CHAPTER - III

REVIEW OF RELATED LITERATURE

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CHAPTER –III
REVIEW OF RELATED LITERATURE

3.01 INTRODUCTION

In order to have good background knowledge of the research studies done earlier the researcher should go through the previous studies. If further provides the researcher with the necessary ideas to formulate the problem.

According to BEST (1997) “a familiarity with the literature in any problem area help the investigator to discover what is already known, what others have attempted to find out, what method of attacks have been promising or disappointing and what problem remain to be solved.

Review of related literature forms the foundation upon which all future work must be benefit, it helps the research worker to develop a thorough understanding and insight into previous work done it can help in limiting the individuals research problems and even defining it better.

Young, P. writes that the function of the review of related literature is:-

i) To help avoid duplication of what already exists in writings or in print

ii) To further the thinking on a given subject as a result of mental stimulation and reflection.

iii) To carry the subject of inquiry further or into related channels and begin in the work where some one else also has left off and.

iv) To give valuable clues as to methods, scores and organization of data.
This chapter presents empirical background for formulating the study. The classification of related literature is made under the following heads

- Studies related to Concentration Based Activity (CBA) in abroad
- Studies related to Concentration Based Activity (CBA) in India
- Studies related to Process Competencies as Process Skills, Scientific Attitudes, and Scientific Knowledge in abroad
- Studies related to Process Competencies as Process Skills, Scientific Attitude, and Scientific Knowledge in India

**3.02 STUDIES RELATED TO CONCENTRATION BASED ACTIVITY (CBA) IN ABROAD**

Various methods of teaching have been proposed and curricular revision has been implemented these in the recent decades. These methods have been completely pupil centered where in the responsibility of learning science rests completely on the pupil. The main objective of such method is to make pupils more exact, more truthful, observant and thoughtful to lay the solid foundation for future self-learning and to encourage the growth of spirit of enquiry of research.

_Eggleston et.al (1976)_ conducted a study on effectiveness of particular set of science teaching method on the development of Scientific Attitude and achievement of pupil. The main objective was to identify the process of science teaching that is the combination of particular set of learning experience and investigate a possible relationship between such methods and the product of this teaching in attitude and achievement of pupil. Tools used for the study were attitude inventory and achievement test. The results indicate that the particular set of learning experience had positive effect on the attitude and achievement of pupil.
Anthony (1977) conducted a study the relative effectiveness of lecture and audio tutorial methods on their achievement in Biology on the non-science major college students. Major objectives of the study were to compare the effect of lecture and audio tutorial method and the achievement, critical thinking, attitude of students. Tools used for the study were Nelson Biology test, critical thinking abilities and attitude towards biology. The results of the study indicated that the two methods were equally effective in terms of achievement in biology.

Arson E Nancy (1977) studied the relative effectiveness of jigsaw technique as an interesting and effective co-operative learning strategy and traditional method for developing scientific knowledge. Major objectives of the study were to know different types of jigsaw technique and their effect on improvement of knowledge and their application. The result shows that as compared with traditional methods, students in the jigsaw classroom demonstrated improved knowledge as well as an ability to apply that knowledge.

Hendricks (1978) studied the comparative effectiveness of content oriented text book approach and activity oriented approach of teaching science on the achievements in science of Grade V rural children. Major objective of the study was to compare the effect of content oriented text book approach and activity oriented approach of teaching science and their effect on achievement in science. Tool used for the study was sequential Tests Educational Progress on Grade V rural children. Major finding of the study was the content oriented text book approach and activity oriented approach of teaching science were equally effective in terms of student’s achievement in science.
Fraser (1982) investigated the effect of science experience provided by the science teacher of Grade-v student’s concept of physical causality. Major objective of the study was to identify the effect of science experience and their impact on achievement. Tool used for the study was achievement test in physics. He found that participation in the selected science experience enhanced the concept of living and floating.

Hopper (1982) studied the effectiveness of modular approach for teaching biology in standard XI. Major objectives of the study was to develop three type of 3 structural modular approaches namely self-learning, peer group learning and with teacher intervention of teaching. Tool used for the study was academic motivation inventory and achievement test. It was concluded that all the 3 structural modular approaches namely self-learning, peer group learning and with teacher intervention of teaching were effective in terms of gain in cognitive developments, higher mental abilities and significant increase in the academic motivation of the students.

Shymansky et, al.(1983) studied the meta-analysis on student performance across activity based programmes in terms of performance clusters( achievement , perception , etc) . Major objective of the study was Meta analysis of activity based programmes in terms of achievement and perception. Tools used for the study were Achievement test, test of Process Skill and Perception Scale. Composite performance measure showed that students in the hand on programme out performed their elementary school counter parts of 9% points. Student’s perceptions of these science programmes as well as performance on science process skills measures were particularly positive, exceeding traditional students by 17 and 19 % points respectively. The data indicate that, these elementary science programmes were more
effective in enhancing student’s achievements and problem solving skills than were in traditional programmes.

_Punser and Renna (1983)_ in their investigation effectiveness of two teaching methods used were concrete instruction (The learning cycle) and formal instruction (exposition) on the intellectual development and achievement in selected biology context. Major objective was to develop concrete, formal instruction and their effect on intellectual development and achievement in selected biology context. Tools used for the study was achievement test and test of intellectual skill. The two teaching methods used were concrete instruction. (The learning cycle) and formal instruction (exposition) they found the former to be more effective than the latter for promoting intellectual development in students

_Baaird and White (1984)_ conducted a study on self-questioning and think aloud process on developing meta-cognition of 9th grade and 11th grade in learning biology. Major hypothesis were there is significant difference in the self-questioning and think aloud process on developing meta-cognition of 9th grade and 11th grade in learning biology. Tool used for the study was Meta cognitive skill test. The result shows that the there is a significant effect on the self-questioning and think aloud process on developing meta-cognition.

_Awodi (1984)_ conducting a study on effectiveness of inquiry method was more effective in teaching biology than the lecture method in terms of achievement in biology of Nigerian X grade biology students. Major hypothesis of the study was there is significant difference between inquiry method and lecture method in terms of achievement in biology of Nigerian X grade biology students. Tool used for the study was achievement test in biology. It is found that the inquiry method more effective than lecture method in terms of achievement in biology.
Osborne and Freyberg (1985) have studied effectiveness of five technique that teacher in activity based programmes have used successfully to get students focus on strategies for learning how to learn through activities. For example, instruction or a particular task can be written on cards and handed to small group of students for unscrambling five to ten minutes spent on the kind of activity answers that students will think about what to do rather merely go through mechanical motions. The results show more effect of using activity based programmes in normal classes.

Coll (1986) studied the effectiveness of the inquiry method and traditional lecture method of teaching science. Major hypothesis was there is significant difference between inquiry method and traditional lecture method of teaching science on developing achievement in XI students. The study was conducted on grade XI student’s 67 students experienced the inquiry method of teaching which 59 was taught the traditional method. He found that inquiry method as being more effective in terms of achievement is science as compared to the traditional method.

Rodwell (1987) conducted an experimental study to compare the effectiveness of two information processing methods namely Taba’s concept formation method and Ausubel’s Advance Organizer method. Major hypothesis was there is significant difference between Taba’s concept formation method and Ausubel’s Advance Organizer method on the retention capacity of facts. Tool used was retention test. The criterion variables were the retention of facts and concepts and the retention of categorizing skill which were pre-tested and post-tested on two occasions, once just after the instruction and again after six weeks of instruction. The findings revealed that the two methods did not differ significantly in their effects except the short term effect of Ausubel’s Advance Organizer method which was found superior in the retention of facts than that of Taba’s concept formation method.
*Goal and Agbeobi (1990)* studied the relative effectiveness between learning physics through the lecture demonstration method and the individual instruction method. Major hypothesis was there is significant difference between lecture method and individual instruction method on the development of achievement of physics. Tool used was achievement test in physics. The results support the conclusion that the psychomotor skills in the subject area of light are achieved better when the students are allowed to manipulates the approaches and perform experiments on their own rather than when they are deprived of the opportunity to manipulate the apparatus, but the students who receive laboratory instruction by the Lectures Demonstration method acquire cognitive skills in the subject area of light significantly better than those who receive instruction by the individual laboratory Method. The better achievement of the related cognitive skills of the group of students who received instruction by the lecture Demonstration method could be attributed to the lecture component of the lecture demonstration method. Their achievement must have been further enhanced due to the lecture which followed the demonstration.

*Chung–Hu- Chi,(2002 )* investigated effectiveness of collaborative team setting in a network supported environment benefits secondary science learning(scientific process skill development, attitude toward school science) among Ninety-four 10th grade (ages 16-17) girl students. Hypothesis was there is significant effect on the science learning of pupil taught through collaborative team setting. Tools used were test of process skill and attitude inventory . it was found that both groups showed significant improvements in skills and attitudes. However, the students in the team situation did not demonstrate significantly better skills or attitudes than the students in the individual situation.
Ochoa, Therasa (2005) studied effectiveness of collaborative learning Dynamics during a problem based learning activity in Education on the development of achievement. Major hypothesis was there is significant effect on collaborative learning Dynamics during a problem based learning activity in Education on the development of achievement. Problem based learning (PBL), especially in conjunction with collaborative learning teams continuous to gain maximum as a popular instructional approach in higher education.

Sampson, Dematrions (2006) studied effect of next generation activity based learning system on improved learning. Hypothesis used was there is significant effect of web based education on class room learning. The result shows that the activity based learning more effective than conventional learning styles.

Kun-Yuan Yang and Jia-Sheng Heh (2007) investigate and compare the impact of Internet Virtual Physics Laboratory (IVPL) instruction with traditional laboratory instruction in physics academic achievement, performance of science process skills, and computer attitudes of tenth grade students. One-hundred and fifty students from four classes at one private senior high school in Taoyuan Country, Taiwan, R.O.C. were sampled. Hypothesis used were there was no significant difference in academic achievement, science process skill, computer attitudes between the groups taught through internet virtual physics laboratory instruction than traditional method. Tools used were test process skill, achievement test and computer attitude inventory. We concluded that the IVPL had potential to help tenth graders improve their physics academic achievement and science process skills.

Carolyn M. Schroeder et,al. (2007) studied the meta-analysis of specific science teaching strategies on student achievement. The six phases of the project included study acquisition, study coding, and determination of inter-coder objectivity,
establishing criteria for inclusion of studies, computation of effect sizes for statistical analysis, and conducting the analyses. Studies were required to have been carried out in the United States, been experimental or quasi-experimental, and must have included effect size or the statistics necessary to calculate effect size. Sixty-one studies met the criteria for inclusion in the meta-analysis. The following eight categories of teaching strategies were revealed during analysis of the studies (effect sizes in parentheses): Questioning Strategies (0.74); Manipulation Strategies (0.57); Enhanced Material Strategies (0.29); Assessment Strategies (0.51); Inquiry Strategies (0.65); Enhanced Context Strategies (1.48); Instructional Technology (IT) Strategies (0.48); and Collaborative Learning Strategies (0.95). The major implication of this research is that we have generated empirical evidence supporting the effectiveness of alternative teaching strategies in science.

Fund Z (2007) studied the effect of scaffolding learning components in a computerized environment, for students solving qualitative science problems in a simulation of laboratory experiments. Four scaffolding components were identified (structural, reflective, subject-matter and enrichment) and used in different configurations to construct four unique cognitive and meta-cognitive support programs based on human teaching. These ranged from low (Enrichment) to full support (Integrated). Tool used were three open-ended subject-matter questionnaires, tapping knowledge and understanding. The findings indicate differential effects of the support programs mostly in the following order: Integrated > Strategic > Operative > Enrichment > Control. The structural component seems to be a sine qua non for success and has a consistent and powerful influence. The combination of reflection and structural components, however, are needed for superior achievement. Both reflection and subject-matter components work cumulatively over time.
BurcinAcar, LemanTarhan (2007) Investigate the Degree of Effectiveness of Cooperative Learning Instruction over a Traditional Approach on 11th Grade Students' Understanding of Electrochemistry. The Study involved forty-one 11th Grade Students from Two Science Classes with the same Teacher. Tool used was the Electrochemistry Concept Test and Interview. According to the Results, twenty-four Misconceptions (Six of them initially Identified) about Electrochemistry were Identified. The Results from the t-test Indicated that the Students who were Trained Using Cooperative Learning Instruction had Significantly Higher Scores in Terms of Achievement than those Taught by the Traditional Approach. According to the post-test and Interviews, it was also Found that Instruction for the Cooperative Group was more Successful in Remediation of the Predetermined Misconceptions.

Recai Akkus, Murat Gunel, Brian Hand (2007) Comparing an Inquiry-based Approach - Heuristic to Traditional Science Teaching Practices on developing achievement of pupil. The objective of this study was to compare the effectiveness of the inquiry-based approach known as the Science Writing Heuristic approach as a treatment to traditional teaching practices in relation to students' achievement level and teacher's implementation of the approach. Tools used for the study was Achievement test. The major findings of this study are that the quality of the implementation does have an impact on student performance on post-test scores and that high-quality implementation of the Science Writing Heuristic approach has significant advantages in closing the achievement gap within science classrooms.

Kemal Doymus (2008) investigates the Effect of Cooperative Learning (jigsaw) Versus Individual Learning Methods on Students' Understanding of Chemical Equilibrium in a first-year General Chemistry Course. This Study was
carried out in Two Different Classes in the Department of Primary Science Education. Students Participating in the Jigsaw Group were Divided into Four "home Groups" since the Topic Chemical Equilibrium is divided into Four Subtopics (modules A, B, C and D). Each of these Home Groups Contained Four Students. The Groups were as Follows: (1) Home Group a (hga), Representing the Equilibrium State and Quantitative Aspects of Equilibrium (module A), (2) Home Group B (hgb), Representing the Equilibrium Constant and Relationships Involving Equilibrium Constants (module B), (3) Home Group C (hgc), Representing Altering Equilibrium Conditions: Le Chatelier's Principle (module C), and (4) Home Group D (hgd), Representing Calculations with Equilibrium Constants (module D). The Home Groups then Broke Apart, Like Pieces of a Jigsaw Puzzle, and the Students Moved into Jigsaw Groups Consisting of Members from the other Home Groups who were assign to the same Portion of the Material. The Jigsaw Groups were then in Charge of Teaching their Specific Subtopic to the Rest of the Students in their Learning Group. The Main Data Collection Tool was a Chemical Equilibrium Achievement Test (ceat), which was applied to both the Jigsaw and non-jigsaw Groups. The Results Indicated that the Jigsaw Group was more successful than the non-jigsaw Group (individual Learning Method).

3.03 STUDIES RELATED TO CONCENTRATION BASED ACTIVITY (CBA) IN INDIA :

*Kalacherry (1962)* conducted a study on the preparation of experimental try out of programmed instruction material in the syllabus of chemistry prescribed for class VIII is Maharashtra. It was estimated that 83% learners were able to respond correctly to 83% of the times, the value of measure of density for the whole
programme was found to be 0.36. It was also found that a few students who scored below 30% in the traditional system score above 45% through programmed materials.

Padma (1976) studied the relationship between four selected teaching patterns and the pupil’s attainment in respect to their application of skills in science. The first teaching pattern was lecturing, problem solving approach, the third was question – answering – feedback – problem solving approach and the last one was the lecture method. Major objective of the study was to find out effect of different types of methods on pupil acquisition skill. It was found that the four teaching pattern had an equal effect on the development of pupils acquisition of skill under both surprise and testing conditions.

Sharma (1978) conducted an experimental study on Guided activity and self learning on the development of scientific attitude, acquisition of scientific knowledge and the training in science skills at the primary level in central school. Major objective of the study to compare the effectiveness of guided activity and self learning and their effect on scientific attitude, acquisition of scientific knowledge and the training in science skills. Major tools used for the study was Scientific attitude inventory, achievement test and test of process skills. It was found guided activity was more effective than the self-activity in respect of concept formation, development of scientific attitude, acquisition of scientific knowledge and the training in science skills.

Jha (1979) compared effectiveness of activity based approach in teaching school science in respect of acquisition of knowledge, application of the scientific knowledge and development of science skills. Major objective of the study was to find out the activity based approach in teaching school science development of acquisition of knowledge, application of the scientific knowledge and development of
science skills. Tools used for the study were Test of process skills and achievement test. It was found that there was strong evidence in favor of activity based approach in teaching school science in respect of acquisition of knowledge, application of the scientific knowledge and development of science skills.

_Basu (1981)_ studied the effectiveness of multi-media programmed materials in the teaching on developing achievement in physics among secondary school students. Major objective of the study was to develop a multi media learning package and their effect on achievement in physics. Toll used for the study was achievement test in physics. It was found that a significant difference existed in the achievement thorough different strategies due to difference in ability. It was also found that multi-media branched programmed instruction was better than the multi-media linear programmed instruction and multi-media semi – programmed instruction. Multi-media hybrid programmed instruction was better than multi-media branched programmed instruction.

_Joshi (1981)_ studied the development of science education for upper primary classes based on environmental approach. It was found that environmental education at the upper primary level was essential and vital to develop insight and skill needed to influence not only the environmental attitude and behaviors in the students, but also to stimulate their reorientation of value regarding the importance of environmental studies. children at the primary stage were interested to learnt from experience with real things than they could manipulate in some way, the teachers did not identify the objects outside the classroom which might be usually brought inside for study, the environment outside the school was potentially significant for educational purpose, and the syllabus was not environmentally oriented which lacked in field studies.
K.N.Shrivastva (1982) conducted a studied effectiveness of different approaches such as demonstration approach, environmental approach on developing achievement and retention among children. Major objective of the study was to compare effect different approach in teaching on developing retention and achievement. Tools used were retention test and achievement test. Major findings were environmental approach showed higher achievement and retention in subject and children had the opportunities of direct experience of phenomena which they had observed in their daily life.

Vardhini (1983) studied the effectiveness of multi-media instructional strategy for teaching science (physical science) on the development of scientific attitude and achievement among secondary levels. Major objective of the study was to develop a multi media strategy for science teaching and their effect on scientific attitude and achievement. Tools used for the study were Scientific attitude and achievement test. The strategy was found valid against the criterion of scientific attitude with significantly higher performance was noted. Intelligence and achievement using this strategy presented in significant relationship was found between scientific attitude and achievement for the experimental group and control group. Visual projections with teacher’s explanation and those with taped commentary were equally effective in terms of achievement in terms of achievement. Programmed materials and discussion sequences were equally effective.

B.N.Panda (1995) conducted an experimental study to compare the effect of activity based teaching with traditional method on achievement in school, children. Objective of the study compare the activity based teaching with traditional method. Tool used was achievement test. He found that achievement of experimental group differ significantly from control group in over all achievement.
Ramadas P (2000) conducted a study on the effect of utilization of science kits on achievement of VIII standard students. Major objective of the study was to compare the utilization science kits by schools and their effect on achievement. Tool used was achievement test. He found that there was highly significantly difference between the achievement of students in science belonging to school with good science kits facilities and the schools with poor science kit facilities.

Jugnu (2003) studied the effectiveness of teaching methods in the development of multiple intelligence of standard VIII pupil. Major objective of the study was to compare the co-operative leaning with traditional method and their effect on Multiple Intelligence. Tool used for the study was multiple intelligence inventory. The result of the study shows no significant difference between two teaching methods co-operate learning and existing method of teaching in the development of multiple intelligence.

Neena (2003) studied the effectiveness of teaching strategy for teaching biology for the development of multiple intelligence of standard VIII pupils. Objective of the study was to compare the teaching strategy with existing method and their effect on multiple intelligence. Tool used for the study was multiple intelligence. Results of the analysis revealed that there is development of multiple intelligences on standard VIII pupils taught through the strategy of teaching Biology for the development of multiple intelligence over existing method of teaching.

Sunil K. (2005) conducted a study on the effect of teaching science using concept mapping strategy on developing achievement and attitude towards science. The main objective of the study is to find out the influence of concept mapping strategy to the achievement in science and attitude towards science. There was a
significant difference in the level of achievement and attitude towards science of experimental group over control group..

*Rosemary (2003)* studied the effectiveness of learning strategies and multiple intelligences achievement in biology of secondary school pupils. Objective of the study was to find out learning strategies and their effect on multiple intelligence. Tools used for the study were multiple intelligence Inventory and achievement test. The findings of the study revealed that learning strategies are significant factors influencing achievement in Biology. But multiple intelligence does not effect the achievement in Biology of secondary school pupils.

3.04 STUDIES RELATED TO PROCESS COMPETENCIES IN ABROAD :

*Campell and Okey (1972)* studied the effectiveness of instruction in science process skills, on pre-service in relation to a control group. The experimental received process skills instruction in all the seven basic process skills of SAPA. The instruction included a statement of purpose, objective, information, directions, for activities and estimated time for completion feedback was showed that the treatment group scored significantly higher process skill achievement than the control group.

*Widick (1974)* studied the process instrument for teachers of science. it is found that pre-service teachers who received instructor directed exposure to the science process skills achieved significantly higher score on the process instrument for teachers of science than did teachers who had to initiate their own process skills training under informal conditions.

*Fitz, Donald, Szboand Michel (1974)* studied the effect of two junior high school science curriculum on the acquisition of the selected process skills of science
and determined the effect of sex and race on the acquisition of science process by students. Students enrolled in intermediate science curriculum study (ISCS) and introducing physical science (IPS) between male and female students and white and non-white students. There was no significant difference between groups on verbal math and science or abstract reasoning ability for the first equivalent comparison. When analysis of variance was performed with process of science Test (POST) scores as criterion and treatment and race as variance, a significant racial effect was observed. Using ANOVA no significant difference between treatment groups, sex groups or racial groups were identified, when ability, math ability and abstract reasoning ability were controlled statistically. The investigation concluded neither IPS no ISCS level II removed racial difference in acquisition of science process skills.

*Jaus (1975)* studied two approaches to train pre-service elementary teachers in integrated science process skills. One group of teachers received science process skills instruction through self-instructional pamlets (developed by Okey and fiel) the formal of the instruction consists of brief informal passage which included instructional tasks for the learners to carry out every pamlet contained practice exercise and self test. A second group received the same instruction plus a three page written communication which advocated the use of integrated skills in the elementary class room and a third served as a control. Both the experimental group performed significantly better than the control group on investigator deluged integrated skill test.

*Tobin and William (1982)* conducted research on relationship between formal reasoning, locus of control, academic engagement and integrated process skills achievement. Major objective of the study was to identify the relationship of formal reasoning, locus of control, academic engagement and integrated process skills
achievement. Tools used for the study were Test of formal reasoning, locus of personality test, test of process skill and academic achievement. The results show that formal reasoning is the strongest predictions of process skill outcomes.

Ahmad, Hamidhsaa, Rubba and Peter A (1983) investigated the extent of process skills in their achievement test among a sample of recent Malaysian high school graduate. Major objective of the study was identify the use process skill in achievement test. Tools used was and the relationships of these scores to science scores among the conclusions is that the science tests placed little emphases on the assessment of process skills.

Llys (1983) conducted a study to determine the effect of science process skills instruction on science on in service secondary teachers achievement of science process skills. It was found that teaching of science process skills to secondary school science teachers enabled them to acquire science process skills competences.

Padilla, Michael J et al (1983) studied the relationship between integrated process skill and formal thinking abilities of middle / high school students (N=492) results indicates that science skill ability is strongly associated with logical thinking suggesting that process skills teaching many influences formal thinking ability.

Walkosz, Margaret, Yeny and Russel H (1984) conducted a study which compared the process skills achievement of students completing the same exercise with students not only completing the same exercise but also receiving instruction in such integrated process skills as identifying variables and stating hypothesis. The relationships among process skill, achievement, cognitive development, overall course achievement sex and attitudes were also examined. The result indicates that
emphasizes on process skill in laboratory can significantly improve process skill and achievement. Students with lower cognitive development have a lower level of process skills achievement across level of cognitive development.

*Padilla and Padilla (1986)* conducted a study on thinking in science process skills of elementary, middle and secondary students. Tool used for the study was test of process skill. Result suggests that thinking in science can be through process skill and also learned by elementary middle and secondary students. Suggestions for teachers are offered like I) making the teaching the teaching tasks and expectations to the level of the learner ii) Teaching efficient problem solving strategies.

*Roth, Wolf, Micahael, Raychoudhary and Anitha (1993)* conducted a male specific study examined the development of integrated process skills in the context of open enquiry laboratory sessions. Major objective of the study was to find out effect of open enquiry laboratory session on the development integrated process skill. Tool used for the study was test of higher order thinking skill A. Major findings from this qualitative study indicate that male students develop higher order skills through non–traditional laboratory experiment that provided the students will freedom to perform experiments of personal relevance in authentic contexts.

*Starwitz and Barbbare M(1993)* studied programmed learning materials could implemented to promote a higher level of process skill proficiency. Objective of the study was the know the effect of programmed learning material and their effect on process skill proficiency. Tool used for the study was process skill proficiency test. The pre-test and post test study involving 55 under graduate elementary science
students are that review strategies did not affect science process skills proficiency and programmed instruction is more effective than researcher directed instruction.

Brotherton, Peter and Peter FW (1995) studied the science process skills and Piagetian developmental levels of about 90 secondary school students in seven, eight, and nine found only a single two-level hierarchy (basic and integrated) of process skills. Objective of the study was to identify the effect of Piagetian developmental and their effect on process skill. Tool used for the study was the test of process skill. They also found considerable overlap between science process skills and Piagetian development level.

Burechfield, Michael, L. Gifford A.M. (1995) conducted a study on effectiveness of computer-assisted instruction and their influence on students’ academic aptitude. Objective of the study was to identify the effect of computer-assisted instruction and their effect on scientific aptitude. Tool used for the study was the scientific aptitude test. The study revealed that no significant difference between the meanings of the control group and the experimental group (0.05 to 0.07) although the experimental group did show a more marked improvement in individual sub-test involving graphing and data interpretation.

Lovoic and Derrick (1999) conducted a study on effect of emphasizing hypothetical – predictive reasoning with in the science learning cycle on high school student’s process skills and conceptual understanding in biology. The study revealed that effect of adding a prediction / discussion phase at the beginning of a three-phase learning cycle involving exploration, introduction and concept application. They study found that instructional innovation produced significant gains relative to the use of process skills, logical thinking skills and scientific attitude.
Harlen (1999) studied on purpose and procedure for assessing science process skills and found that what is assessed in any particular situations is a combination of skills and knowledge and various steps have to be taken if those are to be separated.

Adb – El – Khalick and Lederman (2000) studied on improving science teacher’s conception of nature of science, a critical review of the literature. In this study, reviewed attempts could be categorized into two general approaches implicit and explicit. Implicit attempts utilized science process skills instructions or engaged in science based enquiry activities to improve science teacher’s conception of nature of science. Explicit attempts utilized instruction geared towards various aspects of nature of science and instruction that utilized elements from history and philosophy of science. The explicit approach has relatively more effective in enhancing teachers view.

Soyibo, Kola, Beaumont Walters, and Yonne (2000) conducted a study which determined Jamaican school students level of performance on five integrated science process skills and if there are significant difference in their performance linked to their gender, grade level school, school type, student type and socio-economic background(SEB). Results indicate that the subject mean scores was average. Then wear significant difference in their performance based on their grade level, school type, student type, and SEB. In favor of the tenth graders, traditional high school students. There was a positive significant and fairly strong relationship among their students, type, grade level, and SEB and performance.

Helen L. Gibbson, Chirstphor Chase (2002) studied the longitudinal impact of an inquiry based science programme on middle school students attitude towards science. This study examined the long term impact of the summer science exploration
programme (SSEP) a 2 week inquiry based science camp, conducted at Hamshire College Amherst. The goal of the program was to stimulate greater interest in science and scientific careers among middle school students. The interviews and surveys suggested that SSEP students maintained a more positive attitude towards science and a higher interest in science careers than students who applied to the programme but were not selected.

_Huppert et.al. (2002)_ studied on computer simulations in the high school students cognitive stages, science process skills and academic achievement in micro biology. The result indicates that the concrete and traditional operational students in the experimental group achieved significantly higher than their counter parts in the control group. Girls achieved equally with boys in the experimental group.

_Fabienne C.Von Roten (2004)_ studied the gender difference in attitude towards science in Switzerland. The analysis exploring the extent to which socio demographic back ground and scientific knowledge explain gender difference in attitude towards science. using data from a nationally stratified Swiss survey on attitude towards science, initial result suggest that although have more positive attitude towards science and greater levels of scientific knowledge than gender difference are non – significant once the socio demographic variables are included in the multiple regression models. more specifically scientific knowledge and education have an independent effect on attitudes towards science however the interpretation of these result is slightly different if the hypothesis, that the effect of nay single explanatory variable is the same among men and woman in the regression model is validated. Results show that the interaction between gender and scientific knowledge
is significant so that the effect of scientific knowledge on attitude towards science depends on gender.

*Saat (2004)* studied on the acquisition of integrated science process skills in a web based learning environment. Major objective of the study to set a web based learning environment and their effect on the integrated process skills. Analysis of the data revealed that the children acquired the skills in three phases, from the phase of familiarization and finally to the phase of automation.

*Carla C. Johnson; Jane Butler Kahle; Jamison D. Fargo (2007)* studied the middle school science teachers explored the relationship, if any, between teacher participation in whole-school, sustained, collaborative professional development and student achievement in science. Eleven teachers from Glendale Middle School participated in the Discovery Model Schools Initiative 2-week summer institute, followed by monthly release day professional development sessions focused on implementing instruction outlined in the National Science Education Standards. Student achievement was assessed using the Discovery Inquiry Test in Science. The same students completed the test in grades 6-8. Students of teachers at Glendale Middle School significantly outperformed students at the control school. Findings in this study revealed the positive impact that whole-school, sustained, collaborative professional development programs have on student achievement, indicating that programs of this nature could be a means to narrowing or eliminating achievement gaps in science.

*Midco Chang; Kusum Singh; Yun Mo (2007)* explored the relationship of self-concept and locus of control to science engagement and science achievement. Furthermore, the relationship of self variables with science engagement and science
achievement was studied across ethnicity, gender, and socioeconomic status (SES). The data were accessed from the 3 waves of the National Education Longitudinal Study: 88 (NELS:88) to estimate both cross-sectional and multilevel longitudinal models. It was hypothesized that self-concept and locus of control would have a positive effect on science engagement and science achievement and that science engagement would affect science achievement positively. The results supported the theoretical formulations of the conceptual model and showed significant effects of self-concept and locus of control constructs on science engagement and science Item Response Theory (IRT) scores. Furthermore, science engagement showed a positive but small effect on science achievement, especially the time spent on science homework. The study supported earlier findings that the inclusion of non-ability factors improves the explanation and understanding of differences in science achievement. The study has implications for practice.

**Roman Taraban (2007)** studied the Effects of Active-learning Experiences on Achievement, Attitudes, and Behaviors in High School Biology. Active-learning labs for two topics in high school biology were developed through the collaboration of high school teachers and university faculty and staff and were administered to 408 high school students in six classrooms. The content of instruction and testing was guided by State of Texas science objectives. Detailed teacher records describing daily classroom activities were used to operationally two types of instruction: active learning, which used the labs; and traditional, which used the teaching resources ordinarily available to the teacher. Teacher records indicated that they used less independent work and fewer worksheets, and more collaborative and lab-based activities, with active-learning labs compared to traditional instruction. In-class test data show that students gained significantly more content knowledge and knowledge
of process skills using the labs compared to traditional instruction. Questionnaire data revealed that students perceived greater learning gains after completing the labs compared to covering the same content through traditional methods. An independent questionnaire administered to a larger sample of teachers who used the lab-based curriculum indicated that they perceived changing their behaviors as intended by the student-centered principles of the labs. The major implication of this study is that active-learning-based laboratory units designed and developed collaboratively by high school teachers and university faculty, and then used by high school teachers in their classrooms, can lead to increased use of student-centered instructional practices as well as enhanced content knowledge and process learning for students.

Tenaha O’Reilly ; Danielle S. McNamara (2007) examined how well cognitive abilities predict high school students’ science achievement as measured by traditional content-based tests. Students (n = 1,651) from four high schools in three states were assessed on their science knowledge, reading skill, and reading strategy knowledge. The dependent variable, content-based science achievement, was measured in terms of students’ comprehension of a science passage, science course grade, and state science test scores. The cognitive variables reliably predicted all three measures of science achievement, and there were also significant gender differences. Reading skill helped the learner compensate for deficits in science knowledge for most measures of achievement and had a larger effect on achievement scores for higher knowledge than lower knowledge students. Implications for pedagogy and science assessment are discussed.

Chun-Yen Chang Wei-Ying Cheng (2008) studied the interrelationship between senior high school students' science achievement (SA) and their self-
confidence and interest in science (SCIS) was explored with a representative sample of approximately 1,044 11th-grade students from 30 classes attending four high schools throughout Taiwan. Statistical analyses indicated that a statistically significant correlation existed between students' SA and their SCIS with a moderate effect size; the correlation is even higher with almost large effect sizes for a sub sample of higher-SCIS and lower-SCIS students. Results of t-test analysis also revealed that there were significant mean differences in students' SA and their knowledge (including physics, chemistry, biology, and earth sciences subscales) and reasoning skill subtests scores between higher-SCIS and lower-SCIS students, with generally large effect sizes. Stepwise regression analyses on higher-SCIS and lower-SCIS students also suggested that both students' SCIS subscales significantly explain the variance of their SA, knowledge, and reasoning ability with large effect sizes.

Claire M. A. Haworth; Philip Dale; Robert Plomin (2008) A Twin Study into the Genetic and Environmental Influences on Academic Performance in Science in Nine-year-old Boys and Girls. They investigated for the first time the genetic and environmental etiology behind scientific achievement in primary school children, with a special focus on possible etiological differences for boys and girls. For a representative community sample of 2,602 twin pairs assessed at age nine years, scientific achievement in school was rated by teachers based on National Curriculum criteria in three domains: Scientific Enquiry, Life Processes, and Physical Processes. Results indicate that genetic influences account for over 60% of the variance in scientific achievement, with environmental influences accounting for the remaining variance. Environmental influences were mainly of the non-shared variety, suggesting that children from the same family experience school environments differently. An analysis of sex differences considering differences in means, variances, and aetiology
of individual differences found only differences in variance between the sexes, with boys showing greater variance in performance than girls.

**Hilal Aktamis and Ömer Ergin (2008)** investigate the effects of teaching scientific process skills education to students to promote their scientific creativity, attitudes towards science, and achievements in science. The research includes a pre-test post-test research model with a control group. The subjects of the research consist of 40 students reading at 7th grade of an elementary school existing in Buca District of Izmir Province, Turkey. The data collection tools for the research include the “Combination of Force and Motion- the Energy” Chapter Achievement Scale the Science Attitude Scale and the Scientific Creativity Scale. (Hu & Adey, 2002). As a result of the research, it was determined that the scientific process skills education increased the students’ achievements and scientific creativities, however, no meaningful progress was made on their attitudes towards science when compared to the teacher-centered method.

**Okhee Lee; Rachael Deaktor; Craig Enders; Julie Lambert (2008)** studied the Impact of a Multiyear Professional Development Intervention on Science Achievement of Culturally and Linguistically Diverse Elementary Students. This study examined the impact of the 3-year implementation of a professional development intervention on science achievement of culturally and linguistically diverse elementary students. Teachers were provided with instructional units and workshops that were designed to improve teaching practices and foster positive beliefs about science and literacy with diverse student groups. The study involved third, fourth, and fifth grade students at six elementary schools in a large urban school district during the 2001 through 2004 school years. Significance tests of mean scores
between pre- and post tests indicated statistically significant increases each year on all measures of science at all three grade levels. Achievement gaps among demographic subgroups sometimes narrowed among fourth grade students and remained consistent among third and fifth grade students. Item-by-item comparisons with NAEP and TIMSS samples indicated overall positive performance by students at the end of each school year. The consistent patterns of positive outcomes indicate the effectiveness of our intervention in producing achievement gains at all three grade levels while also reducing achievement gaps among demographic subgroups at the fourth grade.

YI-Hsuan Lee (2008) studied the effectiveness of STS Approach and a Typical Textbook Dominated Approach Source in student learning outcomes in Middle School Science Classes. The purpose of this study was to determine whether Science, Technology, and Society (STS) learning increases student concept mastery, general science achievement, use of concepts in new situations, and attitudes toward science in middle school classrooms. The study involved two teachers and fifty-two students in grades 6 through 8. Two sections of middle school science were taught by two long time teachers where one used an STS approach and the other retained a typical use of the textbook as a class organizer. Each teacher administered the same pre- and post-assessments. Major findings indicated that middle school students experiencing the STS format with constructivist teaching practices: (1) learned basic concepts as well as students who studied them directly from the textbook, (2) achieved as much general concept mastery as students who studied in a textbook dominated way, (3) applied science concepts in new situations better than students who studied science in a more traditional way, (4) developed more positive attitudes about science, (5) exhibited creativity skills that were more individual and occurred more often, and (6) learned and used science at home and in the community more than
students in the typical textbook dominated section. Further, the STS approach coincided well with the kind of teaching across the curriculum that is (recommended as) central to teaching in middle schools.

Jianjun Wang; J. Steve Oliver; John R. Staver (2008) Self-concept and Science Achievement: Investigating a Reciprocal Relation Model across the Gender Classification in a Cross-cultural Context. Science achievement and self-concept are articulated in this study to examine a model of reciprocal relationship during a cross-cultural transition. Trend data have been gathered to assess changes of the perceived English importance before and after Hong Kong’s sovereignty handover from Britain to China. The data analyses were conducted four times across dimensions of gender and timing over which the political transition took place. Besides small gender differences in the statistical results, weak but significant reciprocal relationships have been found between science achievement and self-concept. In line with a policy of switching the medium of instruction from English to Chinese in most secondary schools, interpretation of different path coefficients obliges incorporation of cross-cultural understanding in science education.

Neset Demirci, Zerrin Yagci (2008) evaluate the unit “How Electricity Affects our Lives” in a sixth grade primary school Science Course by using Multiple Intelligence Theory-based activities. The purpose of this study is to evaluate the unit “How Electricity Affects our Lives” in a sixth grade primary school Science Course by using Multiple Intelligence Theory-based activities. This study was conducted with 292 (for pre-test), and 210 (for post-test) students from eight public schools in the province of Balikesir. A Pre-test – post-test control group quasi-experimental design was used in the study. “Multiple Intelligence Inventory” and “Electricity
Achievement Test” were administered as pre-test and post-test to both experimental and control groups before and after the instruction, respectively. According to analyzed results, it is concluded that Multiple Intelligence-based teaching activities were more effective than traditional teaching methods with respect to the Electricity Achievement Test scores; however, there was not much difference found in terms of the Multiple Intelligence Inventory scores between the two groups.

3.05 STUDIES RELATED TO PROCESS COMPETENCIES IN INDIA

Shama (1994) study revealed that the teachers style characterized by a judicious cognitive demand, emphasis on guided discovery and higher number of opportunities for the practice of process skill is more likely to facilitate the development of process skills among children than the teaching style characterized by marked ’earnings towards teacher domination and didactiveness, lower cognitive demand, no emphasis on discovery and lack of provision of opportunities for the practice of process skills.

Sharda(1998) conducted a study on activity based teaching learning strategies (ABTS) is a large size class in a primary state. It was found that proper pre planning was required to implement ABTS is a large €sized class. Learning situation were merged with well planned activities and by keeping enough materials needed to develop the required competencies. Learning strategies become successful since activities were drawn from or related to child’s experience they are enjoying learning by doing. The ABTS motivated children to concentrated on expected competencies and hence to achieve them at mastery level. ABTS were effective in a large sized class and helped the learner in concept attainment and ability development activities involving children in teaching learning process motivates the child to learn better and
hence leads to retention and achievement which is essential for innovations in elementary education.

*Ajitha, Nair and Shankar (1999)* conducted an experimental study to estimate the effectiveness of self-learning instructional materials in teaching biology. It was found that learning through self-learning instructional materials was more effective than traditional methods. It was also found that i) self-learning instructional materials recorded higher achievement scores in realizing the instructional objectives; ii) self-learning instructional materials are more effective in realizing the higher order objectives like application and skill; and iii) the control and experimental groups did not differ significantly with respect to retention test scores.

*Gongoli (2000)* carried out a study on the transaction of science curriculum using textbook-based on open-ended approach. After conducting a score of pre-test and post-test, it had been concluded that guided open-ended approach of doing experiments was superior to the traditional approach in the development of i) cognitive abilities such as knowledge, understanding, and application and ii) practical skills such as a) use of instrument b) organizational skills c) manipulative skills d) communicative skills. These findings remained unchanged when the groups were divided according to intelligent, socio-economic level, and sex difference.

*Indra Sharma (2006)* studied problem-solving ability and scientific attitudes as a determinant of academic achievement of higher secondary students. The results showed the higher secondary students have shown average problem-solving ability as indicated by mean, f-value indicated no difference in problem-solving ability of students. The PSAT score was treated at 3 levels of achievement and mean, SD, and value calculated. The calculated f value of male and female students of the three groups on the basis of achievement is found significant at 0.01 level. It was
revealed that high achievement had high PSA in comparison to average and low achievers.

3.06 DISCUSSION

From the review of section: I of the above studies, it was found that there is evidence in favor of activity based approach in teaching school science in respect of acquisition of scientific knowledge, Application of scientific knowledge and development of scientific skills.

It was reported that activity based learning is more effective than conventional teaching strategies. The study of Hendricks (1978) on the basis of activity oriented approach of teaching science and text book approaches has equal effect on the student’s achievement in science. The study of Coll (1986) about inquiry method is effective in the achievement in science. The Goal and Agbebi (1990) studied individual instruction (Experiments) method was effective in the achievement in science. Krishnan (2003) studies the best achievement in social science from a set of independent variables viz, learning styles and process skills and achievement. Fitz, Donald(1974) studied effect junior science curriculum developing process skills, Tobin and William (1982) studied the relationship between locus of control and process skill, Padilla, Michael J, studied relationship with formal thinking and process skill, Starwitz and Barbbare (1993) studied programmed learning materials could implemented to promote a higher level proficiency, Huppert (2002) studied on computer simulation in the high school students cognitive stages, science process skills and academic achievements, Hilal aktamis and Omer (2008) investigate the effect of teaching scientific process skills education to students to promote their scientific creativity, the findings of all these
studies implied that method of activity has definite influence on process competencies and the achievement

These are the some studies have no significant effect result Ahmad, Hamidhsaa, Rubba and Peter (1983) studied process skill and achievement among Malaysian high school, Burechfield and Michael conducted a study computer assisted instruction developing process skill, The results of the study shows no significant difference between two teaching methods, co-operative learning and existing method of teaching in the developing process competencies. From these all studies it has been conclude that there is an effect on the different learning strategies for developing process competencies

3.06 CONCLUSION

Review of the related literature provided an idea to the investigator as to what are the studies already done and their related aspects. It gives the researcher how to proceed and gives a direction. It enables the researches to formulate relevant hypotheses to the present study. Further it has helped the investigator to formulate methodology and well planned procedure for the investigation.