‘certain factors related to learning disabilities in English in school students’. The objectives of the study were to develop diagnostic tests to identify reading, writing and spelling difficulties in English; to find out the intelligence and personality characteristics of students with learning difficulties. The studies reveal that boys experienced more reading disabilities than girls. Community, parent’s educational qualifications, location of school, medium of instruction influenced learning difficulties particularly spelling difficulties.

**Mehta, Mohan and Pande (1993)** attempted to ‘study the learning problems in rural primary school children’. Their study shows that the common learning problems in the rural primary school children were Poor memory (24.52%), Poor comprehension (20.19%),
Poor concentration (18.5%), Specific learning disabilities (6.9%), Anxiety and stress (11%) and Conduct problems (6.9%).

Mohapatra (1991) studied ‘the problem of reading, memory and attention processes of normal reading disabled children’. (The sample comprised 40 subjects, 20 each from Grade II and Grade IV. Among them 10 were normal and 10 were reading disabled). The tools used in this study are decoding test, comprehension test, letter cancellation test, visual closure test, visual memory test, auditory closure test and auditory memory test. The study reveals that the normal and the reading disabled children did not differ with respect to their intelligence. There was a significant difference in comprehension as a function of reading ability only and not grades.

Parmer et al (1994) ‘A comparative study with normally achieving students’. Indicates that both students with mental retardation and those with learning disabilities lag considerably behind their average achieving peers.

Ramaa (1984) conducted ‘a study on diagnosis and remediation of dyslexia’. Dylexics were identified from among a group of 550 children who were studying in grades III and IV having Kannada as their first language at school through an exclusionary approach by using a set of criteria. Out of those 550 children only 14 could be identified as dyslexics. In diagnostic phase, this phase involved comparison of the neuropsychological process of dyslexics, non dyslexic poor readers and normal readers, comparison of errors
committed by all the three groups while reading Kannada, analysis of the developmental history of the dyslexics was examined.

**Ramaa (1992)** gives a list of commonly observed problems among learning disabled children. They are (i) Abnormal activity level such as hyperactive and hypoactive (ii) Attention problems (iii) Motor problems (iv) Visual perceptual problems (v) Auditory perceptual problems (vi) Language problems (vii) Fully work habits (viii) Social – emotional behaviour problems (ix) Orientation problems and (x) Academic disabilities.

**Reddy (1999)** estimates that at present there are about 10 to 15 percent of the student population suffering from learning difficulties in every classroom at primary stage.


**Reddy’s (2000)** paper on ‘Role of Educational Technology in Learning Disability’ in which he has highlighted the need for assistive technology to the learning disabled. The processing spell checking, proof reading programmes, brainstorming, speech recognition system, speech synthesis, screen reading, word prediction, personal frequency modulated listening systems and talking calculators were of much use to circumvent the learning disabilities in children.
Srivastava, Sushila and Afiah (1992) studied ‘Learning disabilities among elementary school children’. Influence of sex, age and religion. The study focused on the identification of the learning disabled and assessment of their ability in reading, writing, spelling, language and arithmetic. The results revealed that age had a significant influence on disability in reading language and arithmetic.

Usha Ramakrishnan (1998) in her paper on multiple intelligence points out that people with learning disabilities is intelligent and yet has a difficulty in learning. Looking at intelligence differently may be the answer to understand how different people perceive, process, store and retrieve information. Howard Gardner’s theory of ‘Multiple Intelligence’ views intelligence from a different perspective and has major contributions to understand people with learning disabilities.

Bhattacharya (1986) investigated ‘The learning disabilities developed by secondary school students in algebra’. The major aims of the study were (i) to conduct survey of the learning disabilities developed by the beginners in secondary schools under the West Bengal board of Secondary education in linear equations. The important findings are

a. Students develop more learning disabilities in the understanding and application of linear equations sums in one unknown than in the knowledge of solving such sums.
b. The simplified method is more effective than the method of transposition for the development of knowledge and application ability of students in linear equation sums in one unknown.

**Debdulal Dutta Roy (1993)** presented a paper on ‘Computer simulation’ approach to develop strategies for learning disabled children. This paper attempts to understand teaching objectives and teaching strategies for learning disabled children by developing analogy between computer and disabled child. An attempt is made on how to develop cognitive processing function of learning disabled children with some progrmmemes based on BASIC language.

**Dharmaraj (2000)** in his study on ‘Awareness of Primary school teachers towards learning disabilities in mathematics at primary level’. Those educational qualifications of the teachers have influenced the awareness of primary school teachers. Further, post graduate teachers possess better awareness than the secondary grade and graduate teachers on the aspects of learning abilities in mathematics.

**Donga (1993)** says that ‘Learning disabilities are due to unsatisfactory emphasis on developing thinking skills’. During classroom teaching, learners should be provided opportunities to develop various types of thinking skills like thematic thinking, exploratory thinking, productive thinking etc. lack of these thinking skills affects badly to the academic achievement of the learner and causes for learning disabilities.
Dutta (1986) studied ‘The learning disabilities in the reasoning power of the students in geometry’. The main objectives of the study were (i) To diagnose the major patterns of disabilities in a specific area of geometry. (ii) To try out experimentally teaching methods which would prevent development of learning disabilities in the area under study. Some of the findings were (1) 33 major patterns of disabilities were identified; (2) The experimental groups taught by audio-visual materials and the techniques achieved significantly.

Jayanthi Narayanan (1994) has developed ‘Grade level assessment tool for children with learning problems in schools’. Teachers can use or adopt these tests for testing children who fail consistently in one or more subjects. The Grade level assessment (GLAT) helps to test the students systematically making observation of the processing pattern of a child.

Jasobanta Roy (1993) stresses on workshop in evolving appropriate educational strategies for Indian children with learning disability.

Kavitha Milner (1999) explains ‘Eight steps to recognize a problem and get help to the child who has a learning disability’. The eight steps are (1) rhyme with reason (2) watch for warning signals; (3) Visit the doctor (4) Talk to the teacher (5) Study the school environment (6) Teach at home (7) Use technology (8) Don’t give up. Kavitha Milner also quoted that many people had overcome
learning disability to become notable successes. They include Leonardo da Vinci, Thomas Alva Edison and even Albert Einstein.

**Lakshmi Radhakrishnan (1996)** deals about 'The diagnosis and remediation of arithmetic disabilities'. She points out some of the teaching methods to the students with deep problem, she also stresses drill method, multi sensory teaching method, visualizing and verbalizing method.

**Lakshmi (2000)** conducted a study on 'Teaching dyscalculic children using playway method'. The major objectives of the study was (i) to identify children with dyscalculia and prepare it containing various games (ii) Using the kit effectively for teaching and assess the performance. The result shows that playway method was found to be more effective in teaching arithmetic to dyscalculia children.

**Mishra (1991)** study 'Centers upon the problem of development of teaching steps for handling arithmetic disabled children'. With training and following the teaching steps, the disabled subjects could perform in a better way. With repetition the subjects performance improved.

**Mohite Prerana (1989)** attempted 'To develop and implement a classroom instructional programme for children with learning difficulties'. The tools used included Teacher’s Rating Scale (TRS), Word Test of Spelling (GWT) and Criterion – Referenced Test (CRT) of reading. Major findings of the study were many children of the
experimental group improved in oral reading, silent reading and listening comprehension.

**Mohan Kumar and Rajaguru (2002)** attempted ‘To find the effectiveness of multimedia instructional strategies on the achievement of learning disabled children in learning maths concept’. The main objectives of the study were (i) to identify learning disabled children (ii) to find out the effectiveness of multimedia instructions over the Conventional method of teaching on the achievement of learning disabled children in learning maths concepts. The investigators found that the multimedia instruction facilitated the children with learning disabilities in learning maths concepts.

**Nagomi Ruth (2000)** studied ‘Awareness on learning disabilities among regular school teachers’. The main objectives of the study were; (i) to give knowledge about identification and remediation for learning disabled. (ii) to evaluate the impact of knowledge gained by regular school teachers in education technology not withstanding, no machine can replace the teacher. The teacher is the guide, philosopher, friend and supreme as the leader of classroom.

**Ramaa (1992)** in her book ‘Package on learning disabilities’ points out that learning style of the student and content needs of the pupil is important factors in evolving instructional programme for the students. Multi – sensory teaching is also stressed in teaching – learning process for the children with learning disabilities.
Rath (1991) conducted a study on ‘Individualised instruction training approach for teaching children with learning difficulties in reading and comprehension skills’. It was found that there was improvement in scores in the post – training session as compared to the pre- testing scores.

Rozario and Kapur (1993) conducted a study on ‘Effectiveness of intervention strategies with students who have problems in learning’. The major objectives were (i) to identify the nature of the learning problems (ii) to help them through suitable remedial education. The results indicate that there was significant improvement in language and arithmetic skills. There was no significant difference between the students who took tuition and those who did not take tuition.

Sarojini (2000) conducted a study on the ‘Awareness of primary school teachers towards learning disabilities in English at primary stage’. Her studies reveal that there is a need to generate awareness among primary school teachers towards learning disabilities in English.

Sivakami (2000) investigated ‘The effectiveness of certain instructional strategies to overcome learning disabilities in English at primary stage’. The major focus was on the remedial instructional strategies to be adopted for the children with reading, writing and spelling difficulties.
Velumani (1997) prepared a ‘Remedial instruction for children with arithmetic disabilities’. The main objectives of the study were (i) to identify the children and assess the specific problems encountered by them (ii) to study the effect of remedial instruction on children with arithmetic disabilities. The result reveals that remedial instructional materials were found to be effective. Number chart, matching cards, group of sticks, beads, stones, buttons for addition, drawing picture and number line for division, cards with shaded half, full, quarter for fraction, digital clock for time, real coins and currency for teaching money concept were used in the remedial instructional materials.


Affleck, Madge, Adams and Lowessbraun (1988) compared the ‘Academic achievement of students with learning disabilities in an integrated classroom model’, with the achievement of students having learning disabilities in a resource room programme. No significant differences were found between the achievement scores (i.e., in reading maths and language) of students in the respective programmes.
Baiden (1984) states that dyslexia is common around 5% incident regularly identified in the western countries.

Border (1971) finds that there are three groups of dyslexics; 9% of dyslexics have visual problems which are called dyseidefic, 63% of dyslexics have auditory and linguistic problems which are called dysphonetic and the remaining is mixed group.

Case, Lisa Pericola (1997) studied ‘Mathematical understandings to know how students with learning difficulties progress in a constructivist classroom’, six students and their teacher were the focus participants in the study. The teacher participant had two years of experience in project impact, a research study which helped teachers to improve the mathematics achievement of all students through more constructivist teaching methods. The results suggested important relationships between participant’s mathematics learning and (a) their role in the classroom community (b) the methods of instruction and (c) the influence of relationship outside the classroom.

Catherine V. Morsink (1983) initially opines the incidence and prevalence to be about 2%. Crisfield (1996) estimates that as much as 10% of the population may have mild developmental dyslexia and 4% have severe dyslexia. American Psychiatric Association (1994) estimated that approximately 3% of the school population should be regarded as specifically learning disabled.
Coronado V. Marco (1995) studied the ‘Anxiety of learning disabled school children with remedial instruction’. The purpose of the study was to investigate the anxiety levels of elementary schools learning disabled (LD) students provided with at least one semester of remedial instruction. The result indicate that compared to non LD, the LD students is played significantly higher levels of general anxiety, worry, over sensitivity, social concerns and concentration difficulties.

Frost and Emery (1996) Gibson and Levin (1975) report that at least 15% of American school children have reading difficulties.

Johnson et al (1956) estimate indicated that from less than 1.5% to more than 1% children may have difficulties in vocalization.

Mittler (1995) opines that it is difficult to obtain an accurate picture of number of people who were defined as having learning difficulties. The available survey on the prevalence of learning difficulties in the total population is predicted to 2%.

Holcomb, Helene Betley (1995) attempted to compare ‘The achievement of low achieving and learning disabled elementary school students’. This study examined the academic progress in basic reading skills of students identified as learning disabled (LD) with and without ability / achievement discrepancies and low achieving non-disabled (LD) students. The purpose was to examine the characteristics of LD and LA students, and to investigate their achievement in reading and explore the factors that influenced their
academic progress in light of the discrepancy assumption of the learning disabled definition.

The result reveals that the learning disabled students exhibit distinct characteristics that distinguish them from other low achievers. Discrepancy component of the learning disabilities construct suggests that the learning disabled have with discrepancy between ability and achievement in reading.

**Pugach, Marleen, Wesson and Caren (1995)** investigated ‘Teachers and students views of team teaching of general education and learning disabled students in two fifth grade classes’. Data were organized according to respondent’s perspectives on three themes; (1) classroom social climate (2) Instructional effect; and (3) distribution of teacher’s role and task.

**Sally Beveridge (1996)** stated that the teacher’s attitudes, knowledge and communication skills were essential factors to handle learning difficulties in children. Teachers and parents need to demonstrate positive attitude towards children with learning difficulties.

**Smith Sally (1993)** presents answers to common questions on meeting the needs of the students with learning disabilities (LD) in regular classrooms. Their article ‘Enabling the learning disabled’ describes LD, offers instructional strategies and discuss teaching abstract concepts, students self esteem, student depression, teacher
emotions, inclusive education, how to tell whether someone has LD and where to get more information.


Anne J.J. (1991) studied ‘Use of Irien coloured overlays with learning disabled students’. The purpose of the study evaluate the effect of using Irien coloured overlays with learning disabled students in reading resource classes in an elementary classes.

Beatty, H.H (1995) made a ‘Comparison of the achievement of low achieving and learning disabled elementary school students’. The purpose was to examine the characteristics of LD students, to investigate their achievement in reading during a school year and to explore the factors that influenced their academic progress in light of the discrepancy assumption of the LD definition. The results showed that LD students exhibit distinct characteristics that distinguish them from other low achievers.

2.4 STUDIES ON LEARNING STYLES

Malathi and Malini (2006) presented a paper ‘Learning style of higher secondary students of Tamilnadu’. The purpose of the study is to find out the relationship of learning style with achievement of students and to find out the significant differences in the Learning
styles in terms of their sex, classes and types of schools. Barbara A. Soloman and Richard M. Felder's Learning style inventory was used in this study.

1. The results reveal that the learning style of higher secondary students was found to be good.
2. There is no significant difference in learning style in terms of their class and type of school.
3. There is significant difference in learning style between boys and girls.
4. There is high correlation between learning style and achievement, which implies that higher the achievement scores, the better was the learning style among higher secondary students.

Stitt-Gohdes (2001) 'Research supports the concept that most teachers teach the way they learn'. The studies reveals that since a great many teachers have experienced academic success in learning environments that were instructor centered and relief heavily on lecture. It is understandable that their preferred style of teaching, at least initially, would be to repeat 'what worked with them'?

Miller (2001) and Gohdes (2003) express much research supports the views that when students learning preferences match their instructor's teaching styles, student motivation and achievement usually improve.
Hayes and Allinson (1997) found that the matching of teaching / learning style is more beneficial to vocational students who are field independent. Those who prefer more autonomy and less personal interaction, and mismatching is more beneficial for field dependent students those who prefer more guidance and structure.

Nuckles (2000) and Pithers (2001) focused that most vocational classes are composed of students who have different style preferences, teachers need to adopt a flexible approach to their instructional practice. So that their ultimate approach is integrated.

David Kolb (1999) who is credited with initiating the learning style movement notes that, it is more effective to design curriculum. So that there is some way for learners of every learning style to engage with the topic. So, that every type of learner has an initial way to connect with material and then begin to stretch his or her learning capability in other learning modes.

Delahoussaye (2002) stated that Learning is an on going process, occurring over the span of one’s lifetime and delivered by a variety of instruction with a variety of teaching styles in a variety of situations. Learners need to become better all round learners by investing extra effort in under developed or underutilized styles.

Pithers (2002) reports on studies by Rush and Moore explore the feasibility of promoting learner adaptability through training. These researchers discovered that students whose cognitive styles
were more field dependent were able to change the strength of their style through training, which suggests that cognitive styles may be flexible, construct and malleable over the long term.

Ladd and Ruby (1999) found that of primary interest to students was establishing warm personal relationship with their instructors, their preferred learning style of learning was to have direct contact with materials, topics or situations being studied. Knowing this type of information can help instructors develop course structures that provide a better fit between instructional goals and students learning style preferences.

Pratt (2002) presents five perspectives to identify, articulate and justify their teaching approaches rather than simply adopting one practice or another.

Transmission Teachers focus on content and determine what students should learn and how they should learn it. Feedback is directed to student’s errors.

Developmental Teachers value student’s prior knowledge and direct students learning to the development of increasingly complex ways of reasoning and problem solving.

Apprenticeship Teachers provide students with authentic tasks in real work settings.
Nurturing Teachers focus in the interpersonal elements of students learning, listening, getting to know students, and to responding student’s emotional and intellectual needs.

Social reform Teachers tend to relate ideas explicitly to the lives of the students.

Proficient student Centered teachers are able to use a variety of styles. So that their ultimate style is integrated.

**D. Arnold, Robinson and S. Devashayam Selvakumar (2004)** studies on ‘An investigation into the Learning styles and study habits of Middle school students in relation to their achievement in science’. In this study, J.M Reids perceptual learning style inventory was used to identify the learning styles of the students. The main objectives were

1. To find the relative influence of learning styles on pupil’s achievement in science.
2. To find the nature and extent of relationship between study habits and achievement in science.
3. To find the relationship between learning styles and study habits.
4. The study reveals that Kinesthetic / tactile learning and group learning pave the way for higher efficiency in Kinesthetic science.
5. This study also reveals that there is significant relationship between study habits and learning styles.

Rajaguru and Sugumar (2007) research studies on ‘classroom implications of learning styles and instructional strategies’. The main objectives of the study were

1. To adopt tool and assess learning style of student at primary level classes
2. To study the relationship between achievement and learning styles of the children.
3. To study the significant difference, if any, in using different instructional strategies, such as Computer Assisted Teaching learning (CATL) and Conventional Teaching (CT) to teach Environmental Science Concepts to the children with Auditory and Visual learning styles.

The findings of the study were

i. There is significant difference in the achievement of children with Auditory learning style treated with CT and CATL strategies and Conventional teaching (CT) is more effective for Auditory learners.

ii. There is significant difference in the achievement of children with Visual learning style treated with CATL and CT strategies and CATL strategy is more effective for Visual learners.
2.5 STUDIES CONDUCTED ON SCIENCE

A recent report of the National Research Council entitled How people learn and demonstrate abroad consensus about how learning occurs. The report synthesized research from a variety of fields, including cognition, child development and brain functioning. It also drew from research across content areas, with important contributions from the research on science learning. Several general findings from the study are presented below, drawn from research on science learning.

1. Understanding science is more than knowing facts.
2. Students build new knowledge and understanding on what they already know and believe.
3. Students formulate new knowledge by modifying and refining their current concepts and by adding new concepts to what they already know.
4. Learning is mediated by the social environment in which learners interact with others.
5. Effective learning requires that students take control of their own learning.
6. The ability to apply knowledge to novel situations, that is transfer of learning, is affected by the degree to which students learn with understanding.

subject as well as academic performance. Suggests strategies to encourage female participation in science.


Leyden, M (1996) ‘Teaching science - Rising raisins and Sinking divers’. Presents classroom science activities dealing with floatation, which may be presented at different levels of cognitive complexity. The activities involve observing various objects in carbonated soda and deal with concepts of weight, volume and density. Describes a Cartesian Diver activity that allows further examination of the effects of increasing the weight – but keeping volume constant – on an object’s floatation.

Neff, D.B. (1977) ‘Classroom planetarium’. A planetarium, star projector and projector stand all which can be built for $30 are pictured. Classroom activities involving the materials are described.

Newport, J.F. (1973) ‘Alternate approaches in elementary school science’ Examines some alternative approaches to teaching science in the elementary school, and in particular compares the attributes of instructional approaches to those of experimental approaches.

Percey, J.R. (1987) ‘Constellation activities’ Discusses several ways of teaching about constellations. Includes background and historical information, suggestion on visiting a planetarium and a bibliography for sources of constellation stories, computer courseware and constellation slides. Suggests ways of having students produce their own constellation slides.

Roberds, W.M. (1974) ‘Time around the world’. Discusses the concept of time zones around the world and describes a teaching aid that is useful in helping students to understand this concept.
Shaw, J.M., & Puckett, M.J. (1990) 'Thematic science units'. Described are four interdisciplinary units entitled 'A Very Fishy Unit', 'Building Healthy Bodies Unit', 'Hands – on Plants Units,' and 'Butterfly Spell Beauty Unit.' Each unit contains science activities, skills and concepts covered and activities that cover other disciplines.

Lach, C. (2003) 'From all sides now: Weaving technology and multiple intelligences into science and art'. The theory of multiple intelligences (MI) allows teachers to tap into the strengths of each student and to develop capabilities in novel ways. By weaving together technology, MI and curriculum, the Hemenway public elementary school (Framingham, Massachusetts) helps students work in their own 'Magical learning environment' and accomplish the objectives of science and art units.

Kotrlik, J.W. (2003) 'Technology integration by Agriscience teachers in the teaching/learning process'. Responses from 115 of 203 Louisiana secondary Agriscience teachers identified the level of technology integration in their programs. They were most active in exploring its potential for teaching / learning and adopting for instruction; less active in experimentation and advanced integration. Level of technological anxiety and perceptions of barriers and teaching effectiveness predicted the extent of integration.

Novak, J.D. (1990) 'Concept mapping: a useful tool for science education'. This article describes the genesis and development of concept mapping as a tool for science education. It also offers an
overview of this special issue of the ‘Journal of Research in Science teaching’ and comments on the current state of knowledge representation. Suggestions for further research are made.

**Antonisamy (1989)** studied the effectiveness of teaching environmental concepts to school drop-outs through video and charts. The main objectives of the study were:

1. To prepare a video programme on various environmental concepts for school drop-outs.
2. To study the effectiveness of teaching environmental concepts through video and charts. The main findings of the study were as follows:
   i. Teaching the environmental concepts to the drop-outs through video was more effective than teaching the environmental concepts through charts.
   ii. There was no difference between boys and girls, in understanding the environmental concepts taught through the video programme.

**Basu (1981)** studied ‘Effectiveness of multimedia programmed materials in teaching physics’. The main objectives of the study were:

i. To prepare different types of programmed learning materials, semi-programme, linear programme, branching programme, hybrid programme and compare their effectiveness in classroom instruction.
ii. To compare the relative effectiveness of different instructional strategies employing multimedia programmed class teaching on the criteria of immediate achievement, retention and delayed retention.

The study arrived at the following conclusions:

i. There are significant differences among the means of different strategies, on the overall achievement. Multimedia semi-programmed instruction was better than the strategy of the multimedia linear programmed instruction and the multimedia hybrid programmed instruction was better than multimedia branching programmed instruction.

ii. There was significant difference in the achievement through different strategies due to difference in ability.

**Bhatt (1992)** conducted a study on ‘Effectiveness of three modes of teaching science on student’s achievement’. The following were the objectives of the investigation:

i. To develop video cassettes of TV lessons covering ten lessons of selected topics in standard X science.

ii. To teach the students in three groups (boys and girls each) through the following modes:

(a) TV lessons with guidance notes:

(b) Experiments, charts and demonstration; and

(c) Lecture – cum – discussion.
From the results of the study, the major findings are given as follows:

i. TV lessons were significantly more effective than lesson through experiment –cum- demonstration and lecture-cum-discussion.

ii. TV lessons were found quite feasible and useful for secondary school students, in science education; their usefulness would increase if they are prepared with utmost care.

Desai (1985) conducted ‘An investigation into the efficiency of different instructional media in the teaching of science to the pupils of class VIII in relation to certain variables’.

The major objective of the study was to compare the achievement of pupils in science learning through different instructional media and the traditional way of teaching. The major findings were:

i. Programmed learning approach was more effective than the traditional way of teaching science.

ii. The experimental approach was more effective than traditional way of teaching science.

Edward Sahayaraj.S. (1994) conducted an experimental study on ‘Effectiveness of lecture method supplemented with low-cost teaching aids in learning physics by the higher secondary plus one students’ with the following objectives.
i. To find out whether the higher secondary +1 students improved their achievement in physics after teaching physics by lecture method supplemented with low – cost teaching aids.

ii. To find out whether there exist any significant difference between the post-test scores of average students in control group and experimental group.

After analysis, the study arrived at the following conclusions:

i. Low – cost teaching aids could be prepared for most of the units in physics.

ii. The Hr.Sec. +1 students in experimental group significantly improved their achievement in physics after teaching physics by lecture method supplemented with low – cost teaching aids.

**Golani (1982)** studied, ‘The use of audio-visual aids in the secondary schools of the District Thane’. The objectives of the study were:

i. To create awareness among teachers and school heads about the importance of audio –visual aids.

ii. To help raise the academic standard of secondary schools of Thane district.

The main findings of the study were:

i. According to the opinions of the secondary school teachers teaching aids were essential and useful in developing clear concepts and stimulating learning.
ii. Good use of aids could be realized if only teachers were thoroughly trained.

Jayalakshmi (1992) developed a video programme and measured its effectiveness in teaching balanced diet to higher secondary home science students and community people. The objectives of the study are as follows:

i. To develop a video programme on teaching of balanced diet to higher secondary home science students and community people.

ii. To find out whether there exist any difference in learning of balanced diet between higher secondary home science students and community people taught through lecture method and video method.

The study arrived at the following conclusions:

i. There is significant difference in the learning of balanced diet between higher secondary home science students taught through traditional method and video method. The achievement of the students in balanced diet is higher in video method than in traditional lecture method.

ii. There is significant difference in the learning of balanced diet between community people taught through traditional lecture method and video method. The achievement of the community people in balanced diet is higher in video method than in traditional lecture method.
Kalimuthu’s (1991) study on ‘Developing a video programme on environmental pollution biology for higher secondary students’ reveals the following findings:

i. Both the male and female students improved their learning of the concepts of environmental pollution after viewing the video programme.

ii. Both the male and female students learned more concepts of environmental pollution when they were taught by video method than by traditional lecture method.

Ramar (1994) undertook an experimental study on ‘Effectiveness of multimedia based modular approach with special reference to low achievers’ with the following objectives:

i. To know whether there exists any significant difference between the post-test scores of control group low achievers and experimental group low achievers.

ii. To know whether there is any significant difference between the post-test scores of experimental group low achievers and the normal group students.

After analysis, the study arrived at the following conclusions:

i. Multimedia based modules can be developed to teach all the subjects of STD VIII.

ii. There is significant difference between the pre-test and the post-test mean scores of experimental group low achievers. Their achievement in the post-test is higher than their achievement in the pre-test. This tremendous progress in the post-test
performance can be attributed to the effectiveness of multimedia based modular approach.

**Vibha Joshi (1993)** conducted a study on ‘Effectiveness of school television programmes in science’ with the following objectives:

1. To study the STV programmes in science at the secondary school level in main terms of:
   i. Instructional objectives
   ii. The extent to which media attributes and limitations of television are being taken care of.
   iii. Suitability of the organisation of learning experiences.

2. To study the impact of STV programmes in science at the secondary school level on the student’s performance in terms of:
   i. Scholastic achievement (as related to the exposed topics)
   ii. Scientific attitude.

The findings of the study are given as under:

i. The content of the STV programmes was adequate as well as accurate.

ii. For the selection of the topics for STV programmes, the attributes and limitations of the medium (television) were mostly considered but many a time they had been overlooked due to certain handicaps. The procedure
employed for the selection of topics for STV programmes was found to be appropriate.

**Sahajahan (1980)** conducted ‘An experimental study on teaching science in Standard VI and VII through modules’. The objectives of the investigation were:

i. To study the effectiveness of the modules as an instructional method with respect to the conventional method.

ii. To compare the achievements through modules of high achievers and low achievers, boys and girls, high academic motivation and low academic motivation and the like.

The major findings of the investigation were:

i. The modular way of learning was more effective than the conventional method in the case of some modules while in the case of other modules it was found as effective as the conventional method.

ii. An overwhelming majority of the students possessed a favourable attitude towards modular instruction and their attitude was stable throughout the period of experimentation.

**Thalaimalai, R. (1996)** studied the ‘Effectiveness of multimedia based modular approach in teaching botany at higher secondary level’. The study concluded that this multimedia based modular approach was more effective than traditional lecture method in teaching botany to plus one students. This multimedia modular treatment was more effective to below average students, moderately
effective to average students and not so significantly effective to above average students as it was to the students of the other two groups. The study also pointed out that concrete presentation of subject content, direct experience and learner’s involvement could be ensured in this approach.

Reddy and Ramar (1995) undertook a study to assess the ‘Effectiveness of computer assisted instruction teaching science to slow learners’. After the experiment, the slow learners in the experimental group evinced better mean gain than the control group slow learners. Also, they could narrow down the gap between them and the normal group students. The narrowed down gap between both the groups may be ascribed to the effectiveness of CAI in Indian school setting where most of the schools do not have even a single computer.

Reddy and Ramar (1996) conducted an experimental study on ‘Relative effectiveness of video instruction in teaching science and social science to slow learner’. The study established the effectiveness of video instruction in teaching science and social science to slow learners. There was better rate of progress in social science than in science. This strategy enabled the experimental group slow learners to cope with normal students to a considerable extent.

Reddy and Ramar (1997) undertook an experimental study to verify the ‘Effectiveness of multimedia instructional strategy in teaching science to slow learners’. The obtained results showed that
the multimedia instructional strategy was more effective than the traditional lecture method in teaching science and it enabled the slow learners to cope with normal students to a considerable extent. The study also furnishes a wide ranging list of further researches to be undertaken with special reference to slow learners.

Sontakey, (1986) conducted ‘A comparative study of personality factors and achievement motivation of high and low achievers in natural and biological sciences’. The major findings of the study were:

i. High achievers were more intelligent, less excitable tough minded, self reliant and realistic than the low achievers as groups in biological sciences.

ii. The achievement motivation as measured by G.Rao’s achievement motivation test was a poor predictor of achievement in biological and natural sciences.

Soundararaja Rao and Rajaguru (1995) studied ‘Effectiveness of video assisted instruction on the achievement of slow learners’. The major objectives of the study were:

i. To investigate the effectiveness of video assisted instructions on the achievement of slow learners in learning science concepts.

ii. To make a comparative study of the achievement of slow learners in terms of the following variables: Sex difference, socio – economical difference, management of school, parent’s educational status and family size of slow learners.
After analysis, the study gave the following conclusions:

i. The slow learners of control and experimental groups were alike in immediate retention. But female slow learners of video assisted instruction group performed better in immediate retention than conventional learning group.

ii. The socio-economic status had impact on immediate retention of slow learners in learning science concepts through video assisted instruction.

**Benaloh, Lauril Anne Blake (1994)** conducted a study entitled ‘Teachers, students and instructional software: What works, well when and why’. This research was an exploratory study based on teacher and student evaluation of different teaching styles while using instructional software. Three teaching styles (monitoring, coordinating and mediating) were used with each of three software packages in three grade 5 classes. The classroom teachers and 18 students, selected to represent different preferred learning styles were interviewed as to what they felt were the advantages and disadvantages of each style/software dyad.

Contrary to expectations, the effectiveness of the three styles did not seem to depend on the primary instructional style of the teacher or on the preferred learning styles of the students. Rather, these results suggested that, for optimal effectiveness, all three styles should be used with every instructional software programme.
Dobbins, E. Renee, (1994) undertook a study to measure the effectiveness of ‘Math computer assisted instruction with remedial students and students with mild learning / behaviour disabilities’. The purpose of the study was to compare the performance of third and fourth grade students with mild learning / behaviour disabilities and selected third and fourth grade students without mild learning /behaviour disabilities when using the computerized programme, ‘math concepts and skills’ as measured by the in-line analysis provided by the programme. The major findings of the study were:

i. There was a statistically significant difference between the gain scores of students with mild learning /behaviour disabilities and students in the Chapter I programme when repeated measurement of gain scores were analysed over the three months period.

ii. There was a statistically significant difference within the group of students in the Chapter I programme when repeated measurement of gain scores were analysed over the three months period.

Nishino, Alan Koki (1994) undertook ‘An exploratory investigation to determine the effects of a multimedia computer – based science learning environment and gender differences, on achievement and attitudes and interests of students in an eighth – grade science classroom’. This study employed an exploratory investigative approach which utilized a quantitative two-by two experimental factorial designs. The purpose of the study was to
determine the relationship of a multimedia computer based science learning environment and gender differences on achievement and attitudes and interests of students in an eighth grade science classroom. The following relationships were found:

i. Students in the experimental classroom had a significantly higher post-test mean score in ‘self concept’ than the students in the traditional science classroom.

ii. Students in the experimental classroom had a significantly higher post-test mean score on the Hueneme Computerised Instruction Test on science than the students in the traditional classroom.

2.6 STUDIES ON COMPUTER ASSISTED TEACHING LEARNING

There are five major ways that computers will help our science teaching:

1. ‘Lab’ data analysis / processing
2. Dialog and tutorial
3. Simulating and modeling
4. Drill and practice
5. Teacher utility (Word processing, record keeping, etc)

‘Lab’ data analysis and processing – ‘Lab’ data analysis and processing, is based on the four bases: drill and practice, teacher utility, simulating and modeling and dialog and tutorial. ‘Lab: data analysis and processing is discussed first because
1. It is easy for elementary school teachers to emphasize drill and practice applications because this is what we know and do ourselves.

2. ‘Lab: data analysis and processing attempts to use the computer as a tool to aid discovery, not merely as mechanical flash cards.

3. Computers are new to most elementary school science programs. Teachers should emphasize the most creative and innovative uses of computers, rather than the least imaginative, mechanical uses.

**Dialog and tutorial** – Another kind of CAI used by science teachers is interactive dialog or tutorial. Students could learn how blood circulates, the names of the organs in the circulatory system of a fish and then be tested to reinforce the concepts learned. Generally, tutorial CAI involves students in active dialog which requires them to answer correctly before going to the next step.

**Simulating and modeling** – Although difficult to program because of complex computer graphics, simulating and modeling has great potential as a CAI teaching tool. The computer can simulate experiments that are difficult to do in elementary school classrooms, such as wave properties or population growth. Students enjoy the action and direct involvement in the graphic displays; witness the popularity of video games.

**Drill and practice** – The most common type of computer assisted instruction is drill and practice, which is relatively simple to
write. CAI drill and practice and practice are good for teaching things like scientific terminology, classification and computation.

**Teacher utility** – The computer has obvious and far-reaching applications in the areas of record keeping, data processing, and other administrative and clerical tasks.

A few studies have been conducted to verify the effectiveness of CATL as an instructional strategy. Such studies is listed below under the subhead.

**Darling (1986)** studied mathematics skills achievement using computer instruction. He found that there was no significance difference between computer instruction and other traditional instructions in the achievement of basic mathematical skills.

**Fox James Albert (1986)** made an attempt to find out whether any significant difference exists between lectures based instruction and computer based individualised instruction. For this two identical groups were selected. One was control group and the other was experimental group. The control group was given treatment with conventional methods of teaching i.e., the lecture based instruction and the experimental group was treated with computer based individualized instruction.

Pre test, post test and retention test were conducted for both the groups and the results were analyzed using appropriate statistical
techniques. The result shows that experimental group children performed better than the control group children. This shows that the computer based individualized instruction helps the experimental group children to perform better than their counterparts.

Lee, Yi jen Doris (1989) made an attempt to find out the effects of feedback and second try in computer assisted instruction for a role of learning task. For this two identical groups were selected. One was control group and the other was experimental group. The control group was given treatment with conventional methods of teaching i.e. the lecture based instruction and the experimental group was treated with computer based individualised instruction. Pretest, Posttest and Retention test were conducted for both the groups and the results were analysed using appropriate statistical techniques. The result shows that experimental group children performed better than the control group children. This shows that the computer based individualised instruction helps the experimental group children to perform better than their counterparts.

Madhur Gupta (1989) investigated on the topic, ‘Two strategies of Computer Assisted Instruction in Chemistry’. The main objectives of the study were:

i. To design two strategies of computer assisted instruction

ii. To study the relative effectiveness of two strategies of computer assisted instruction in Chemistry.

iii. To compare the mean retention scores of two strategies of computer assisted instruction in Chemistry.
The study concluded that the students under the first strategy scored significantly higher than the students under strategy II in terms of their mean gain scores and mean retention scores in the criterion test.

Lee, Wen – Cheng (1990) made an attempt to find out the ‘Effectiveness of computer assisted instruction’. For this two identical groups were selected. One was control group and the other was experimental group. The control group was given treatment with conventional method of teaching i.e., the lecturer based instruction and the experimental group was treated with computer based individualised instruction. Pre test, Post test and Retention test were conducted for both the groups and the results were analysed using appropriate statistical techniques. The result shows that experimental group children performed better than the control group children. This shows that the computer based individualised instruction helps the experimental group children to perform better than their counterparts.

Clark, K.F., Hostika A., Schriver M., and Bedell, J. (2002) ‘Computer Based Virtual Field Trips’ this paper discusses computer based virtual field trips that use technologies commonly found in public schools in the United States. The discussion focuses on the advantages of both using and creating these field trips for an instructional situation. A virtual field trip to Cumberland Island National Seashore, St. Marys, Georgia is used as a point of discussion.
for the technologies involved and the value of their use for instruction in a science classroom.

While this field trip is being used as a point of discussion, the techniques and advantages identified can be applied over a P – 16 grade ranges in all subject areas. If the decision is made by an instructor to create a virtual field trip, the technologies used can be as simple as using digital pictures and text in Microsoft PowerPoint or Hyperstudio or as complex as using digital video and panoramas in Macromedia Director. The level of complexity will depend on the technology available and skills of the developers.

Smith-Gratto, K., and Blackburn, M.A. (1997) ‘The computer as a scientific tool: integrating spreadsheets into the elementary curriculum’. Describes the ‘ABCD’ model for integrating spreadsheets into elementary science instruction, which consists of four steps: analyzing the software and curriculum; brainstorming connections between parts of the software and the content areas; creating connections among the curriculum, the brainstorming information and non computer classroom activities; and defining curriculum objectives that can be incorporated and related activities.

Hargis, J. (2001) ‘Can students learn science using the internet’. Discussion of using the Internet to learn science focuses on an online study that presented a constructivist and an objectivist format containing the same information and examined the effect on
learning of variables that included age, gender, racial identity attitude, aptitude, self regulated learning and self-efficacy.

**Kelley, D., Finley R., KoehlerK., and Picard, K. (2001)** ‘Equal access: integrating technology into the elementary and secondary curriculum’. This article discusses two collaborative efforts of classroom and computer teachers to integrate adopted technology into the elementary and secondary curriculum of 25 students with visual impairment. In the primary level project students developed computer Internet and word processing skills while studying desert life. In the secondary-level project students developed research, software, internet and alternative media skills while studying earthquakes.

**Torri Jr., G.J. (1994)** ‘Using video technology as an instructional strategy within the elementary science curriculum’. This practicum was designed to increase elementary education interns used of video technology within the science curriculum. Interns from previous semesters were not using technology within their final semester projects, and most were not comfortable using technology. The purpose of this practicum was to increase the scientific and technological literacy of the interns and develop a positive attitude toward the use of technology within their instruction. Within this practicum, the interns’ has the opportunity to develop the skills and confidence needed to be technology literate.
A cooperative training program with the local public broadcasting station was developed and instructional video technology was modeled within the weekly course presentation. Also, a video technology resource room was created for the interns. Analysis of the interns’ final thematic unit presentation indicated an increased use of video technology and through a reflective attitude paper, all the interns stated an increased comfort level for using technology within the curriculum.

Winter, Christina Surrency (1994) devised ‘A strategy for identifying when interventions should occur in computer assisted instruction’. The main purpose of the study was to develop, describe and demonstrate a system for assessing the normative or expected progress of pupils who are engaged in learning through computer-assisted instruction. A model is built which would enable an instructor to intervene as needed in the student’s learning, thus encouraging early intervention of pending learning problems.

Smart – Leathy Ann (1994) studied the ‘Effect of traditional versus multimedia augmented instruction on exposure time determination’. The main purpose of this study was to compare the effectiveness of traditional instruction and traditional instruction augmented by a multimedia module for psychomotor learning and to determine if academic level and previous experience had an effect on accuracy of density determination for photographic print. The experimental group that received the multimedia augmented
lesson treatment had less absolute density error that is, the treatment had a positive effect.

Tay, Young – Wu (1994) made ‘An assessment of the developmental status of educational technology in the People’s Republic of China’. Educational technology is a process for analyzing problem in human learning and managing their solutions. This study subtly points out how vigorous efforts at promoting the application of educational technology have led to the establishment of central agencies at national levels, audio-visual education stations in rural areas, audio-visual centres in universities and the operation of central and local radio and television universities.

2.7 STUDIES ON EXPERIENTIAL LEARNING

The education category includes the largest number of Experiential Learning Theory (ELT) studies. The bulk of studies in education are in higher education. Many of the studies in higher education use Experiential Learning Theory (ELT) as a framework for educational innovation. These include research on the matching of learning style with instructional method and teaching style and curriculum and program design using Experiential learning.

Hainer (1992) ‘Cognitive and learning styles of high school students: Implications for ESL curriculum development’. This education research has been primarily focused on the use of ELT as a frame work for curriculum design, particularly in language and science.
Boyatzis and Kolb (1995) ‘From learning styles to learning skills’. This study examined the relationship between learning style and management style, decision-making and problem solving and investigated the effect of a match between learning style and learning environment on job satisfaction and performance. ELT has been used as a framework for innovation in management including research on matching learning styles and learning environment, program design and experiential learning in computerized business games.

Hunt (1992) ‘The renewal of personal energy’. This study investigated Experiential learning theory as a model for personal growth and development, including examination of counselor/client learning style match and its impact on counselling outcomes.

Laschinger (1990) reviewed the ‘Experiential learning research in nursing’. Kolb theory of experiential learning has been tested extensively in the nursing population and study the relationship between learning style and learning preferences, decision making skills, educational preparation, nursing roles, nursing speciality, factors influencing careers choices and diagnostic abilities. As would be expected in a human service profession, nursing learning environments have been found to have a predominantly concrete learning press, matching the predominating concrete styles of nurses, Kolb’s cycle of learning which requires the use of a variety of learning modalities appears to be a valid and useful model for instructional design in nursing education.
Hick Cox (1990) ‘An historical review of Kolb’s formulation of experiential learning theory’. She extensively reviewed the theoretical origins of ELT and qualitatively analyzed 81 studies in accounting and business education, helping professions, medical professions, post-secondary education and teacher education. She concluded that overall 61.7% of the studies supported ELT, 16.1% showed mixed support, and 22.2% did not support ELT.

Vince (1998) ‘Behind and beyond Kolb’s learning cycle’. This study has been more focused on the theory than the instrument examining the intellectual origins and underlying assumptions of ELT from what might be called a post-modern perspective where the theory is seen as individualistic, cognitivist and technological.

Mainmelis, Boyatzis and Kolb (1999) ‘Learning styles and adaptive flexibility testing Experiential learning theory’. These new research directions, coupled with the growing dissemination of experiential learning theory in various academic disciplines bring experiential learning theory back to its basics: the creative exploration of the links between experience, learning and development across the social spectrum.

2.8 AN OVERVIEW OF THE LITERATURE REVIEWED
The researchers reviewed clearly show that many studies have been conducted on learning difficulties in India and abroad. Anna Elizabeth Kuruvilla (1999), Bindu Prasad (1998), Rama (1992), Reddy’s (2000), Srivastava, Sushila and Afiah (1992), Lakshmi
A close look at these studies reveals that most of these studies are conducted on causes, characteristics and remedial instructional programmes for learning difficulties in children.


Studies related to CATL as an Instructional strategy are found in large number in India and abroad. The studies made by Darling (1986), Fox James Albert (1986), Lee Yi Jen Doris (1989), Smith – Gratto, K., and Blackburn M.A (1997), Hargis, J. (2001), Winter,
Christiana Surrency (1994) have established the effectiveness of CATL strategy besides providing guidelines as to how to develop CATL strategy. The limited studies have been conducted on Experiential learning, Hainer (1992), Hunt (1992), Hickcox (1990), Vince (1998). The said studies focused on Experiential learning, learning styles and learning skills.

From the above review it is very clear that adequate studies have not been attempted in Indian setting. Only a few studies have been undertaken so far. They are related to personal characteristics or causes of learning difficulties. Very limited experimental studies have been attempted so far. Even these studies also have not thought of all possible dimensions with regard any specific learning difficulties such as language learning difficulties, mathematics learning difficulties and science learning difficulties. It warrants a great deal of research to be undertaken in the area of specific learning difficulties in Indian context.

Therefore, the investigator has made an earnest effort to establish different instructional strategies to apply to the students with learning difficulties with different learning styles, so as to circumvent their difficulties in learning of Environmental science concepts and also to assess the effectiveness of the different applied strategies on the achievement of students with learning difficulties in learning of Environmental science concepts at primary level. The details of procedure adopted for this study is presented in third chapter.