

REVIEW OF LITERATURE

CHAPTER II

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2.0 Introduction:

A careful survey and review of related literature provide the basic ground for academic guidance to the researcher for his significant problem and proper solution. It is an important pre-requisite of research work which connect previous knowledge with the new idea or knowledge to be grasped. It provides a good source of information about methodology, possible suggestions and working hypothesis with specific objectives. A thorough and comprehensive study of related literature makes the researcher up-to-date on the results of the work which other researchers have already done. The important purpose of it is to know the recommendations of previous researchers highlighted in their studies for future work. It also helps in discussion which is possible only when researchers have a thorough understanding of the related literature, the findings and conclusions drawn by the previous workers and add new findings from the present investigation.

Numerous research studies have been conducted both at the national and international levels on use and effectiveness of methods in teaching science. Keeping in view the objectives of the present study, pertinent and relevant literatures as per availability to the researcher, have been reviewed. The supplied review served as a strong background to the researcher and helped her to a great extent to delimit and define her problem, avoid unfruitful and useless problem areas, formulation of hypothesis, understand the research methodology and know about the recommendations of previous works for future research studies. Hence, an attempt has been made here to present a brief review of some studies and work which are found to have relevance and relationship with the present problem.

The review of related literature is classified into two broad categories:

2.1 LITERATURES ON SCIENCE TEACHING ABROAD:

2.2 STUDIES DONE IN INDIA:

2.3 STUDIES DONE IN THE NORTH-EAST:

2.1 LITERATURES ON SCIENCE TEACHING ABROAD: The researcher reviewed the related literature in a systematic manner, arranged it chronologically and explained here. Pioneering researches have been conducted in science teaching and learning to realize the aims and objectives of science education. Some progressive approach to the study of teaching and learning process of science in the schools seems to have been conducted in foreign countries. Most of the new traditions in research in this area have come from U.S.A, U.K. and China.

Prof. Armstrong (1848-1937) went to Germany for research in chemistry and was influenced by the German tradition of science teaching. He was in favour of heuristic method which means ‘to discover’ in Greek language. The aim of this method is to put the pupil as discoverer or researcher. It is based on curiosity and makes acquisition of knowledge a great adventure. The urge to overcome problems should come from within. Prof. Armstrong has written a book “The Teaching of Scientific Method” and he suggested learning for the children by observing and experimenting; the teacher should give necessary guidance to the pupils in setting up and carrying out those experiments. Prof. Armstrong used this method at St. Dunstan’s College.

John Dewey (1910) in his publication - How we think? He accepted the problem-solving approach as an alternative to passive learning. John Dewey was an exponent of pragmatist philosophy and introduced discovery learning through reflective thinking to remove the passivity of the lecture method. Dewey says ‘Knowledge is an outcome of inquiry and a resource in further inquiry’.

Mallinson (1947) studied on approaches of teaching and found that there is no difference in terms of achievement in general biology when two groups experienced the laboratory and a lecture-demonstration approach respectively. Mallinson called for more research using more control group.

. In 1954, B.F. Skinner presented an article, “The Science of Learning and the Art of Teaching” in a conference at Chicago, which was meant for programme learning. It was published in the Harvard Educational Review (1954) Robert M. Gagne (1958), B.F. Skinner (1954) and Gilbert (1958) developed principles of programmed learning which are helpful in designing an efficient learning situation in teaching science. These are —

- 1) Learning in science takes place rapidly if the learner is actively participated with the subject matter.
- 2) Learning takes place as a result of connecting responses when teaching is continued. Making of relevant responses can keep the pace of learning.
- 3) Learning in science requires immediate feedback for responses. Learning in science takes place rapidly if the teaching points are arranged in a hierarchical order. Each learner can learn according to his/her own pace. The problem of individual differences can be removed by this programme in science subject.

Richard Suchman (1960) developed the Inquiry development programme, and offers suggestions to teachers to implement inquiry method in their classrooms. His suggestions are as follows:

- 1) Encourages students to ask questions and teach them to response.
- 2) Allow students to ask as many questions as they wish.
- 3) Avoid to evaluating the work with accuracy that may pose a problem to students.
- 4) Encourage students for discussion at any time.

Scientists Kuslan and Stone (1968) have mentioned about the use of inquiry approach in science teaching which can not only minimise memorization but also the use of lecture method. According to them inquiry teaching in science is that teaching where teachers and children study scientific phenomena with the approach and the spirit of the scientist.

In 1974, John Heed recommended activity method for teaching science as science is an experimental subject. Therefore, such methods should be used where self-learning such as enquiry, problem-solving, project and laboratory methods play an important role in learning process.

Amoradht, K. (1975) studied on “The problems concerning the provision on use of audio-visual aids in science teaching in the secondary schools of Thailand.”The objectives were to find out the use of audiovisual aids in teaching science and problems faced by the teachers.

The major findings of the study were:

- 1) Most of the school principals, the teachers and the students showed a favorable attitude towards the utilization of audiovisual aids in science teaching.
- 2) The majority of the school principals and teachers in the secondary schools of Thailand had undergone formal training in the use of AV aids in science teaching.
- 3) The Audio-Visual education service in schools of Thailand were poor as it provided only simple and common A-V aids like maps and charts.
- 4) The teachers used A-V aids like chalk- board and pictures frequently but used museum specimens occasionally.
- 5) The teachers were likely to use A-V aids more frequently if better facilities were available.

According to Gage, Berliner (1975), teaching science depends upon the number of students, if there is only one student, then individualized instruction is effective but in case of more than one to twenty students, inquiry or laboratory method is preferable. When number of students is more than 40 then lecture method and team teaching is preferable

Hoftein & Lunetta (1982) conducted a research on the school science laboratory and their finding are:

- 1) Learning science occurs due to laboratory activity

2) In teaching science rich benefits is possible through laboratory-centred approach. They carried out this research work for twenty years and published many research papers and cited critical views of the research on the school science laboratory. Now, they realised that due to new technological resources and standards in science education, learning by inquiry approach is highly preferable.

Findings are:

- 1) Use of laboratory resources by the researcher.
- 2) Assessment of students' work in laboratory.
- 3) Proper use of laboratory activities by the teacher to enhance intended learning outcome.
- 4) Preparation of current models by the students on the basis of constructivism.
- 5) Engagement of students and teachers in different activities of science laboratory.

Makkar, S.L. (1991) Studied on "Education and Scientific Research in Japan." The objectives were to find out the status of scientific research and nature of school education.

The major findings of the study:

- 1) Most of the high schools are co-educational and grouped as general schools and special schools.
- 2) Formal education begins at the 6th year, it is compulsory for nine years and the pattern of education is 6+3+3.
- 3) There were excellent science laboratories for the various branches of sciences.
- 4) Junior high schools students are introduced to the methods of science with the help of exploring natural phenomena.
- 5) Admission to the universities was highly competitive.

6) Research facilities are excellent in the country.

Haury, David L. (1993):- Teaching science through inquiry approach. His studies are related to inquiry-oriented science instruction. He explained the benefits of inquiry instruction in science teaching. He summarizes that inquiry-oriented teaching engages students in investigations to satisfy curiosities which help to explain their experiences. There is no meaningful learning if there is no inquiring mind seeking an answer, solution, explanation or decision.

Ken Appleton and David Symington (1996) Studied on “Changes in Primary, Science over the past decade in Australia.”The main aim was to enumerate the changes and progress in primary science in Australia. Another aim was to identify new directions for both teaching and research in primary science.

The major findings were:

- 1) During the early 1980’s in Australia, there was a new wake of expectancy about primary education where science as new curricula, was being considered or introduced.
- 2) Research findings showed the new directions for both teaching process and research in primary science stream.
- 3) A key implication for the research community drawn from the analysis showed that the science education researcher tended to neglect working in collaboration with education departments and authorities for the improvement of primary science education.

Deborals Tippins and others (1996) studied on “A constructivist approach to change in elementary science teaching and learning in U.S.A.”.The objectives were to study the use of constructive approach in science teaching and learning at elementary stage.

The major findings of the study were:

- 1) Constructivism is a set of beliefs that can be used by teachers to think about teaching and to plan accordingly, for teaching any topic of science curriculum.

- 2) Constructivism is used by primary science teachers to account for their various roles in teaching.

Gibson, H.L. and Chase, C (2002): They studied the impact of Summer Science Exploration Program (SSEP), a 2-week inquiry-based Science Camp, conducted at Hampshire College Amherst (1992-94).

Objective: To stimulate greater interest in Science and Scientific careers among middle-school students.

Sample: Using stratified random sampling. 158 students were selected.

In 1996 another group of 22 students were participated.

Experimental design: Pre-test & post-test design.

The findings of the study were:

- 1) SSEP students maintained a more positive attitude towards science and a higher interest in science careers than students who applied for the program but were not selected.

Khalick et. al. (2004) conducted a research on Inquiry in Science Education: International perspectives. The themes are:

- (a) Philosophical conceptions of inquiry in the science curriculum.
- (b) Images of the enactment of inquiry in the curriculum, classroom instruction, and assessment practices.
- (c) Factors and conditions to the educational setting which facilitate inquiry based science education.

Findings were:

- 1) Emerged conceptions of inquiry teaching.
- 2) Significance of inquiry in science education will trigger in future course of action.

Buch, L.B. Bretz, S.L. and Towers, M.H. (2008): "Characterizing the Level of Inquiry in the Undergraduate Laboratory". Objectives of the paper are- to propose a quantitative rubric designed to characterize level of inquiry in laboratory activities and laboratory curricula. He explained that a common goal of science education is to engage students in inquiry. There are many factors to complete the task. The word 'inquiry' is used ubiquitously throughout education literature both as a style of teaching and as a method for conducting research (Flick 1995). The term is used to describe both teaching and doing science (Colburn 2000). They have provided faculty with an expanded tool to determine the level of inquiry fostered by their laboratory curriculum. Faculty may use this fabric to evaluate a course/program. Researchers may also use this rubric as a well-defined means of communicating with each other in the literature.

Brickman, P. Gormally, C. Armstrong, N & Hallar, B (2009) conducted research work and presented a paper on effects of inquiry based learning on students' science literacy skills and confidence.

Objectives were:

- 1) To develop science literacy skills by developing inquiry laboratories.
- 2) To find out the level of transfer of scientific ability and skills of students in real-life situation.
- 3) To find out the self- confidence level of inquiry students' and traditional students'.

Sample: 1300 students of life science from 72 laboratory sections (2006 & 2007)

Methods: Experimental design was adopted to compare inquiry and traditional laboratory curriculum.

Statistical method: ANOVA

Findings were: 1) Students in the traditional laboratory gaining greater self-confidence in their ability to explain and write about biology while students in

inquiry laboratory gained less confidence to explain and write about biological ideas.

- 2) The students of inquiry laboratory demonstrated a significant improvement in science literacy skills like an average citizen.
- 3) Adopting on inquiry based laboratory curriculum requires a substantial investment in curriculum development and new training for teachers.

Chang and Mao (2010) have conducted a study “Comparison of Taiwan Science Students’ outcomes with Inquiry-Group Versus Traditional Instruction”. Objective: To find out comparative efficiency of inquiry-group instruction and traditional teaching methods on Junior H.S. students’ achievement and attitudes toward earth science in Taiwan”.

Design: Quasi-experimental design involving 16 intact classes.

Sample: 319 students as treatment group received an inquiry group instruction. 293 students as control group received a traditional approach.

Tools used: Achievement test, Attitudes towards Earth Science Inventory

(S.L. Mao & Cy. Chang, 1997)

Technique: Analysis of co-variance.

Findings were:

- (1) Experimental group had significantly higher achievement scores than the control group i.e. Inquiry Group is better than the traditional group in achievement scores.
- (2) There were statistically significant differences in favour of the inquiry group instruction on student attitudes towards earth science in Taiwan.

Ali, Azar, Sengulec and Aydin, O (2011): Worked on “Computer-Assisted and Laboratory Assisted Teaching Methods in Physics Teaching’’: The effect on

students' Achievement in Physics and Attitude towards Physics. The objectives were:

- 1) To find the effectiveness of computer assisted teaching method, just like laboratory-assisted teaching method in teaching physics.
- 2) To find out its effect on students' achievement and attitude towards physics.

Method: Experimental design-pre-test and post-test. Sample: 50 students of 9th grade.

Data were analysed by using SPSS 16.0 statistical analysis program and t-test technique.

Findings: Students' achievement and attitude towards physics through computer-assisted teaching method is more effective than the laboratory-assisted teaching method.

Hussain, A. Azeem, M. and Shakoor, A (2011) of Pakistan conducted this research including Punjab Education System in Physics Teaching Methods. The paper is "Physics Teaching Methods: Scientific Inquiry versus Traditional Lecture". The objectives are:

- (1) To scrutinize how the presence of scientific inquiry might affect undergraduate student's achievement in physics.
- (2) To find out the difference of scientific inquiry method of teaching and lecture method of teaching on students' achievement in physics.
- (3) To find out the significant difference of guided, unguided, combine inquiry method of teaching and lecture method of teaching on student ability.

Population and simplicity: All 10th grade students of public institutions in Faisalabad District studying physics comprise target population. 175 male physics students of 10th grade of age 15-17 years were selected as sample students. Experimental design: Pre-test and post-test.

Instrumentation: Following instruments were used in the study:

- (1) Physics Proficiency Test
- (2) Students' Intelligence Test
- (3) Socio-economic Status Performa.

Findings: 1) There is significant difference of scientific inquiry method of teaching and lecture method of teaching on students' achievements in physics. Scientific inquiry method of teaching is significantly better than lecture method.

- 2) The differences between the mean scores on the physics proficiency test by experimental groups were highly significant and showed favourable effect of scientific inquiry. This proves that scientific inquiry is a better method of teaching science at secondary level.
- 3) The students who taught by the guided, unguided, combination of scientific inquiry method of teaching were better in applying the concepts of physics to real life situations as compared to those students who were taught with traditional lecture method of teaching physics.

2.2 STUDIES DONE IN INDIA: In India few useful reports and studies dealing with science teaching have been appeared after independence (1947). Some of these relevant studies are discussed below:

Secondary Education Commission (1952-1953) emphasized on high quality teaching system using proper methods and strategies. Education Commission (1964-1966) also suggested that use of method can easily influenced the student teachers at training situation which will motivate them to use the method in classroom teaching.

To know the effectiveness of methods, Rai (1958) undertook a comparative study on lecture cum lecture demonstration method in science. His findings were in favor of demonstration method. Patole (1967) conducted an extensive survey in science teaching of rural primary schools. He selected 100 sample schools, 550 teachers, 2000 pupils and 200 rural family heads. His findings showed that science

was taught as a part of social science and teachers were not properly qualified. Only 10% schools possessed complete equipments for science and none of the schools had a separate science room.

According to Kothari commission (1964-66) ‘Method of teachings and evaluation in training institutions are extremely important and attitudes of students teacher will be influenced more by the method used with them than by what they are formally taught the methods they should in school’ . In 1958 for the first time, Veerappa conducted a research work and aim was to examine the position of science education in India, and assessed the developing trend globally. The feasibility of introducing these trends in Indian institutions was also studied with different dimensions. He tried to find out the developing trends of science education through teaching and evaluation process. Result reflects that science teacher followed the Herbartian lesson-plan, lecture demonstration method in teaching science and essay type questions in evaluation process.

Goyal completed a study on methods in 1975, and his aim was to study the academic achievement of the students. Results indicate a trend of improvement in students` performance from lecture to discovery method in science teaching, and findings are in favor of discovery method.

Yadav (1977) completed a comparative study of lecture and guided discovery methods in teaching science. The result showed the effectiveness of discovery method over lecture method. Lecture method has been criticized by different educationist like Kothari (1964), Yadav (1977), Sharma (2003)etc.

Gupta, V.P., Rajput, J.S. and Vaidya, N (1978) conducted a study on “Science laboratory in the Western Region.” The aim was to study the condition of science laboratory in Western Region.

The major findings of the study were:

- 1) In M.P. 68.7% schools did not have any arrangement of water supply. 91.43% schools had no gas supply and 28.5% schools did not have electricity.

- 2) In Maharashtra 45.45% schools have water supply, 31.8% made gas facility, 22.7% had Botanical garden and 45.5% had workshops while in Gujarat corresponding figures were 44.4%, 18.5% 2% and 22.2% respectively.
- 3) As many as half the schools included in the samples and awarded with prizes and certificates for distinctive work.
- 4) Surprisingly 10% school did not have laboratory.
- 5) In M.P. 55% schools did not provide laboratory facilities for class IX, for Gujarat and Maharashtra the corresponding figures were 20% and 25% respectively.

Maddu, V (1978) Studied “The Prevalent status of institutional procedure in Biology in High schools of Hyderabad & Secunderabad”. The aim was to study the status of institution and instructional procedure in Biology in High schools of Hyderabad & Secunderabad .

The major findings of the study were:

- 1) 59% of the teachers stated that they did not have adequate classroom to teach biology.
- 2) Most of the teachers preferred only lecture demonstration method.
- 3) Facilities of reference books, magazine and general books on biology were not adequately available in school libraries.
- 4) 66% teachers were found to give priority to knowledge objective in dealing with the topics in biology while application and interest aspects were slightly followed and measured.
- 5) In 70% schools, there was no separate biology laboratory.
- 6) Only 35% students maintained good practical note books.
- 7) Teachers expressed their difficulties in conducting demonstrations practical in biology because of crowded classrooms and the absence of adequately equipped laboratory.

Swarnama, C (1978) Studied “The teaching of biology in the upper primary schools of Kerala.”

The major findings of the study were:

1. Lack of facilities in schools, lack of mastery over the subject on the part of the teachers, lack of experimentation in the classroom, over dependence of teachers on texts books, overcrowding in classroom were listed by the pupils as some of the reasons for finding Biology a difficult subject.
2. Most of the teachers adopted lecture demonstration method in the teaching of biology in the upper primary classes.
3. The pupils found it difficult to draw diagrams and to mark parts thereof.
4. The achievement level of the pupils was not quite satisfactory.
5. The teachers in general failed to develop scientific attitude among pupils of upper primary classes.

Badola (1980), studied on method of science teaching. His aim was to find out advanced and effective method for teaching science. His findings were supported by educational psychologists and experts, who try to find out more and more advanced methods of science teaching at school level. .

Mishra, M.A. (1980) conducted a study on “A critical study of the influence of socio-economic status on academic achievement of higher secondary students in rural and urban areas of Kanpur.” He found that academic achievement of the urban students was higher than the rural students. It was supported by other researchers and found that quality of school is high.

Dev (1981) had conducted a critical study on methods and showed the significant effect in case of teaching learning process of science at school level..

Bhalwankar (1983) compared the methods in teaching science in terms of knowledge, understanding and application level. In order to control the effect of pre-achievement on subsequent achievement, the researcher administers a pre-achievement test. Findings showed the progressive effect in teaching science.

Anjaria, R. (1984) conducted a study on the systems approach in the teaching of science. The objectives of the study were:

- 1) To prepare an instructional model with the help of resources for the unit on light in 10th standard, on the basis of the systems approach.
- 2) To measure the effectiveness of the systems approach in the teaching- learning process and
- 3) To evaluate the effectiveness of the systems approach in planning the design of the experimental work.

Students of class X of three different schools of Surat formed the sample of the experiment. All together, there were 248 sample students selected for the conduct of the experiment. The students in each school were divided into two groups, one experimental group and another one control group. The two groups in each of these schools were matched, with respect to their mean age, previous academic achievement and sex. The investigator prepared programmed learning materials, a tape slide visual programmed on the unit of light and a criterion test.

She also utilized the available resources like charts, models and film strips. For measuring intelligence, Patel's Non-verbal group intelligence test was used.

Pre-test and post-test with control group experimental design was used.

The major findings of the study were as follows:

- 1) The experimental group scored higher than the control group and the T-test was found to be significant. It could be then claimed that the systems approach to instruction was more effective than the traditional approach to instruction.
- 2) With reference to retention of the subject matter, it could be claimed that the systems approach to instruction was more effective than the traditional approach to instruction.
- 3) Replications of the experiment could considerably confirm the results and could raise the level of general ability.
- 4) The systems approach was found effective in maximum utilization of available resources.

Deopuria, R.P. (1984) performed a comparative study of teaching science through environmental and traditional approach in school of Madhya Pradesh.

The objectives of the study were:

- 1) To compare the cognitive achievement of students of classes V, VIII, IX and X towards science taught through the environmental versus the traditional approach.
- 2) To compare the environmental awareness and attitude of students when taught by the above two methods.
- 3) To compare the attitudes of the teachers towards the environmental approach of teaching. The investigator formulated 15 null hypothesis around the dependent variable related to knowledge, understanding, and application scores, environmental awareness score, attitude towards environmental problems, and environmental approach.

The major findings of the study were:

- 1) The students of the experimental group of classes V, VIII, IX and X obtained higher achievement scores due to teaching of science through the environmental approach.
- 2) The environmental approach showed greater cognitive achievement in knowledge, understanding and application of science concepts related to environmental education at primary, middle and secondary school levels.
- 3) The students of primary schools of the experimental group showed considerable improvement towards environmental awareness.
- 4) The environmental attitude inventory showed significant positive gains in attitudes towards the environment for the entire experimental group of students.
- 5) The obtained value of 't' showed that teachers of the experimental group of school had a very high positive attitude towards the environmental approach for teaching science.

- 6) No significant difference between male and female teachers' attitude towards the environmental approach and it revealed that sex had no effect on the attitude towards the environmental approach.
- 7) There was no significant difference between the attitudes of teachers towards the environmental approach followed at different grade levels. In 1983, Barman studied the development of science in India While Sharma (1984) studied status of school science post- independence i.e. from 1947-1977. The progressive development of science covers different aspects of science like, teaching of science through the integrated or concept approach, inclusion of science as general or specific in the curriculum, acceptance of environmental science as core subject for different stream, application of information technology etc. Research works in science have highlighted the various paradigms in the development of modern Science at school level.

Tripathi, P. (1987) conducted a research on "A comparative study of the correlates of academic attainment of pupils of junior high schools.

Objectives: 1) To make a comparative study of the academic attainment of pupils in four main subjects— Hindi, Social Science, Science and Mathematics.

2) To determine the degree of relationship between the scores of achievement test in the main subjects and main correlates selected.

Sample: 1200 students of class (900 boys + 300 girls) VIII selected from junior high schools of rural and urban areas of three districts of Uttar Pradesh.

Tools used: 1) A group test of intelligence by Tandon (2) Four achievement tests. (3) A check list. (4) Questionnaire of SES (Socio Economic Status) (5) Questionnaire on educational facilities.

Findings:

1) The average level of scores in all the selected correlates and academic attainment were found to be low.

- 2) Boys have better academic performance
- 3) Urban students had done better in intelligence scores.
- 4) Private school boys showed better results in intelligence than the government boy's school.
- 5) Urban areas school students appeared to be having better educational facilities than the rural areas.

Srivastava (1985) measured the scientific attitude and his finding was, amount of scientific knowledge or general awareness to science subject formed an impact on scientific attitude. To develop scientific attitude among the students is an important aim of all schools matter of subject. Research in science teaching are mainly of two types-one type of which can be termed as status studies, pertains to the survey of the present state of teaching of science at different levels, while the other type is related to the experimental verification of the effectiveness of different methods or strategies or techniques of teaching.

Malhotra, V.K. (1988) studied on "Existing facilities of science teaching and construction of evaluation instruments for its supervision in different types of secondary school in Delhi."

The major findings of the studies were: It was observed that the three types of schools differed significantly in the following cases:

- i. Existing facilities for science based co-curricular activities.
- ii. Existing human facilities.
- iii. The supervision of the theory classes.
- iv. Supervision of the practical classes.

Gupta, M.K. and Rao, K.N. (1990) studied on "Science laboratories in secondary schools in selected states."

The major findings of the study were:

- 1) In Maharashtra out of the 111 secondary schools, 105 were reported to have science laboratories, 96% schools in urban areas and 92% of rural areas schools had science laboratories.
- 2) Out of 70 Higher Secondary Schools which responded, 84.28% had science laboratories in urban area, as against 72% in the rural area.
- 3) 25% secondary schools had separate laboratory.
- 4) Time devoted to science practical was more in urban schools than that of rural schools.
- 5) In the secondary schools of Rajasthan 92% rural schools had laboratories as compared to 53% in rural schools.
- 6) About 50% schools provide facilities to students for carry out practical experiments individually in physics, the corresponding percentage for Biology and Chemistry were 81.72% and 74.74% respectively.

Begum (1990) carried out an experiment in Andhra Pradesh. Her aim was to find out the problems of science syllabus in class VII standard. She found that schools conditions need to be improved for pupils' participation, involving the sequential steps i.e. classifying, enquiry and experimentation. She suggested improving the conditions of schools for implementation of the syllabus.

Goel & Agbebi (1990) conducted an experiment on lecture demonstration and individualized instruction methods in teaching science at high school level. Both were adopted for teaching physics at high school level. They showed that the lecture demonstration and individualized instruction methods have the significance differences in case of teaching science.

Benugopal, S. (1992) conducted a research on "A comparative study of the rural and urban secondary schools teachers of Karnataka". Objective: (1) To find out the problems faced by the teachers in both types of schools. (2) To find out the relationship between job satisfaction of the teachers and academic achievement of the students.

Sample: 1000 secondary school teachers of Karnataka where 500 from rural area and 500 from the urban areas.

Tools used: (1) Scale by Pandey (PJSS), (2) Self prepared questionnaires (3) Data gather schedule by the researcher.

Findings:

- 1) The rural school teachers face more problems than the urban school teachers.
- 2) A significant relation is found between job satisfaction of the teachers and the academic achievement of the students.

Malhotra, P.K. (1993) conducted a study on “A comprehensive study of secondary schools in rural and urban areas of Punjab with special reference to the academic achievement”. Objectives of the study were:

- 1) To make a comparative study between the academic achievement of the students of rural secondary schools and urban secondary schools.
- 2) To find out the academic achievement of students of studying at different secondary schools of Punjab.
- 3) To find out the relationship between the academic achievement of student of selected schools and type of management of the school.

Sample: randomly selected 40 secondary schools of Punjab.

The Findings were:

- 1) The academic achievements of different secondary schools of Punjab were found satisfactory.
- 2) The academic achievement in urban schools was found to be better than the rural schools.
- 3) There exists a significant relationship between the academic achievement of the schools and management type of the schools. The students of government

schools showed better academic performance than the students of privately managed schools.

Krishnan, Shanthana and Mary, Lawrence A. (1995) studied on “The effectiveness of teaching chemistry for VIII standard students through Auto learning module in Tutieorin town of Tamil Nadu.”The objectives were to find out the effectiveness of auto learning module in teaching chemistry at 8th standard, and to compare between the conventional and auto learning module in respect of instructional objectives like - knowledge, understanding and application.

The major findings were:

- 1) There was a significant difference between the mean scores of the post tests for the objective knowledge taught through conventional and auto learning module.
- 2) There was a significant difference between mean scores of the post tests for the objective understanding taught through conventional and auto learning module.
- 3) There was a significant difference between mean scores of the post test for the objective application taught through conventional and auto learning module.

Devi Swatantra, T.K. (1996) studied “the effectiveness of video assistant instruction programme in teaching chemistry at High School level.”The objective was to study the effectiveness of video assistant instruction in teaching chemistry at high school level and its effect on academic achievement of the students.

The major findings of the study were:

- 1) The control group and the experimental group were different significantly in their academic achievement at the post test level. The video group performed better than the control group.
- 2) The academic achievement of the girls in the experimental group was better than that of the boys in the same group at the post test level.
- 3) The performance of the urban students in the experimental groups was better than that of the rural students in the same group at the post test level.

- 4) The subject matter should conform to the interest and needs of the students of class X.

Yogamoorthy, A. (1996) conducted the research work on “Promotion of Scientific literacy among students through integrated science teaching.” The objectives were

- 1) To promote scientific literacy for all the students and fulfillment of the aim of integrated science teaching.
- 2) To clear the concept about teaching of science and about science.

The major findings were:

- 1) The apparent dichotomy the wish to provide scientific literacy for all and the need to prepare future scientists which was one of the important issues in integrated science teaching.
- 2) A teacher should teach science or about science at what level and to what extent are demanding questions for those involved in designing integrated science.
- 3) There are conceptual mismatches between teaching of science and about science.
- 4) Challenge of Education — “a policy perspective is a document of the ministry of education, Govt. of India which represent an important stage in the process of reviewing and reshaping the educational system to enable to meet the challenges and observation presented in this paper lead to a number of general conclusions. Regarding the school facilities Govt. admits that the quality and maintenance of school building in urban areas were very much better than in rural areas. Urban schools generally have better library and laboratories facilities.

D.S. Kothari has suggested -“ Learning by doing”, as the best method for teaching and learning of science subject (Siddique & Siddique, 1998).

Delargey (2001) reported that school general science curriculum desires that the students develop the skills of observation and reasoning. The great didactic approach, a method of teaching would enable teachers to ensure that knowledge would be permanently retained by their students. He formulated “Golden Rule” for teacher in case of science teaching. It is based on the assumption that the skills of observation and reasoning can be used to learn science at school level.

According to Sharma (2003) pupil centric methods (modern) are more effective than the teacher centric methods (traditional) because these are scientific, psychological and logical in nature.

Choudhury, V (2005) conducted an experiment on -“ Effectiveness of Lecture-Cum-Demonstration Method over Lecture Method”. Her objective was to find out the comparative effectiveness of lecture -cum-demonstration method over lecture method of different academic level in terms of teaching-learning objectives. Samples of the study consisted of the 40 students of Saraswati Vidya Mandir in Garhwal Region. The sample was divided into two matched groups in order to find out the comparative effectiveness of one method over the other method. Experimental method with pre-test and post-test design was adopted. Tools were question papers. The t- test was applied in order to find the difference between these two methods. It was observed that the subjects gained significantly better on post-test than the pre-test in experimental group taught through lecture -cum-demonstration method. The finding showed an effectiveness of lecture -cum-demonstration method over lecture method. She suggested that the students of lower classes should be taught through lecture -cum-demonstration method in place of traditional method. It creates better teaching-learning situations in science stream. An effective use of method in teaching may raise the mental ability of students, so that students may think and learn better than that through traditional methods.

Devi, P. (2007), Gauhati University conducted a research on the topic Academic achievements of high school students— a comparative study of private and government schools in Barpeta district.

Objectives:

- 1) To find out the academic achievement of the students.
- 2) To make a comparative study of academic achievement of the student on the basis of sex.
- 3) To find out the academic achievement of the students in relation to (a) management— government vs private (b) Medium — Assamese vs English.

Sample: (1) 7 schools (2) 7 Principals (3) 240 students. Tools used: (1) Performa for collection of annual examination result (2) Questionnaire for students (3) Interview (4) Observation.

Findings:

- 1) Private schools show better result than the government schools.
- 2) Private school girls' academic achievement is better than the private boys' school.
- 3) Achievements of girls from Govt. school is poor than that of boys of government schools.
- 4) Boys in Assamese medium showed better result than the girls while equal achievement level of boys and girls were observed in English medium schools.

Kalita, Bhanita (2008) conducted a study on “A study on the pupils academic achievement in science and arts stream of H.S. course during the period 2003-2007) with special reference to the H.S. schools of greater Guwahati area”, (M.Phil, Dissertation).

Objectives:

- 1) To make an assessment of the academic achievement of the students in H.S. final examination of science and arts during the year 2003-2007.
- 2) To find out the factors which have their influence on the academic achievement of the students?

- 3) To suggest remedial measures to improve the academic achievement of the students.

Sample:

- (1) 10 higher secondary schools of greater Guwahati
- (2) 53 teachers from science and arts stream
- (3) 228 students from both the stream.
- (4) 10 principals from the selected schools.

Findings:

- 1) The average academic achievement of the students of Arts stream was better than the students of science stream.
- 2) The course content of the science stream is too comprehensive.
- 3) The infrastructural and other facilities like teaching aids, scientific equipments etc. needed for the students of science stream are not available /adequate in the school.
- 4) Most of the teachers of science stream are highly educated but they are untrained. Most of the teachers of Arts stream are laborious and try to make the concept clear to the students while the teachers of science stream only help the students to understand the topic.

2.3 STUDIES DONE IN THE NORTH-EAST:

Bhattacharya, P.C. conducted a study on “A critical study of science education in Assam and Meghalaya schools” in 1979. The aims of the investigation were an endeavour to determine the status of Assam and Meghalaya in case of science education and also to find out the way so that they could go forward more effectively and more vigorously.

The major findings of the study were:

1. Assam and Meghalaya respectively had 70.65% and 86.85% of teachers eligible to teach science in secondary classes.
2. The average teaching experience of science teachers in Assam and Meghalaya stood at 6.04 and 8.57 years respectively.
3. The economic condition of science teachers was poor and private tuition was the most common sources of earning.
4. In Assam and Meghalaya, science education had some disadvantages. Only 79.96% laboratories were in secondary schools of Assam and Meghalaya.
5. The trainees and trained teachers and the married and unmarried teachers ranked about the same in teaching effectiveness.
6. The number of books in the school library varied from 200 to 2500 and the average came to 1240 books.

Darchengpur studied on “Science achievement, Science attitude and problem solving ability among secondary schools students in Aizawl” (1989). His objective was to assess the relation between achievement of students and problem solving ability in science.

The major findings of the study were:

- 1) The study indicated significant relationship between scores of students on scientific attitude and achievement in science.
- 2) There exist significant sex differences in achievement of science and problem solving ability.
- 3) High socio-economic status, family facility and type of school showed favoured achievement in science and scientific attitude.

Sarmah, Sarat Chandra studied in “The standard of teaching Science in the Secondary Schools of Assam” (1992).

The Major Objectives of the study were:

- i. To ascertain the requirement of certain basic facilities in the schools.

- ii. To compare the existing facilities between urban and rural schools.
- iii. To investigate the frequency of using the existing facilities.
- iv. To assess the teacher opinion on how the situation might be improved.
- v. To focus the attention of teachers, administrators and educational planners on this very important aspect.
- vi. To offer some helpful suggestion for improving science education.

The major findings of the study were:

- 1) Only 51% schools have science laboratory. The corresponding figure for urban and rural school is 48% and 62% respectively.
- 2) 9% school of rural area and 19% school of urban area had separate library room while none had a science library.
- 3) 72% schools supplied all the required text books to all the teachers, while 93% schools have not supplied any hand book to the teachers.
- 4) Only 5% schools had the provision of science club.
- 5) Only 13% schools had untrained science teachers.
- 6) In Assam, 27% schools had only one science teacher, 37% schools had two science teachers and 27% schools had more than three science teachers.
- 7) Among the different teachers 32% teachers were not satisfied with the condition of their schools.

Deka, K.R. investigated on “The status of science education in the independent middle schools of Kamrup district of Assam” 1996.

The objectives of the study were:

1. To study science curriculum with a view to assessing its likes with the children environment.
2. To evaluate the standard of science teaching with 5 independent middle schools along with secondary schools in which the same text books were taught for the age group of 13 years.

3. To investigate how far science kits (Science apparatus) and teaching aids were used, including laboratory facilities in the two groups of schools.

The major findings of the study were:

- 1) There was a single science teacher in each independent middle school of Kamrup district without having any professional qualification.
- 2) 40% of the independent middle schools had been provided with a science kit, while 60% schools were not provided with science kit.
- 3) Students achievement in science subject was very poor. 47% students studying in independent middle schools secured only pass marks.
- 4) There was no regular provision of grants incase of science independent middle schools.
- 5) Lack of teachers handbook hampered in importing the science concepts to the science subject.
- 6) The attitude of Headmasters towards improvement of science teaching was annoying.

Bhuyan, S (2004) conducted a study on defects of science curriculum and teaching strategies in secondary schools of Assam. He found that there were a number of defects in general science curriculum, general science text books, teaching-learning strategies adopted by the teachers of the secondary schools of Assam under SEBA. Only few science teachers used teaching aids in their teaching- learning process.

Kour,M (2007) conducted a study on methods of science teaching at secondary level.Aims were to find out the effectiveness of Lecture cum demonstration, enquiry and laboratory method of teaching science, and comparison between traditional and modern method of teaching.

Findings were in favour of methods which can enhance the learning outcome of learners in science at secondary level. Modern methods were more effective than the traditional one in teaching science.

Conclusion on review of literature:

Hence from the review of the related literature it is clear that use of proper methods can help the teacher and the taught. Effectiveness of methods can enhance learning outcome of learners and strengthen teaching competency of the teachers particularly at school level. Studies at the international level are broad and up-to-date while at the national level it is not sufficient. It is also noticeable that the science teachers are facing unavailability of equipments in school of some region or area.

From the review of related research work it is clear that no significant study has been conducted to study the effectiveness of lecture cum demonstration method, inquiry method and laboratory method for teaching general science in secondary schools of Assam. Therefore comparative study should be made to find out the effectiveness of these methods in teaching science. Hence it seems appropriate and innovative step on the part of the researcher to inquire into this problem and help the teaching community.